TEXAS MILITARY DEPARTMENT
INVITATION FOR BIDS
CONSTRUCTION SERVICES

IF NOT BIDDING -- DO NOT RETURN THIS FORM
BIDDER AGREES TO COMPLY WITH ALL TERMS & CONDITIONS OF THIS IFB

AGENCY TO INVOICE
TEXAS MILITARY DEPARTMENT P.O. BOX 5218 AUSTIN, TX 78763-5218

DESTINATION OF GOODS IF DIFFERENT THAN ABOVE
TXARNG - WESLACO READINESS CENTER 1100 VO-TECH DRIVE WESLACO, TEXAS 78596-9022

WHEN BIDDING:
Each bid must be placed in a separate envelope with bid opening date and bid number annotated in the lower left corner on SEALED BID ENVELOPE.

RETURN SEALED BIDS TO:
Texas Military Department
P. O. Box 5218
Austin, TX 78763-5218
OR HAND DELIVER TO:
2200 W. 35th St..
Building 11, 2nd Floor (8:00AM - 5:00PM)
OR OVERNIGHT/EXPRESS MAIL TO:
2200 W. 35th St.
Camp Mabry Mail Room (7:30AM - 4:00PM)
ATTN: Lanette Thaler
Austin, TX 78703

BID OPENING: 2:00 PM Central Time (CT), 08/20/2018
BID NO.: TX18-ENG(C)-08
BID NAME: Weslaco Readiness Center Major Maintenance Modernization Project

FAILURE TO SIGN WILL DISQUALIFY BID

_____ _____
AUTHORIZED SIGNATURE DATE

By signing this bid, Bidder certifies that if a Texas address is shown as the address of the Bidder, Bidder qualifies as a Texas Bidder as defined in Comptroller of Public Accounts (CPA) 34 TAC Rule 20.32(68).

VENDOR CONTACT INFORMATION AND IDENTIFICATION

Company Name: _____
Company Remit Payment to Address: _____
City, State and Zip Code: _____
Printed Name of Representative: _____
Email Address: _____
Phone Number: _____
Fax Number: _____
CPA Vendor Number: _____

Before payees can receive payments from the State of Texas, they must first be set up on Texas Identification Number System (TINS) with a unique 11-digit Texas Identification Number (TIN).

Bidder's Texas Identification Number: _ _ _ _ _ _ _ _ _ _ _
THE FEDERAL EMPLOYERS IDENTIFICATION NUMBER (EIN) WILL BE USED TO ESTABLISH A TEXAS IDENTIFICATION NUMBER:

Please enter your Federal EIN: _ _ _ _ _ _ _ _ _
Every Bidder MUST have an Employer Identification Number (EIN) prior to receiving payment under an awarded contract. This is being required in an effort to minimize identity theft. For information on obtaining your EIN, you may call the IRS at 800-829-4933 or visit the following web site: http://www.irs.gov/businesses/

CHECK HERE IF YOU ARE A SOLE OWNERSHIP OR PARTNERSHIP: ☐

PREFERENCES
See Section 2.38 of CPA's State of Texas Procurement Manual regarding preferences.
Check below to claim a preference under CPA's 34 TAC Rule 20.38

□ Goods produced or offered by a Texas Bidder that is owned by a Texas resident service-disabled veteran
□ Goods produced in Texas or offered by a Texas Bidder that is not owned by a Texas resident service-disabled veteran
□ Agricultural products grown in Texas
□ Agricultural products offered by a Texas Bidder
□ Services offered by a Texas Bidder that is owned by a Texas resident service-disabled veteran
□ Services offered by a Texas Bidder that is not owned by a Texas resident service disabled veteran
□ Texas Vegetation Native to the Region
□ USA produced supplies, materials or equipment
□ Products of persons with mental or physical disabilities
□ Products made of recycled, remanufactured, or environmentally sensitive materials including recycled steel
□ Energy Efficient Products
□ Rubberized asphalt paving material
□ Recycled motor oil and lubricants
□ Products produced at facilities located on formerly contaminated property
□ Products and services from economically depressed or blighted areas
□ Vendors that meet or exceed air quality standards
□ Recycled or Reused Computer Equipment of Other Manufacturers
□ Foods of Higher Nutritional Value

TEXAS MILITARY DEPARTMENT

INVITATION FOR BIDS FOR CONSTRUCTION SERVICES

Class & Item: 90638; 92567; 91438; 92531; 91468; 91060; 92588; 34016; 93609; 92066; 91579

1. **INVITATION:**
In accordance with the provisions of Texas Government Code §2156.063, Solicitation of Bids, the Texas Military Department (TMD) is seeking bids from qualified vendors to provide modernization of the Texas Army National Guard (TXARNG) Weslaco Readiness Center (RC) facility including mitigation of life safety and code related deficiencies, with interior building improvements including architectural, mechanical, electrical, plumbing, structural, fire alarm and IT/telecom trades and exterior building improvements including site civil modifications, fencing modifications, and site utility upgrades in accordance with the requirements outlined in this Invitation for Bids (IFB). All bid submissions will be reviewed to ensure that the Bidder's submission and product meets or exceeds the minimum qualifications. TMD will evaluate all bids received and will award based on best value to the State of Texas and TMD.

2. **SCHEDULE OF EVENTS:**
The following Schedule of Events for this IFB may be modified as required.

Event	Date
Re-bid Issued Date	August 13, 2018
Deadline for Submission of Bids	August 20, 2018 2:00 PM CST
Bid Opening	August 20, 2018 2:00 PM CST

Bid opening shall take place at:
Texas Military Department – Camp Mabry Building 11, 2nd Floor
Treaty Oaks Conference Room, 213 Hallway D, Room 218
2200 West 35th Street
Austin, Texas 78703

3. **QUESTIONS REGARDING INVITATION FOR BIDS SOLICITATION**:
See **Attachment J – Addendum 1 from June 29, 2018 IFB posting** for the Question and Answer document from solicitation originally issued on June 29, 2018. There will be no further questions and answers for this re-bid solicitation.

4. **PRE-BID SITE VISISTS:**
Reference the site visits that took place at 2:00 PM CST on Wednesday, July 11, 2018 and at 10:00 AM CST on Thursday, July 12, 2018 at Weslaco Readiness Center, 1100 Vo-Tech Drive, Weslaco, Texas 78596. No other site visit will be conducted for this re-bid solicitation.

5. **ADDENDA TO IFB SOLICITATION:**
Bidder must sign and submit with the bid proposal all addenda associated with the IFB solicitation sent by the Architect/Engineer (A/E).

6. **SUBMISSION REQUIREMENTS:**
   A. By submitting a response to this solicitation, Bidder certifies that they meet all the terms and conditions listed within this solicitation and all accompanying attachments.

   B. Each bid proposal shall be placed in a separate envelope, properly addressed and marked clearly on the outside that a bid proposal for this Project is enclosed.

      i. The Bidder shall indicate the business name and address in the upper left corner.
      ii. In the lower left corner, Bidder shall indicate "**Invitation for Bid –**

TX18- ENG(C)-08" and the re-bid bid opening date and time.

iii. Secure all documents in a manner that readily permits copying, i.e., binder clips or three-ring notebook.

C. No penalty or other responsibility shall be assigned to TMD's representative for the premature opening of any bid proposal not properly addressed and identified.

D. The Bidder is responsible for all costs incurred in the preparation and submission of a response.

E. Responses become TMD records and cannot be returned.

F. It is the Bidder's responsibility to ensure the IFB response is received in the TMD Purchasing & Contracts Division by the deadline listed in *Section 2. Schedule of Events* of this solicitation. TMD will not be responsible for bids being received late, illegible, incomplete or otherwise non-responsive. Any bid received after the specified deadline will not be considered under any circumstance and will be returned to Bidder unopened.

G. Bid cannot be altered or amended after opening time. Any alterations made before opening time must be initialed by Bidder or an authorized agent. Only corrections, deletions or additions to bid proposal forms shall be made by electronic communication provided such communication is received in correct and comprehensive form prior to the opening time of bids and is confirmed by letter over the signature of the Bidder.

H. TMD may reject bid responses that do not comply with requirements in the IFB solicitation and state and federal laws. TMD may accept or reject all or any part of any bid response, waive procedures for submitting bid responses, waive formalities and/or minor technicalities, and award by item or groups of items, whichever best serves the interests of TMD. TMD may also cancel this procurement and withdraw this IFB solicitation at any time before a contract is signed by TMD. TMD shall be the sole judge of the best interests of TMD. TMD may award one or more contracts for all or part of the Work.

I. Bidder is required to make any information created or exchanged with the state pursuant to this solicitation, and not otherwise excepted from disclosure under the Texas Public Information Act, available in PDF or other format that is accessible by the public at no additional charge to the state.

J. The bid response is a public record. By signing and submitting a response, Bidder hereby acknowledges:

i. That the solicitation, bid response and subsequent documents submitted to TMD are subject to the Texas Public Information Act (PIA);

ii. That it is the Bidder's obligation to specifically identify information it contends to be confidential or proprietary and accepts that TMD may in its sole discretions deem a bid response as non-compliant; and

iii. That Bidder grants a royalty-free, non-revocable, world-wide, perpetual license to reproduce any copyrighted portions of the bid response and subsequent documents to comply with Legislative Budget Board (LBB) reporting requirements, PIA disclosures, or any other reporting requirements mandated by law or statute.

7. SPECIFICATIONS:

A. Each Bidder will be held to have studied the Plans and Specifications as provided by A/E and referenced in this IFB as **Attachment B – Plans and Specifications**, to have visited all sites affecting the proposed work, to have satisfied themselves regarding all existing conditions and measurements, and to have included in the bid proposal an amount sufficient to cover all work.

B. Should Bidder find discrepancies between the Plans and Specifications, or should Bidder be in doubt as to the Plans and Specifications exact meaning, Bidder should notify the

A/E at once. The A/E, in conjunction with TMD, at their option, may issue clarifying addenda.

C. TMD will not be responsible for oral instructions or for misinterpretation of Plans and Specifications. If the Bidder has objection to the use of a material, appliance or method of construction as shown or specified, Bidder shall register written objections with TMD. Otherwise, Bidder shall proceed to bid the work under the stipulation that a satisfactory job is required. In the case of contradictory work item requirements between documents, the more stringent requirement shall apply.

D. The AE, in conjunction with TMD, reserves the right to issue, at any time prior to the Bid Opening, addenda which become upon issuance, an inseparable part of the Plans and Specifications. Each Bidder shall acknowledge receipt of all addenda by signing each addendum and submitting them with the bid proposal. Failure to acknowledge receipt of all addenda issued could cause the bid to be ruled as non-responsive. TMD reserves the right to make the final decision.

E. Materials regulated by 42 USC 6901 et. seq. will be submitted to the A/E, or TMD, to ensure compliance with structural specifications. This applies to all tier levels. All items bid shall be new, in first class condition, including containers suitable for shipment and storage, unless otherwise indicated in bid invitation. Verbal agreements to the contrary will not be recognized.

8. <u>BIDDER REQUIREMENTS:</u>

A. In addition to the preferences listed on the cover page of this IFB, mark below if bidder claims preference under 1 Texas Administrative Code §20.39:

( ) Agricultural products produced or grown in other states of the United States.
( ) Supplies, materials, or equipment produced in Texas or offered by Texas Bidder
( ) Historically Underutilized Business (HUB) certified by GSC

B. A Bid Security is required for this Project in the form of either a Bid Bond, a Certified Check or Cashier's Check (drawn on a solvent bank in the State of Texas), drawn to the order of the Texas Military Department, in the sum of not less than five percent (5%) of the total amount of the bid proposal, in accordance with 1 Texas Administrative Code §20 (Texas Comptroller of Public Accounts, Bidding Procedures).

i. For Out of State Bidders, each Bid Proposal, regardless of performance and payment bond requirements, must be accompanied by a non-resident Contractor's surety bond, drawn to the order of the Texas Military Department in the sum of not less than five percent (5%) of the total amount of the bid proposal, including all alternates, unless the Bidder is eligible for a reciprocity exemption under Article 5160a, Texas Civil Statutes. No other form of security will be accepted.

ii. Should the successful Bidder fail, neglect or refuse to begin performance of the Contract after receiving the contract award, said security shall be forfeited to TMD. Bid security furnished by the successful Bidder will be returned when a Notice to Proceed is issued. Bid security furnished by unsuccessful Bidders will be returned when a Contract is executed.

C. Successful Bidder, at their expense, will hire a Third-Party Inspector qualified in construction and certified in code compliance, who will verify in writing the milestone and/or phase completion. The Third-Party Inspector will inspect and certify that milestones and/or phases meet building code and project plans/specifications. The Third-Party Inspector must be approved by TMD prior to any inspections being performed.

D. Bidder shall provide a Work Breakdown Structure (WBS) which will include **Attachment A – Schedule of Values (SOV)** with itemized Labor, Equipment, and Material for the referenced project.

i. This document shall prove and evidence the price quoted for the given Project. Bidder shall provide evidence of the Bidder's project management Gantt Chart

via a copy of the MS Project, one (1) electronic copy on CD-ROM, and one (1) hardcopy in support of Bidder's schedule. Provide the version of the MS Project on the CD-ROM. These documents shall be submitted with Bidder's bid proposal.

E. Having carefully examined the Plans and Specifications, as well as the premises and conditions affecting the work, the Bidder proposes to furnish all labor, materials, tools, equipment, licenses, permits, fees, insurance, taxes, bonds, and services necessary to complete the Project for the modernization of the Weslaco Readiness Center facility per Plans and Specifications. Attachment A shall be completed. Transfer totals from Attachment A to appropriate spaces below:

BASE BID AMOUNT:

Base Bid Amount (Figure): _____

Base Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 1

Bid Amount (Figure): _____

Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 2

Bid Amount (Figure): _____

Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 3

Bid Amount (Figure): _____

Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 4

Bid Amount (Figure): _____

Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 5

Bid Amount (Figure): _____

Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 6

Bid Amount (Figure): _____

Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 7

Bid Amount (Figure): _____

Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 8

Bid Amount (Figure): _____

Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 9

Bid Amount (Figure): _____

Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 10

Bid Amount (Figure): _____

Bid Amount (Written): _____

BID AMOUNT: ALTERNATE 11

Bid Amount (Figure): _____

Bid Amount (Written): _____

F. The cost for Third-Party Inspection(s) will not factor into award of this contract and is a separate line item cost. The Third-Party Inspection shall not be included in the base bid cost. The cost for Third-Party Inspection(s) shall not weigh and/or factor into the base bid and will be excluded from evaluation of award. Notate the Third-Party Inspection amounts below:

THIRD PARTY INSPECTION AMOUNT:

Third Party Inspection Amount (Figure): _____

Third Party Inspection Amount (Written): _____

G. Amounts above shall match line item totals from Attachment A.

9. HISTORICALLY UTILIZED BUSINESS (HUB):

A. The Bidder agrees to provide a response to the HUB policy goal of TMD, and provides the following information:

i. Bidder's firm is qualified as a HUB: _____ Yes _____No

ii. State agencies are required to make a Good Faith Effort (GFE) to assist HUBs in receiving contract awards issued by the State of Texas (Tex. Gov't Code, Chapter 2161). The goal of this program is to promote full and equal business opportunity for all businesses in state contracting with the State of Texas.

In accordance with the TMD's policy of encouraging the use of HUBs in State procurement, TMD shall make a GFE to utilize HUBs in contracts. TMD shall achieve the annual program goals by contracting directly with HUBs or indirectly through subcontracting opportunities. Any business that contracts with TMD shall be required to make a GFE to award necessary subcontracts of the total contract value to HUBs in accordance with Comptroller of Public

Accounts (CPA) Rule 20. The GFE program does not prevent any business group from participating in contracting opportunities with the State of Texas.

B. TMD has determined that the work to be performed under this Contract includes subcontracting opportunities, to include but not limited to architectural, mechanical, electrical, plumbing, structural, fire alarm, IT/telecom, site civil modifications, fencing modifications, and site utility upgrades.
   i. A completed HUB Subcontracting Plan (HSP) will be required. The HSP must be submitted as part of the Bidder's bid response or the bid response will be rejected as non-responsive and returned unread.
   ii. Further information concerning the Bidder's GFE documentation requirements can be found in **Attachment C – HUB Subcontracting Plan**.
   iii. Successful Bidder is required to perform a GFE in providing HUB firms with opportunities to participate in the bid and construction process.
   iv. Electronic copies of the HSP and additional HUB information can be found at: https://comptroller.texas.gov/purchasing/vendor/hub/

10. CHANGES AND EXCEPTIONS TO THE TERMS AND CONDITIONS:

Exceptions that are not advantageous to TMD may result in the deduction of points in the evaluation or disqualification of the bid response.

11. SUBMISSION CONSIDERATION:

Only bid responses submitted by the bid opening deadline with required submittal documents, including attachments, addendums, amendments and meeting qualifications will be considered. Failure to submit the required information may be cause for rejection of the bid response.

TMD reserves the right to:

A. Waive informalities and minor irregularities in bids received;
B. Consider respondent qualifications, equipment, facility, references;
C. Conduct studies and other investigations as necessary to evaluate any response;
D. Request additional relevant information; and
E. Disqualify bid response based on unsatisfactory reference checks, reports and records of service.

12. AWARD:

Award will be based on the most qualified, responsive, responsible Bidder and lowest price based on base bid and all alternates. TMD will consider best value for the state as directed by Texas Government Code § 2155.074 when awarding a Contract. Award is contingent upon the availability of State and/or Federal funding. TMD reserves the right to award all, none, or any sequence of bid alternates contingent upon availability of funds.

13. ORDER OF PRECEDENCE:

Any conflicts in terms and conditions shall be resolved with precedence given to the following order of descending priority:

A. Purchase Order;
B. Conditions contained in the Invitation for Bids; and
C. Successful Bidder's bid response to IFB.

14. TMD STANDARD TERMS AND CONDITIONS:

Successful Bidder shall adhere to the Terms and Conditions as outlined in **Attachment H – TMD Standard Terms and Conditions**.

15. WORK SCHEDULE:

A. Successful Bidder must begin work on the project within ten (10) calendar days after receiving the Notice to Proceed. Successful Bidder must receive written authorization from TMD to begin work at a later date. Failure to comply with this provision may result in

termination for default.

B. Work shall be conducted Monday through Friday between the hours of 8:00 AM to 5:00 PM unless other arrangements are made in advance with Project Manager, Contracting and/or TMD staff.

C. The Bidder agrees that, if awarded the Contract, the Work will be substantially complete, unless delayed by inclement weather, in **days** following Notice to Proceed. (**Bidder must enter number of days in blank**)

16. CONTRACT TERM AND EXTENSIONS:

A. The Contract period will be mutually agreed upon between the successful Bidder and TMD and set forth in the final awarded Contract.

B. In case the established period of the year is not suitable to provide the work as outlined in Attachment B, with reasonable notification and with proper TMD approval, the completion date may be extended at no cost up to 12 months until the project is completed.

17. VENDOR PERFORMANCE:

State agencies shall report a Vendor's performance on any purchase of $25,000 or more from contracts administered by TMD or any other purchase made through an agency's delegated authority or a purchase made pursuant to the authority in Government Code, Title 10, Subtitle D or a purchase exemption from CPA/TPASS procurement rules and procedures.

A. Bidder's past performance will be measured based upon pass/fail criteria, in compliance with applicable provisions of §2155.074, 2155.075, 2156.007, 2157.003, and 2157.125, Gov't Code. Historic reports submitted prior to February 10th, 2017 were graded on a satisfactory/unsatisfactory scale. The score will be displayed as "Legacy Satisfactory" or "Legacy Unsatisfactory". Bidders may fail this selection criterion for any of the following conditions:

i. A score of "Legacy Unsatisfactory" for scores submitted prior to February 10th, 2017;
ii. A score of less than 90% or a letter grade below 'A' in the Vendor Performance System for scores submitted after February 10th, 2017;
iii. Currently under a Corrective Action Plan through the Comptroller of Public Accounts;
iv. Having repeated negative Vendor Performance Reports for the same reason; and/or
v. Having purchase orders that have been cancelled in the previous months for non-performance.

B. TMD may conduct reference checks with other entities regarding past performance. In addition to evaluating performance through the Vendor Performance Tracking System (as authorized by 34 Texas Administrative Code §20.108), TMD may examine other sources of vendor performance including, but not limited to, notices of termination, cure notices, assessments of liquidated damages, litigation, audit reports, and non-renewals of contracts. Any such investigations shall be at the sole discretion of TMD, and any negative findings, as determined by TMD, may result in non-award to the Bidder.

C. Contractor performance information is located on the CPA web site at: http://www.window.state.tx.us/procurement/prog/vendor_performance/

D. Successful Bidder's performance will be monitored and reported through the Comptroller's VPTS as described in 34 Texas Administrative Code § 20.108 (b).

18. PAYMENT:

Invoices shall be submitted to:
Texas Military Department, Accounts Payable
P.O. Box 5218

Austin, TX 78763-5218
or via email at: accountspayable@military.texas.gov

A. Payment Submittals:

i. TMD shall provide the Successful Bidder with all original TMD documents required for the Project.
ii. The Successful Bidder shall complete and submit original TMD documents required for Project designed and supervised by TMD.

Payment submittals shall be submitted on TMD forms.

B. Each time a request for payment is submitted, the Successful Bidder shall submit:

i. Two originals of TMD Document for Payment with Continuation Sheet;
ii. One notarized copy of Contractor's Payment Affidavit; and
iii. The HUB Subcontracting Plan (HSP) Prime Contractor Progress Assessment Report
iv. Requests for payment will not be processed until all forms are received.

C. Final Payment:

i. The Successful Bidder shall provide with the request for final payment the following original TMD documents as applicable. All documents will be notarized as required:
   a. Two original Application & Certificate for Payment;
   b. Certificate of Substantial Completion;
   c. Contractor's Affidavit of Payment of Debts and Claims;
   d. Contractor's Affidavit of Release of Liens; and
   e. Consent of Surety Company to Final Payment.
ii. At the direction of TMD, the Successful Bidder will submit specific warranties, workmanship bonds, maintenance agreements, record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, similar final record information and final certification.
iii. Any close-out requirements unique to this Project shall be identified in the Special Conditions attached to and a part of the signed contract.

19. TERMINATION:

A. The Contract, either in whole or part, is subject to cancellation without penalty by TMD by giving thirty (30) days written notice of intent to terminate.

B. If Contract termination is for failure of the successful Bidder to fulfill the Contract obligations, TMD may complete the work by Contract or otherwise and the successful Bidder will be liable for any additional costs incurred by TMD.

C. If, after termination for failure to fulfill Contract obligations, it is determined that the successful Bidder had not failed, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the state.

D. The rights and remedies of TMD provided in this clause are in addition to any other rights and remedies provided by law or under the Contract.

E. The Contract is subject to cancellation without penalty either in whole or part if funds are not appropriated by the Texas Legislature, Federal Government or otherwise made available.

20. ADDITIONAL CONTRACT CLAUSES:

A. Any terms and conditions attached to a bid response will not be considered unless specifically referred to on this solicitation and may result in disqualification.

B. If Special Conditions apply to this Project, they will be attached to and made part of the

Contract.

C. In the event the Project is contingent on Federal funds, all required Federal clauses are applicable.

D. TMD has a policy of being a smoke-free agency, which includes but is not limited to electronic cigarettes. The policy reflects TMD's commitment to providing a healthy environment for all employees and visitors. This policy prohibits smoking within any state building or on the grounds. Successful Bidder, by acceptance of the Contract, agrees to abide by this policy when on TMD property.

E. Neither the United States, nor any of its Departments, Agencies or Employees, is, or will be a party to the IFB or any resulting Contract.

F. Bid acceptance period: All bids will be valid for one hundred and twenty (120) calendar days after the bid opening date and will constitute an irrevocable offer to TMD for the 120-calendar day period. Such period may be extended beyond the 120-calendar day period upon mutual agreement of both parties.

G. Federal Debarment and Terrorism Regulations:

i. Bidder certifies that they are in compliance with Texas Government Code, 1 TAC 113 and in compliance with Executive Order 13224 relating to terrorism. The Designated Foreign Terrorist Organizations list is located at: https://www.sam.gov/portal/SAM/##11#1.

ii. Bidder certifies that neither the Bidder nor any of its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal, State, or any other Government Department or entity. The Debarred Vendor list is located at: https://www.sam.gov/portal/SAM/##11#1.

iii. Pursuant to Chapter 808 of the Texas Government Code, Bidder is forbidden by law from conducting business with companies on the Companies that Boycott Israel list. The list can be located at:

https://comptroller.texas.gov/purchasing/publications/divestment.php

ATTACHMENTS LIST

Attachment A – Schedule of Values

Attachment B – Plans and Specifications

Attachment C – HUB Subcontracting Plan

Attachment D – Third-Party Building/Milestone Inspection Guidelines

Attachment E – Wage Rates

Attachment F – Bonds and Insurance Requirements

Attachment G – Bidder's Checklist

Attachment H – TMD Standard Terms and Conditions

Attachment I – Uniform General and Supplemental Conditions

Attachment J – Addendum 1 from June 29, 2018 IFB posting

ATTACHMENT A – SCHEDULE OF VALUES

WESLACO READINESS CENTER MAJOR MAINTENANCE
TX18-ENG(C)

BID COST BREAKDOWN WORKSHEET

Date

ESTIMATOR	CHECKED BY	PROJECT
---	---	---

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
	Base Bid				
	General Conditions				
	Project Management and Coordination				
	Construction Progress Documentation				
	Bonds & Insurance				
	Quality Control (QC)				
	Temporary Utilities				
	Construction Facilities				
	Construction Aids				
	Vehicular Access and Parking				
	Temporary Barriers and Enclosures				
	Project Identification				
	Cleaning and Waste Management				
	Protecting Installed Construction				
	Existing Conditions				
	Flooring Demolition				
	Slab Demolition				
	Door Demolition				
	Window Demolition				
	Wall Demolition				
	Ceiling Demolition				
	Selective Removal Furnishings (Gym equip., desks, file cabinets, copiers, etc.)				
	Cleaning Building Exterior				
	Concrete				
	Building Foundation				
	Architectural Improvements				
	Infill of Existing Masonry				
	New Cabinentry and Millwork				
	Joint Sealants				
	Roof Repair and Openings				
	Interior Doors and Frames				
	Drywall and Metal Stud Partitions				
	Rubber Floor Base				
	Ceramic Tile				
	Miscellaneous Metal Fabrications				
	Resilient Flooring				
	Sealed concrete floors				
	Acoustical Ceiling Tile and Grid				
	Windows and louvers				
	Painting				
	Room Signage				
	Handicapped Signage				
	Toilet Accessories				
	Plumbing Improvements				
	Plumbing Demolition				
	Water Distribution				
	Sanitary Waste and Vent Improvements				
	New Plumbing Fixtures				
	Natural Gas System Improvements				
	Mechanical Improvements				
	Demolition				
	Exhaust Equipment				
	New Ventilation System for Drill Hall				
	Split System for Comm Room				
	New HVAC Units				
	Ductwork				
	Diffusers, Grilles and Air Distribution Devices				
	Condensate Piping				
	Electrical Improvements				
	Demolish Existing Power and Lighting				
	Switches, Receptables and Branch Wiring				
	Disconnect Switches				
	Panelboards				
	Apparatus Feeders				
	Conduit and Conductors				
	Electric Hand Dryers				
	Interior Lighting				
	Exterior Lighting				
	IT/Telecom Improvements				
	Telecom Basket Tray, Conduit and Outlets				
	Telecom Cabling				
	Telecomm Patch Panels				
	Equipment Racks				
	Telecom Grounding				
	Fire Alarm				
	Fire Alarm/ Mass Notification System				

	Additional Costs				
	Allowance 1A - Concrete Crack Repair	1000	LF		
	Allowance 1B - Concrete Spalling Repair	50	Cu. Ft.		
		SUBTOTAL:			
		MOBILIZATION			
		SUBTOTAL:			
		OH & P			
		Weslaco RC Subtotal Without SECO Items:			
	SECO Item #1				
	Occupancy Sensors	[redacted]			
	Add occupancy sensors				
		OH & P			
		SECO Item 1 TOTAL:			
	SECO Item #2				
	Provide DDC Control System	[redacted]			
	Provide New BACNet DDC Control System				
		OH & P			
		SECO Item 2 TOTAL:			
		Weslaco RC Base Bid Total:			
	Bid Option #1				
	Temporary Restroom Building	[redacted]			
	Rental of temporary toilets				
	Temporary water & sewer hookups for temporary toilets				
	Temporary power hookup for temporary toilets				
		OH & P			
		Bid Option 1 TOTAL:			
	Bid Option #2				
	Temporary Shower Building	[redacted]			
	Rental of temporary showers				
	Temporary water & sewer hookups for temporary showers				
	Temporary power hookup for temporary showers				
		OH & P			
		Bid Option 2 TOTAL:			
	Bid Option #3				
	Full IT System Including Upgrades	[redacted]			
	Telecom Basket Tray, Conduit and Outlets				
	Telecom Cabling				
	Telecomm Patch Panels				
	Equipment Racks				
	Telecom Grounding				
		OH & P			
		Bid Option 3 TOTAL:			
	Bid Option #4				
	Additional HVAC Upgrades/Repairs/HVLS Fans	[redacted]			
	Fan / rebalancing of area A systems / split systems in unit storage offices				
	Demolition				
	HVAC Equipment				
	Multi-Split Systems for IT Rooms				
	Exhaust System				
		OH & P			
		Bid Option 4 TOTAL:			
	Bid Option #5				
	Restroom/Conference Room Renovation in Admin Wing	[redacted]			
	Concrete Demolition				
	Concretre Slab				
	Casework				
	Openings Demolition				
	Hollow Metal Door Frames				
	Wood Doors/Hardware				
	Finishes Demolition				
	Metal Studs & Gypsum Board				
	Ceramic & Quarry Tile				
	Resilient Flooring, Carpet, & Vinyl Base				
	Acoustical Ceiling Tile and Grid				
	Painting				
	Toilet Accessories/Partitions				
	Plumbing Demolition				
	Water Distribution				
	Sanitary Sewer				
	Plumbing Fixtures				
	Electrical Demolition				
	Switches, Receptables and Branch Wiring				
	Lighting				
		OH & P			
		Bid Option 5 TOTAL:			
	Bid Option #6				
	Exterior Building/ Parking Improvements/ Building Sign	[redacted]			
	Masonry Demolition				
	Masonry Demolition				
	Site Demolition				
	Site Concrete				
	Existing Site Concrete Paving Maintenance				
	Asphalt Paving				
	Electrical Demolition				
	Lighting				
	Site Utilities				
		OH & P			

		Bid Option 6 TOTAL:	
	Bid Option #7		
	Exterior Earthwork & Drainage	[redacted]	
	Clearing & Grubbing		
	Utilities		
	Landscaping		
		OH & P	
		Bid Option 7 TOTAL:	
	Bid Option #8		
	Electrical Generator Provisions	[redacted]	
	Connection point, Cam Lock, conduit, wiring, panel		
	Automatic Transfer Switch 1200 Amps		
		OH & P	
		Bid Option 8 TOTAL:	
	Bid Option #9		
	Site Security Fencing	[redacted]	
	Site fencing & barbed wire		
	Vehicle Gates & openers		
	Electrical provisions		
		OH & P	
		Bid Option 9 TOTAL:	
	Bid Option #10		
	Provide New Storage Caging In Existing Northeast Storage Area	[redacted]	
	Remove wire mesh caging, return to owner		
	Wire caging from floor to bottom of deck		
	Wire caging doors, single		
		OH & P	
		Bid Option 10 TOTAL:	
	Bid Option #11		
	Provide TA-50 Lockers For Secure Equipment Storage	[redacted]	
	TA-50 Lockers		
	Freight for lockers		
	Concrete curb under lockers, 4"		
		OH & P	
		Bid Option 11 TOTAL:	
	3rd Party Inspector		
	Independent 3rd Party Inspector of General Construction Activities	[redacted]	
		3rd Party Inspector Cost Total	
		Weslaco RC Additional Costs Total:	
		PROJECT TOTAL:	

NOTES:

ATTACHMENT B – PLANS AND SPECIFICATIONS



NORTH

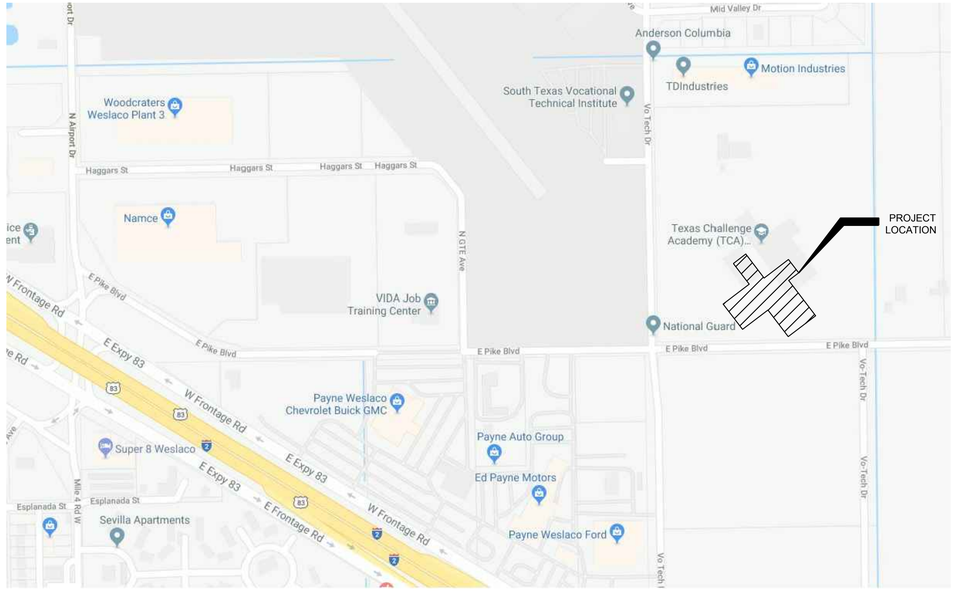
COUNTY LOCATION MAP

NOT TO SCALE

INDEX OF DRAWINGS

SEQ NO.	SHEET NO.	DESCRIPTION
1	G-1	COVER SHEET
2	C-1	DEMOLITION PLAN
3	C-2	PAVING PLAN
4	C-3	GRADING PLAN
5	C-4	PAVING DETAILS
6	C-5	EROSION CONTROL DETAILS
7	A-0	ABBREVIATIONS AND SYMBOLS
8	A-1	EGRESS PLAN AND CODE REVIEW
9	A-2	ACCESSIBILITY AND PARTITION SCHEDULE
10	A-3	SITE PLAN
11	A-4	SITE DETAILS - BID OPTION 9
12	A-5	SECURITY FENCING DETAILS - BID OPTION 9
13	A-6	DEMOLITION FLOOR PLAN - OVERALL
14	A-7	DEMOLITION FLOOR PLAN - AREA 'A'
15	A-8	DEMOLITION FLOOR PLAN - AREA 'B'
16	A-9	DEMOLITION FLOOR PLAN - AREA 'C
17	A-10	DEMOLITION FLOOR PLAN - AREA 'D'
18	A-11	DEMOLITION REFLECTED CEILING PLAN - OVERALL
19	A-12	DEMOLITION REFLECTED CEILING PLAN - AREA 'A'
20	A-13	DEMOLITION REFLECTED CEILING PLAN - AREA 'B'
21	A-14	DEMOLITION REFLECTED CEILING PLAN - AREA 'C'
22	A-15	DEMOLITION REFLECTED CEILING PLAN - AREA 'D'
23	A-16	FLOOR PLAN - OVERALL
24	A-17	FLOOR PLAN - AREA 'A'
25	A-17A	FLOOR PLAN - AREA 'A' - BID OPTION 5
26	A-18	FLOOR PLAN - AREA 'B'
27	A-19	FLOOR PLAN - AREA 'C'
28	A-20	FLOOR PLAN - AREA 'D'
29	A-21	OVERALL REFLECTED CEILING PLAN
30	A-22	REFLECTED CEILING PLAN - AREA 'A'
31	A-23	REFLECTED CEILING PLAN - AREA 'B'
32	A-24	REFLECTED CEILING PLAN - AREA 'C'
33	A-25	REFLECTED CEILING PLAN - AREA 'D'
34	A-26	ROOM FINISH SCHEDULE
35	A-27	DOOR SCHEDULE AND TYPES
36	A-28	ENLARGED FLOOR PLANS
37	A-29	INTERIOR ELEVATIONS
38	A-30	MILLWORK ELEVATIONS & DETAILS
39	A-31	DETAILS
40	A-32	EXTERIOR ELEVATIONS
41	A-33	DOOR TYPES AND DETAILS
42	S-0	GENERAL NOTES
43	S-1	FOUNDATION PLAN
44	S-2	TYPICAL DETAILS
45	S-3	FOUNDATION DETAILS
46	S-4	FRAMING DETAILS
47	M-0	LEGEND, GENERAL NOTES AND ABBREVIATIONS
48	M-1	DEMOLITION PLAN - A
49	M-2	DEMOLITION PLAN - B
50	M-3	DEMOLITION PLAN - C
51	M-4	DEMOLITION PLAN - D
52	M-5	FLOOR PLAN - A
53	M-6	FLOOR PLAN - B
54	M-7	FLOOR PLAN - C
55	M-8	FLOOR PLAN - D
56	M-9	SCHEDULES
57	M-10	NETWORK ARCHITECTURE DIAGRAM
58	M-11	P&ID CONTROL SCHEMATICS
59	M-12	P&ID CONTROL SCHEMATICS
60	M-13	MECHANICAL DETAILS
61	M-14	MECHANICAL DUCT DETAILS
62	P-0	LEGEND, GENERAL NOTES, DETAIL AND SCHEDULES
63	P-1	DEMOLITION PLAN A
64	P-2	DEMOLITION PLAN B
65	P-3	DEMOLITION PLAN C
66	P-4	DEMOLITION PLAN D
67	P-5	FLOOR PLAN A
68	P-6	FLOOR PLAN B
69	P-7	FLOOR PLAN C
70	P-8	FLOOR PLAN D
71	P-9	ENLARGED PLAN
72	P-10	SANITARY RISER DIAGRAM
73	P-11	DOMESTIC WATER RISER DIAGRAM
74	P-12	WATER HEATER ROOM & DETAILS
75	E-0	LEGEND
76	E-1	ELECTRICAL SITE PLAN
77	E-2	LIGHTING DEMOLITION PLAN - AREA 'A'
78	E-3	LIGHTING DEMOLITION PLAN - AREA 'B'
79	E-4	LIGHTING DEMOLITION PLAN - AREA 'C'
80	E-5	LIGHTING DEMOLITION PLAN - AREA 'D'
81	E-6	POWER DEMOLITION PLAN - AREA 'A'
82	E-7	POWER DEMOLITION PLAN - AREA 'B'
83	E-8	POWER DEMOLITION PLAN - AREA 'C'
84	E-9	POWER DEMOLITION PLAN - AREA 'D'
85	E-10	LIGHTING PLAN - AREA 'A'
86	E-11	LIGHTING PLAN - AREA 'B'
87	E-12	LIGHTING PLAN - AREA 'C'
88	E-13	LIGHTING PLAN - AREA 'D'
89	E-14	LIGHTING CONTROLS PLAN - AREA 'A'
90	E-15	LIGHTING CONTROLS PLAN - AREA 'B'
91	E-16	LIGHTING CONTROLS PLAN - AREA 'C'
92	E-17	LIGHTING CONTROLS PLAN - AREA 'D'
93	E-18	POWER PLAN - AREA 'A'
94	E-19	POWER PLAN - AREA 'B'
95	E-20	POWER PLAN - AREA 'C'
96	E-21	POWER PLAN - AREA 'D'
97	E-22	ENLARGED POWER PLAN - AREA 'D'
98	E-23	ONE-LINE DIAGRAMS
99	E-24	SCHEDULES I
100	E-25	SCHEDULES II
101	E-26	SCHEDULES III
102	E-27	LIGHTING CONTROL DIAGRAMS I
103	E-28	LIGHTING CONTROL DIAGRAMS II
104	E-29	DETAILS I
105	FA-1	LEGEND
106	FA-2	DEMOLITION PLAN - AREA 'A'
107	FA-3	DEMOLITION PLAN - AREA 'B'
108	FA-4	DEMOLITION PLAN - AREA 'C'
109	FA-5	DEMOLITION PLAN - AREA 'D'
110	FA-6	PLAN - AREA 'A'
111	FA-7	PLAN - AREA 'B'
112	FA-8	PLAN - AREA 'C'
113	FA-9	PLAN - AREA 'D'
114	T-0	OVERVIEW AND SYMBOLS
115	T-1	OVERALL DEMOLITION FLOOR PLAN
116	T-2	DEMOLITION FLOOR PLAN - A
117	T-3	DEMOLITION FLOOR PLAN - B
118	T-4	DEMOLITION FLOOR PLAN - C
119	T-5	DEMOLITION FLOOR PLAN - D
120	T-6	OVERALL FLOOR PLAN
121	T-7	FLOOR PLAN - A
122	T-8	FLOOR PLAN - B
123	T-9	FLOOR PLAN - C
124	T-10	FLOOR PLAN - D
125	T-11	ENLARGED PLAN
126	T-12	ENLARGED PLAN
127	T-13	ENLARGED PLAN
128	T-14	ENLARGED PLAN
129	T-15	DETAILS

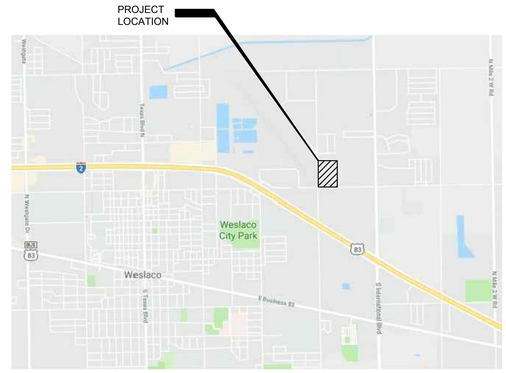
SET NO:



NORTH

SITE LOCATION MAP

NOT TO SCALE



NORTH

VICINITY MAP

NOT TO SCALE

BUILDING CODE SUMMARY

1. INTERNATIONAL CODE COUNCIL
   - A. BUILDING CODE — INTERNATIONAL BUILDING CODE 2012
   - B. STRUCTURAL CODE — INTERNATIONAL BUILDING CODE 2012
   - C. PLUMBING CODE — INTERNATIONAL PLUMBING CODE 2012
   - D. MECHANICAL CODE — INTERNATIONAL MECHANICAL CODE 2012
   - E. FIRE CODE — INTERNATIONAL FIRE CODE 2012
   - F. ENERGY CODE — INTERNATIONAL ENERGY CONSERVATION CODE 2012

2. NATIONAL FIRE PROTECTION ASSOCIATION
   - A. ELECTRICAL CODE — NATIONAL ELECTRICAL CODE 2012

3. STATE ENERGY CONSERVATION OFFICE/TEXAS COMPTROLLERS OFFICE
   - A. ENERGY CODES FOR STATE BUILDINGS — TITLE 34, PART 1, CH. 19, SB.C, RULE 19.31

4. ACCESSIBILITY CODES
   - A. AMERICANS WITH DISABILITIES ACT — TITLE II
   - B. TEXAS ACCESSIBILITY STANDARDS — TDLR, ABA- ART. 9102

TEXAS ARMY NATIONAL GUARD

CONSTRUCTION & FACILITIES MANAGEMENT OFFICE - CFMO

2200 W. 35TH STREET - CAMP MABRY - AUSTIN, TEXAS 78703

SCOPE OF WORK

FACILITY RENOVATION TO MODERNIZE THE WESLACO TEXAS ARMY NATIONAL GUARD READINESS CENTER AND MILITARY RECRUITING OFFICE. SCOPE INCLUDES ARCHITECTURAL, MEP, CIVIL, STRUCTURAL, FIRE ALARM AND DATA/IT MODIFICATIONS.

DESIGN TEAM

ISSUED FOR BID

REGISTERED ARCHITECT HOMERO SAENZ 25047 STATE OF TEXAS

04/20/2018

FREESE AND NICHOLS

4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

FNI PROJECT # ADG17589A

STATE OF TEXAS VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER

04/20/2018

SHEET # G-1

BID OPTIONS "◯"

1) TEMPORARY RESTROOM BUILDING.
2) TEMPORARY SHOWER BUILDING.
3) FULL IT SYSTEM INCLUDING UPGRADES.
4) ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.
5) RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN WING.
6) EXTERIOR BUILDING / PARKING IMPROVEMENTS/ BUILDING SIGN.
7) EXTERIOR EARTHWORK & DRAINAGE.
8) ELECTRICAL GENERATOR PROVISIONS.
9) SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.
10) NEW STORAGE CAGING IN EXISTING NORTHEAST STORAGE AREA.
11) TA-50 LOCKERS FOR SECURE EQUIPMENT STORAGE.

SECO OPTIONS "□"

1) PROVIDE OCCUPANCY SENSORS.
2) PROVIDE DDC CONTROL SYSTEM.

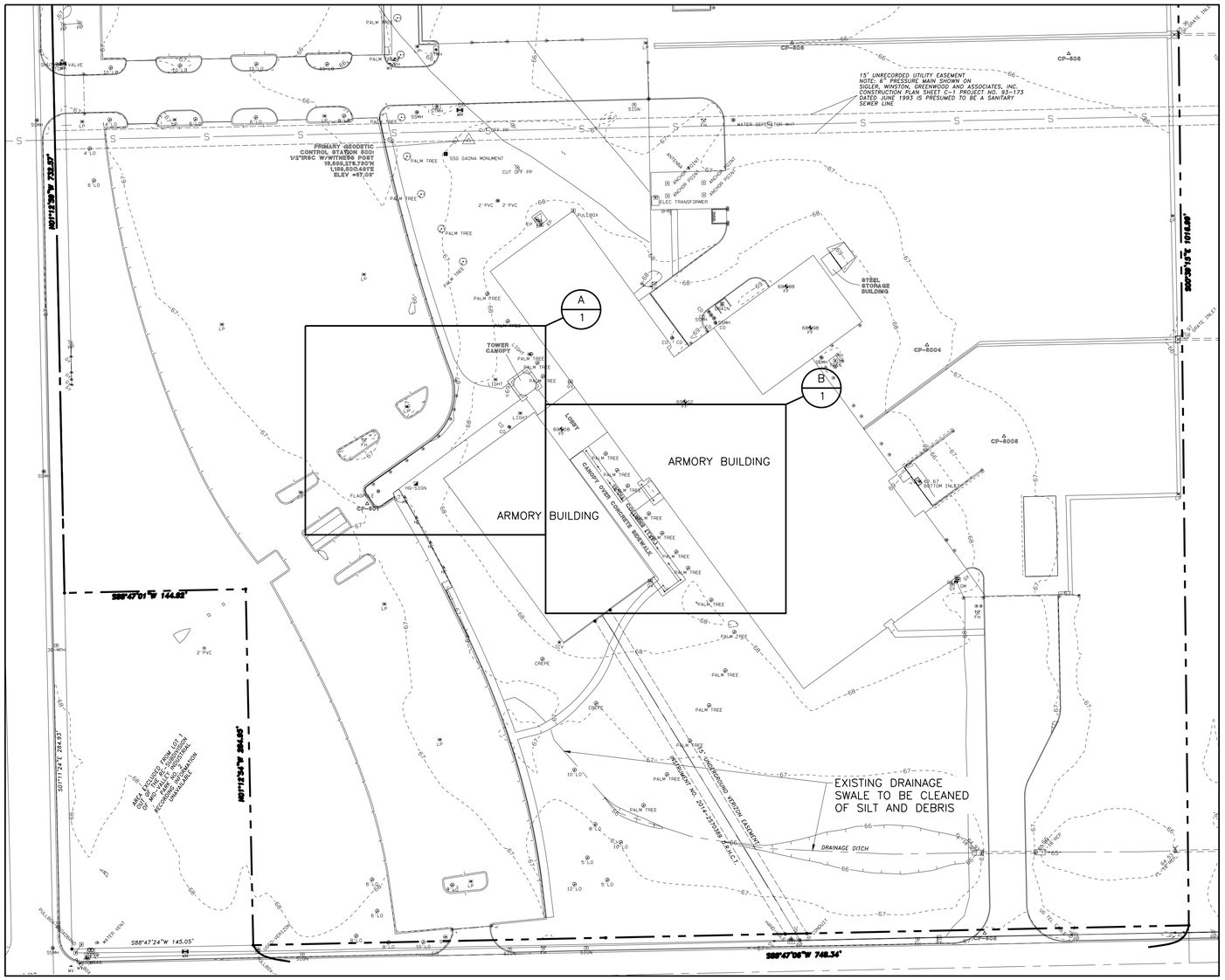
STAR Campaign FY18 Weslaco Readiness Center Major Maintenance

TEXAS ARMY NATIONAL GUARD

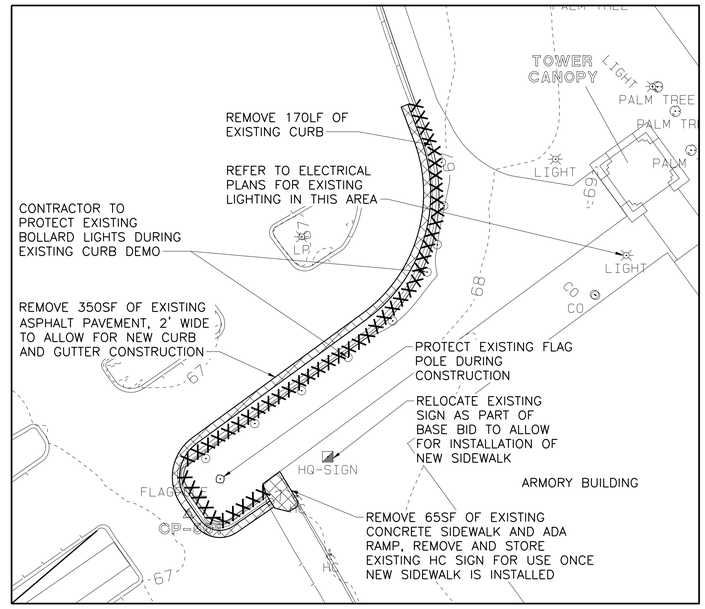
1100 VO-TECH DRIVE
WESLACO, TEXAS 78596

PROJECT NO: 48190030

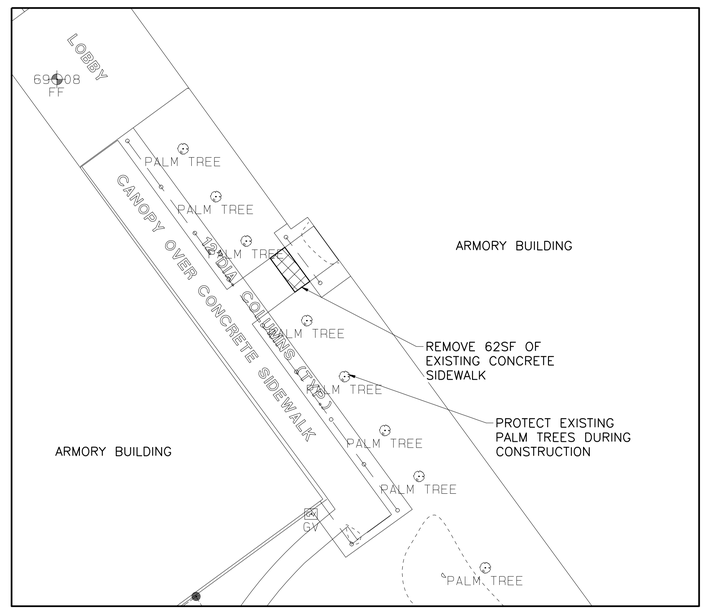
DATE: 04-20-2018



NORTH 1 — OVERALL DEMO PLAN
1" = 50'-0"



NORTH A 1 — DETAIL ENTRANCE DEMO BASE BID
1" = 20'-0"



NORTH B 1 — DETAIL BREEZEWAY DEMO BID OPTION 7
1" = 20'-0"

0 10' 20' 40'
SCALE IN FEET

0 50' 100'
SCALE IN FEET

LEGEND

- EXISTING PAVEMENT DEMOLITION AS BASE AND BID OPTION 7
- XXXXXX — TO BE DEMOLISHED
- PROPERTY LINE

NOTES

1. SUMMARY OF CIVIL BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. CONTRACTOR SHALL CONSULT WITH OWNER FOR MATERIAL STORAGE AND LAY-DOWN AREAS.

BID OPTIONS "◯"

6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/BUILDING SIGN.
7. EXTERIOR EARTHWORK & DRAINAGE.
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.

STATE OF TEXAS
BRETT M. BRISTOW
101000
LICENSED
PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: BMB
REVIEWED BY: THH

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

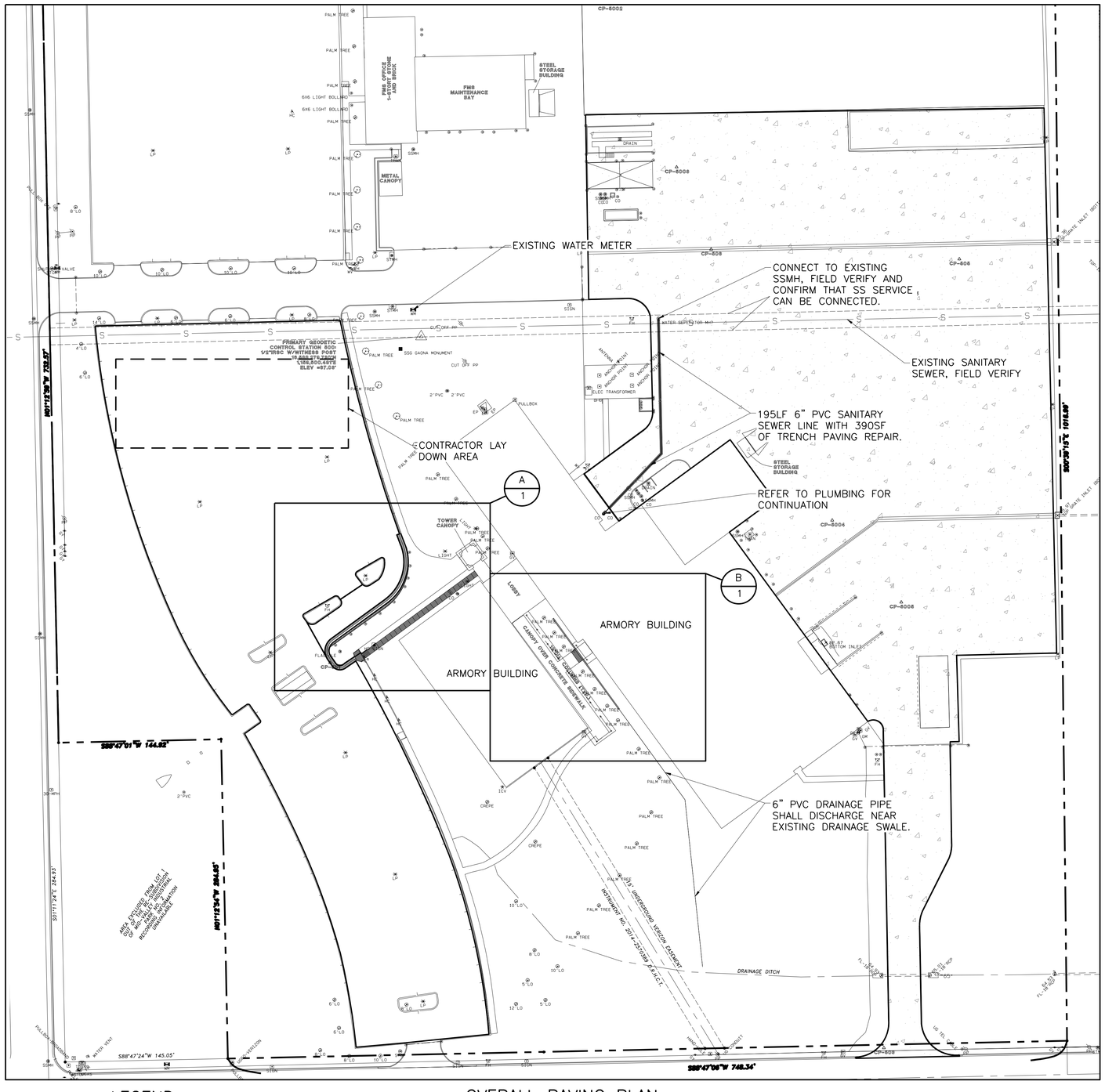
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

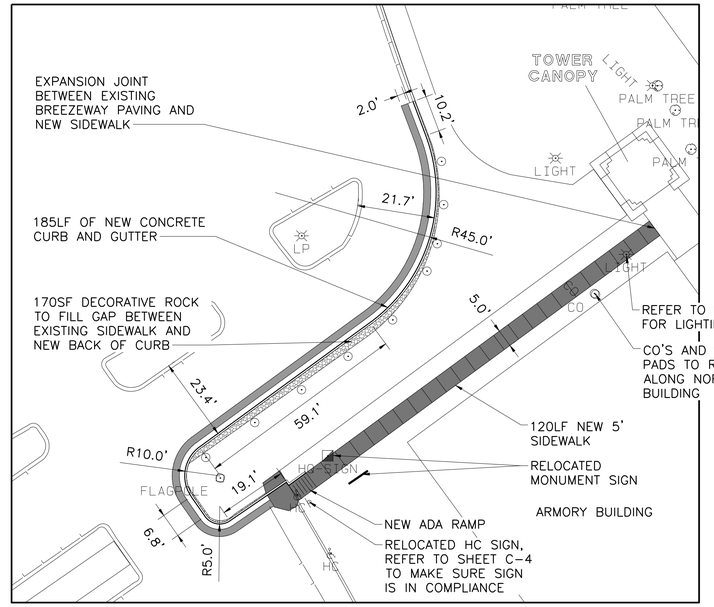
TXARNG CFMO

CIVIL
DEMOLITION PLAN

C-1

SHT. 1 of 129

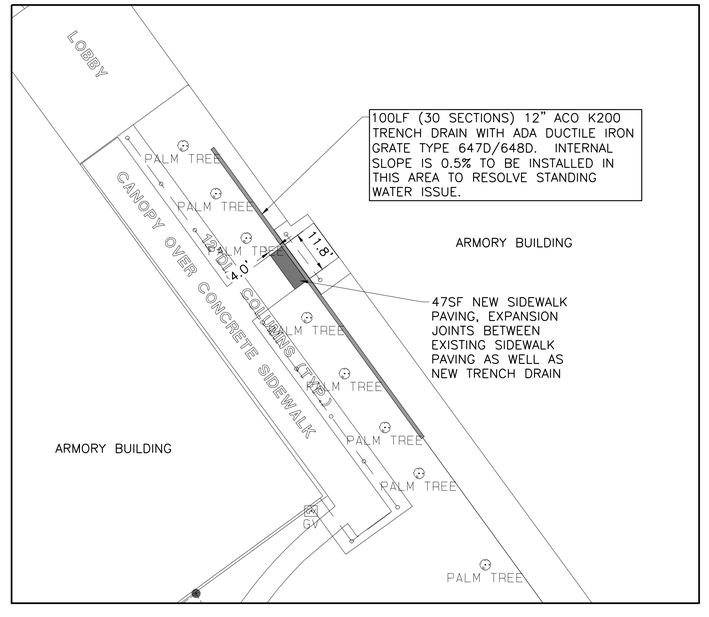




DETAIL ENTRANCE PAVING
BASE BID

NORTH A/1

1" = 20'-0"



DETAIL BREEZEWAY PAVING
BID OPTION (7)

NORTH B/1

1" = 20'-0"

LEGEND

- EXISTING CONCRETE MAINTENANCE EFFORT, BID OPTION (6)
- NEW CONCRETE SIDEWALK FOR ADA COMPLIANCE, BASE BID
- 2' ASPHALT PAVING FOR INSTALLATION OF CURB AND GUTTER, BASE BID

OVERALL PAVING PLAN
BASE AND BID OPTIONS 6&7

NORTH 1/–

1" = 50'-0"

BID OPTIONS "◯"

6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/BUILDING SIGN.
7. EXTERIOR EARTHWORK & DRAINAGE.
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.

NOTES:

1. REFER TO ARCHITECTURE SHEETS FOR UPDATED SECURITY FENCING LOCATIONS.
2. SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
3. ALL DIMENSIONS AND COORDINATES ARE TO FACE OF CURB OR EDGE OF PAVEMENT UNLESS NOTED OTHERWISE.
4. SEE SHEET C-4 FOR PAVING DETAILS, PAVEMENT SECTIONS AND JOINTING NOTES.
5. ALL NEW SIDEWALKS AND RAMPS SHOWN ON DRAWINGS MUST BE IN COMPLIANCE WITH CURRENT TEXAS ACCESSIBILITY STANDARDS AND ADA.
6. CURBS IN THE PARKING LOTS THAT WILL BE RESEALED AND RE-STRIPED SHALL BE PROTECTED. IF CURBS ARE DAMAGED DURING CONSTRUCTION CONTRACTOR SHALL REPLACE CURB.

0 10' 20' 40'
SCALE IN FEET

0 50' 100'
SCALE IN FEET

STATE OF TEXAS
BRETT M. BRISTOW
101000
LICENSED
PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: BMB
REVIEWED BY: THH

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6151 FAX (512) 782-1481

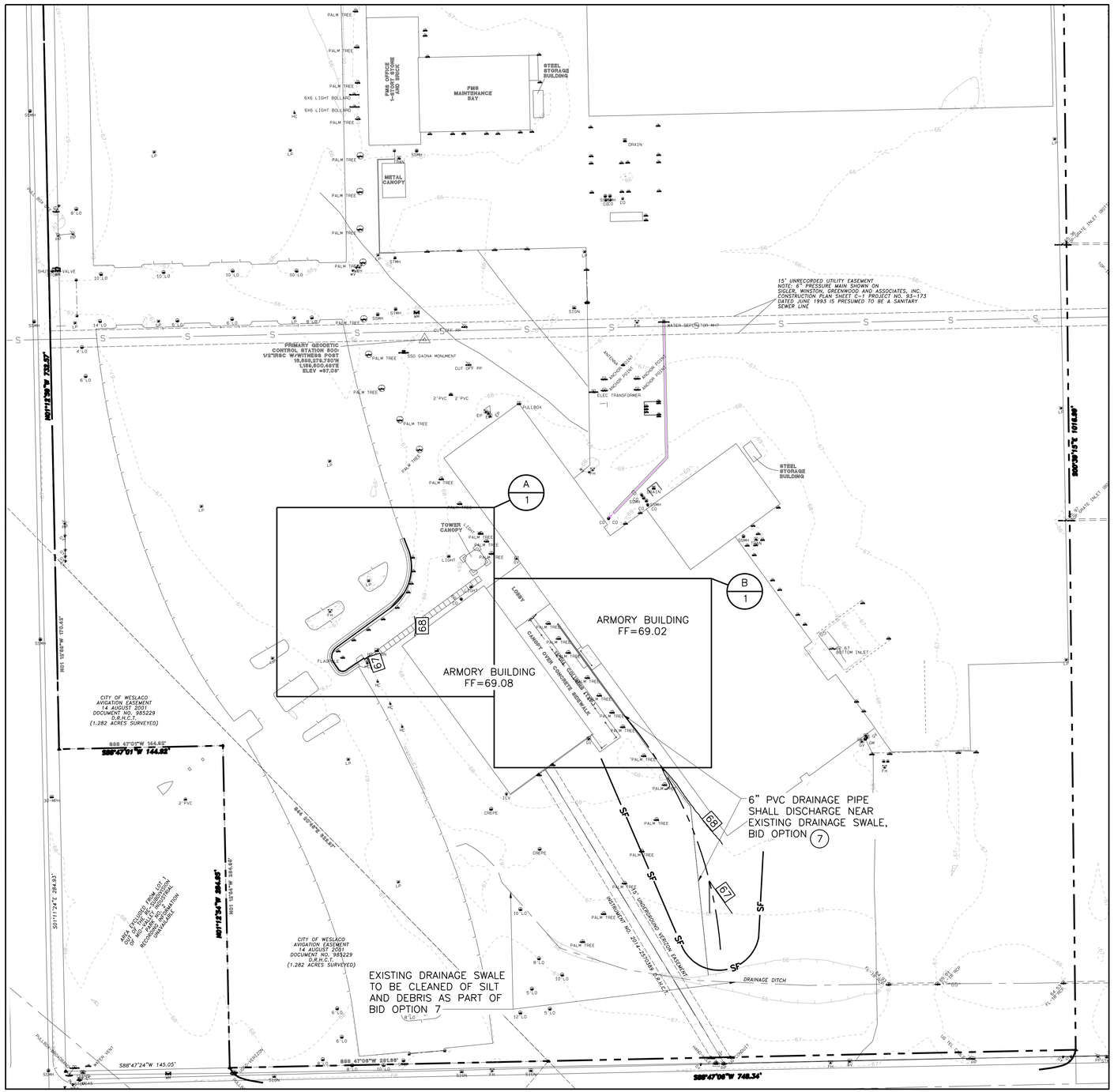
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

CIVIL
PAVING PLAN

C-2

SHT. 3 of 129



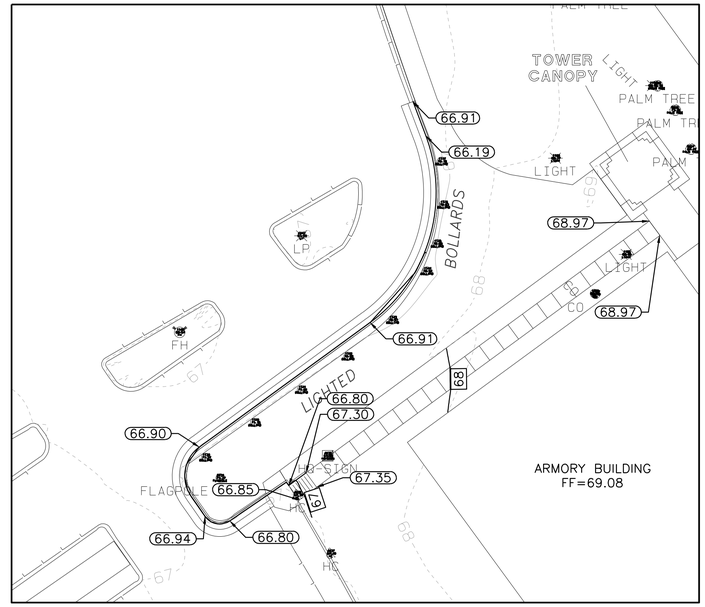
LEGEND

- 65.00 — TOP OF PAVEMENT
- 65.00 — NATURAL GROUND
- 65.00 — EXISTING SHOT
- 65 — EXISTING CONTOURS
- 65 — PROPOSED CONTOURS
- SF — SILT FENCE, REFER TO DETAIL 1, SHEET C-5
- FLOW LINE

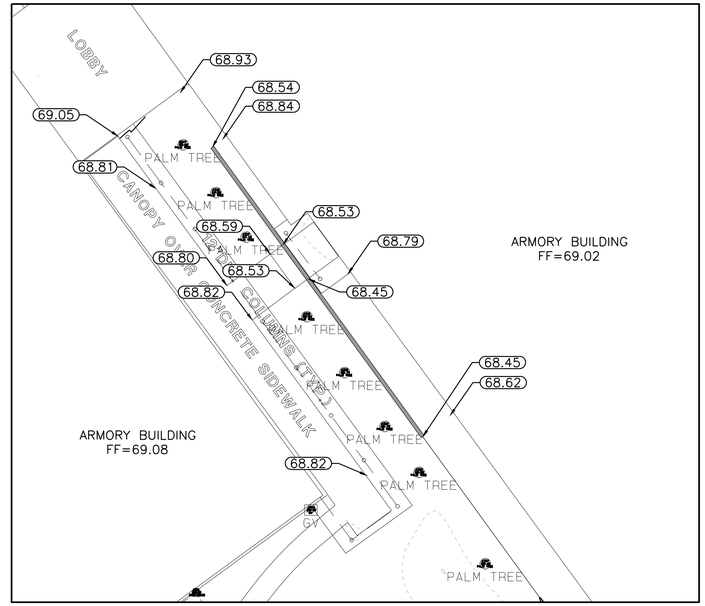
NORTH 1 – OVERALL GRADING PLAN
BASE AND BID OPTIONS 6&7
1" = 50'-0"

BID OPTIONS "◯"

6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/BUILDING SIGN.
7. EXTERIOR EARTHWORK & DRAINAGE.
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.



NORTH A 1 DETAIL ENTRANCE GRADING
BASE BID
1" = 20'-0"



NORTH B 1 DETAIL BREEZEWAY GRADING
BID OPTION (7)
1" = 20'-0"

0 10' 20' 40'
SCALE IN FEET

0 50' 100'
SCALE IN FEET

NOTES:

1. SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1.
2. ALL PROPOSED SIDEWALKS AND HANDICAP RAMPS MUST BE INSTALLED SO THEY ARE IN COMPLIANCE WITH CURRENT TEXAS ACCESSIBILITY STANDARDS AND ADA.
3. REFER TO SHEET C-5 FOR EROSION CONTROL DETAILS.

STATE OF TEXAS
BRETT M. BRISTOW
101000
LICENSED
PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: BMB
REVIEWED BY: THH

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

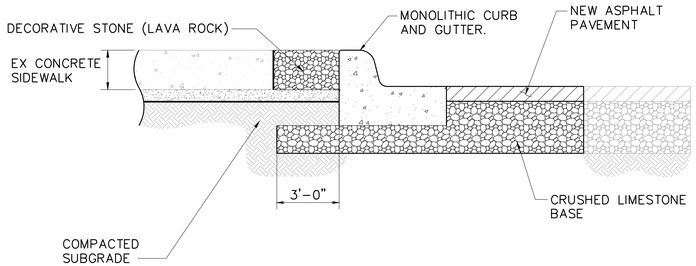
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

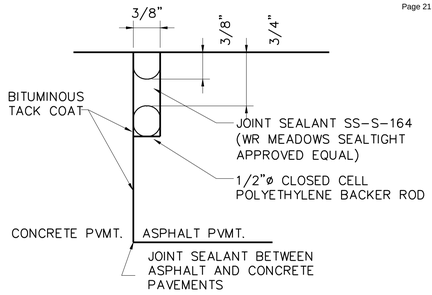
CIVIL
GRADING PLAN

C-3

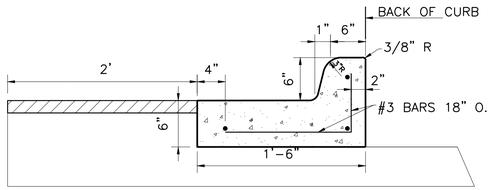
SHT. 4 of 129



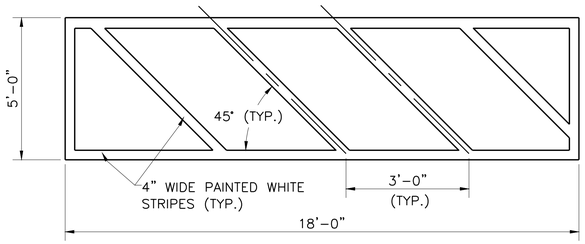
1 SIDEWALK PAVING SECTION
NOT TO SCALE



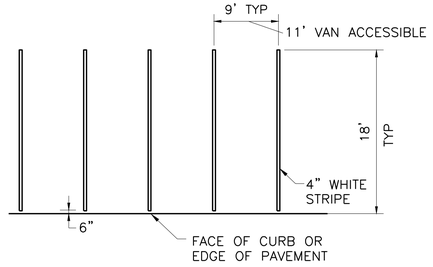
2 JOINT SEALANT BETWEEN ASPHALT AND CONCRETE PAVEMENT
NOT TO SCALE



3 CURB AND GUTTER DETAIL
NOT TO SCALE

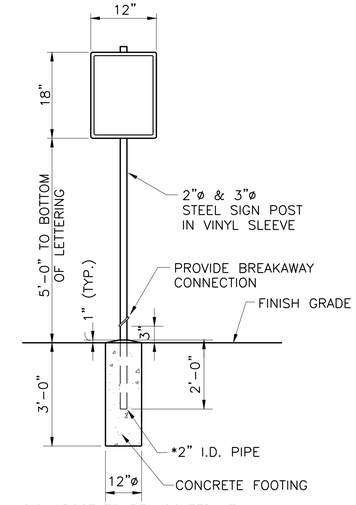


4 HANDICAP PARKING STRIPING DETAIL
NOT TO SCALE



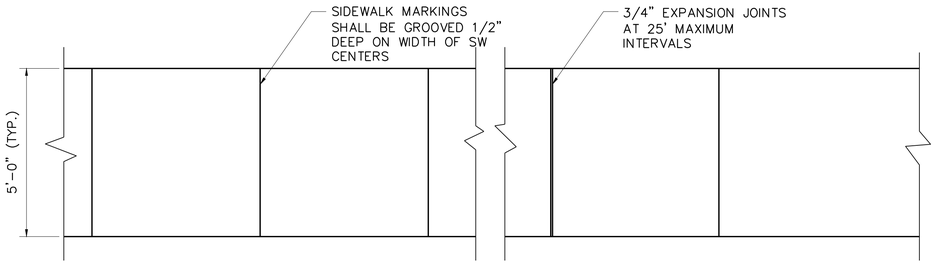
90° PARKING

5 TYPICAL PARKING STRIPE DETAIL
NOT TO SCALE

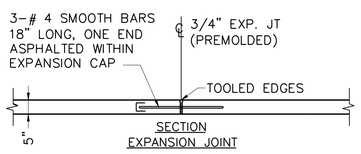


* SIGN POST TO BE LOCATED AT BACK OF SIDEWALK AS INDICATED ON PAVING PLAN SHEET

6 ADA PARKING SIGN
NOT TO SCALE



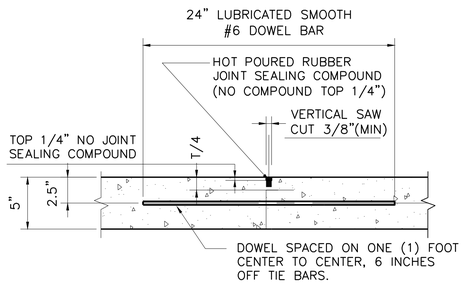
7 SIDEWALK PAVING
NOT TO SCALE



CONCRETE SIDEWALK
NOT TO SCALE

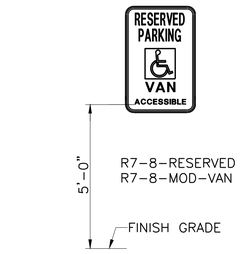
NOTES:

1. JOINTS SHALL BE EQUALLY SPACED BETWEEN SIDEWALK INTERSECTION JOINTS SHOWN IN THE PLAN

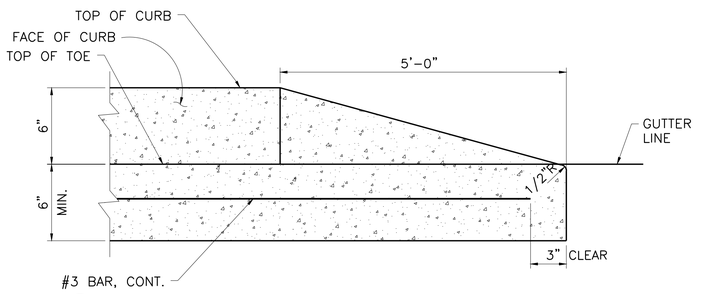


T = PAVEMENT THICKNESS

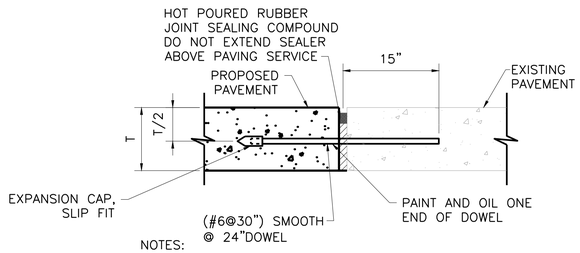
8 CONTRACTION JOINT
NOT TO SCALE



9 RESERVED AND VAN ACCESSIBLE PARKING SIGN
NOT TO SCALE



10 CURB TERMINAL DETAIL - TYP.
NOT TO SCALE



NOTES:

1. FOR EXISTING PAVEMENT - DRILL AND EPOXY DOWEL IN PLACE.
2. EXPANSION JOINTS SHALL BE 3/4" THICK REDWOOD FOR FULL DEPTH OF PAVEMENT AND SHALL INCLUDE GREASED 30" SMOOTH 3/4" DIA. DOWEL STEEL BARS WITH CAPS.

11 EXPANSION JOINT AT EXISTING CONCRETE
NOT TO SCALE

STATE OF TEXAS
BRETT M. BRISTOW
101000
LICENSED
PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: BMB
REVIEWED BY: THH

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

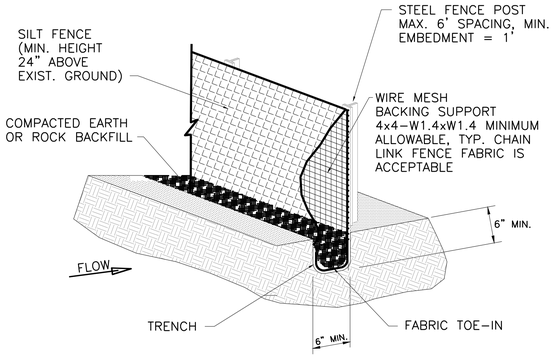
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

CIVIL
PAVING DETAILS

C-4

SHT .. of ..



1 ISOMETRIC PLAN VIEW
NOT TO SCALE

1 SILT FENCE
NOT TO SCALE

SILT FENCE GENERAL NOTES:

1. STEEL POSTS WHICH SUPPORT THE SILT FENCE SHALL BE INSTALLED ON A SLIGHT ANGLE TOWARD THE ANTICIPATED RUNOFF SOURCE. POST MUST BE EMBEDDED A MINIMUM OF ONE FOOT.
2. THE TOE OF THE SILT FENCE SHALL BE TRENCHED IN WITH A SPADE OR MECHANICAL TRENCHER, SO THAT THE DOWNSLOPE FACE OF THE TRENCH IS FLAT AND PERPENDICULAR TO THE LINE OF FLOW. WHERE FENCE CANNOT BE TRENCHED IN (e.g. PAVEMENT), WEIGHT FABRIC FLAP WITH ROCK ON UPHILL SIDE TO PREVENT FLOW FROM SEEPING UNDER FENCE.
3. THE TRENCH MUST BE A MINIMUM OF 6 INCHES DEEP AND 6 INCHES WIDE TO ALLOW FOR THE SILT FENCE FABRIC TO BE LAID IN THE GROUND AND BACKFILLED WITH COMPACTED MATERIAL.
4. SILT FENCE SHOULD BE SECURELY FASTENED TO EACH STEEL SUPPORT POST OR TO WOVEN WIRE, WHICH IN TURN IS ATTACHED TO THE STEEL FENCE POST. THERE SHALL BE A 3 FOOT OVERLAP, SECURELY FASTENED WHERE ENDS OF FABRIC MEET.
5. INSPECTION SHALL BE MADE EVERY TWO WEEKS AND AFTER EACH 1/2" RAINFALL. REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
6. SILT FENCE SHALL BE REMOVED WHEN THE SITE IS COMPLETELY STABILIZED SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
7. ACCUMULATED SILT SHALL BE REMOVED WHEN IT REACHES A DEPTH OF HALF THE HEIGHT OF THE FENCE. THE SILT SHALL BE DISPOSED OF AT AN APPROVED SITE AND IN SUCH A MANNER AS TO NOT CONTRIBUTE TO ADDITIONAL SILTATION.



04/20/2018



PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: BMB
REVIEWED BY: THH

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

CIVIL
EROSION CONTROL
DETAILS

C-5

SHT 6 of 129

SCHEDULE OF TYPICAL ARCHITECTURAL ABBREVIATIONS

(NOT ALL ABBREVIATIONS MAY BE USED)

A	
AB	ANCHOR BOLT
ABV	ABOVE
ACC	ACCESS
ACOUST	ACOUSTICAL
ADH	ADHESIVE
A/C	AIR CONDITIONING
ADJ	ADJACENT OR ADJUSTABLE
AFF	ABOVE FINISH FLOOR
AGG	AGGREGATE
ALUM	ALUMINUM
ALT	ALTERNATE
ANC	ANCHOR
ANOD	ANODIZED
APPROX	APPROXIMATELY
ARCH	ARCHITECT(URAL)
ASPH	ASPHALT
ATC	ACOUSTICAL TILE CEILING
AUTO	AUTOMATIC
AUX	AUXILIARY
B	
B/F	BELOW FLOOR
BLDG	BUILDING
BLKG	BLOCKING
BM	BENCH MARK OR BEAM
BCMU	BURNISHED CONCRETE MASONRY UNIT
BRG	BEARING
BOT	BOTTOM
BEL	BELOW
BET	BETWEEN
BIT	BITUMEN
BLK	BLOCK
BD	BOARD
BRZ	BRONZE
C	
C	CHANNEL OR CONDUIT
CAB	CABINET
C/C	CENTER TO CENTER
CG	CORNER GUARD
CIP	CAST IRON PIPE OR CAST IN PLACE
CISP	CAST IRON SOIL PIPE
CJ	CONTROL JOINT
CL	CENTERLINE
CLG	CEILING
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COL	COLUMN
CONC	CONCRETE
COND	CONDITION
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS
CONTR	CONTRACTOR
CSK	COUNTERSINK (SUNK)
CT	CERAMIC TILE
CTR	CENTER
CPT	CARPET (ED)
CSMT	CASEMENT
CB	CATCH BASIN
CHT	CEILING HEIGHT
CW	COLD WATER
D	
D	DEPTH OR DRAIN
DBL	DOUBLE
DCO	DOUBLE CLEANOUT
DET	DETAIL
D.I.	DUCTILE IRON
DIA	DIAMETER
DIAG	DIAGONAL
DN	DOWN
DR	DOOR OR DRIVE
DS	DOWNSPOUT
DWG	DRAWING
DWL	DOWEL

E	
EA	EACH
ECJ	EDGE CONTROL JOINT
EF	EACH FACE OR EXHAUST FAN
EL	ELEVATION
ELEC	ELECTRIC(AL)
ELEV	ELEVATOR/ELEVATION
EMERG	EMERGENCY
EM	ELECTRO MAGNETICALLY
EMH	ELECTRICAL MANHOLE
EQ	EQUAL
EQUIP	EQUIPMENT
EW	EACH WAY
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
EXH	EXHAUST
EXIST	EXISTING
EXP	EXPOSED
EXP.JT.	EXPANSION JOINT (OR E.J.)
EXT	EXTERIOR
F	
F	FIRE PIPE
FA	FIRE ALARM
FCO	FLOOR CLEANOUT
FDC	FIRE DEPT. CONNECTION
FD	FLOOR DRAIN
FDN	FOUNDATION
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FF	FINISH FLOOR
FH	FIRE HYDRANT
FHC	FIRE HOSE CABINET
FIN	FINISH
FIX	FIXTURE
FL/FLR	FLOOR
FPRF	FIREPROOFING
FR	FIRE RATED
FS	FLOOR SINK
FT	FEET
FTG	FOOTING
FVC	FIRE VALVE CABINET
G	
G	GRILLE OR GAS
GALV	GALVANIZED
GB	GRAB BAR OR GRADE BEAM
GCO	GRADE CLEANOUT
GI	GALVANIZED IRON OR GRATE INLET
GL	GLASS
GND	GROUND
GR	GRADE
GWB	GYPSUM WALLBOARD
GYP	GYPSUM
H	
HB	HOSE BIBB
HD	HANDICAP
HDWE	HARDWARE
HDWD	HARDWOOD
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HR	HOUR
HS	HIGH STRENGTH OR HEADED STUDS
HT	HEIGHT
HTR	HEATER
HVAC	HEATING/ VENTILATING/ AIR CONDITIONING
HW	HOT WATER
HWTM	HOT WATER TEMPERATURE MAINTENANCE
I	
ID	INSIDE DIAMETER
IF	INSIDE FACE
IN	INCH
INSUL	INSULATION
INT	INTERIOR
J	
J	JUNCTION
JAN	JANITOR
JB	JUNCTION BOX
JT	JOINT

K	
KCJ	KEYED CONSTRUCTION JOINT
KIT	KITCHEN
KV	KILOVOLT
KVA	KILOVOLT-AMPERE
KW	KILOWATT
KWH	KILOWATT-HOURS
L	
L	LENGTH
LAM	LAMINATE
LAV	LAVATORY
LF	LINEAR FEET
LL	LIVE LOAD
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LONG	LONGITUDINAL
LP	LOW POINT
LT	LIGHT
LTG	LIGHTING
LT WT	LIGHT WEIGHT
LVL	LEVEL
M	
M	MOTOR
MAINT	MAINTENANCE
MAS	MASONRY
MAT	MATERIAL
MAX	MAXIMUM
MECH	MECHANICAL
MTL	METAL
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MO	MASONRY OPENING
MTG	MOUNTING OR MOUNTED
MTL	METAL
N	
NFWH	NON-FREEZE WALL HYDRANT
NO	NUMBER OR NORMALLY OPEN
NOM	NOMINAL
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
O	
OA	OUTSIDE AIR
OC	ON CENTER
OCEW	ON CENTER, EACH WAY
OD	OUTSIDE DIAMETER
OF	OUTSIDE FACE
OFD	OVERFLOW DRAIN
OH	OVERHEAD
OPNG	OPENING
OPP	OPPOSITE
OSB	ORIENTED STRAND BOARD
P	
PART	PARTITION
PL	PROPERTY LINE OR PLATE
PLAM	PLASTIC LAMINATE
PLAS	PLASTER
PLYWD	PLYWOOD
PNL	PANEL
PR	PAIR
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
Q	
QT	QUARRY TILE
R	
R	RISER, REGISTER, OR RADIUS
RA	RETURN AIR
RAD	RADIUS OR RETURN AIR DUCT
RD	ROOF DRAIN
RE	REFER TO
REF	REFERENCE
REFL	REFLECTED
REINF	REINFORCING (REINFORCED)
REQ'D	REQUIRED
RET	RETAINING
REV	REVERSE
RM	ROOM
RO	ROUGH OPENING

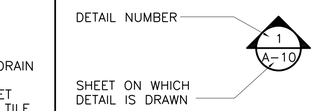
S	
SA	SUPPLY AIR
SAN	SANITARY
SAT	SUSPENDED ACOUSTICAL TILE
SCH	SCHEDULE, SCHEDULED
SCHED	SCHEDULE, SCHEDULED
SD	SMOKE DAMPER OR STORM DRAIN
SECT	SECTION
SF	SUPPLY FAN OR SQUARE FEET
SGFT	STRUCTURAL GLAZED FACING TILE
SH	SPRINKLER HEAD
SHT	SHEET
SIM	SIMILAR
SM	SPRINKLER MAIN
SPEC	SPECIFICATIONS
SQ	SQUARE
SS	SERVICE SINK OR SANITARY SEWER
SSM	SOLID SURFACE MATERIAL
SSMH	SANITARY SEWER MANHOLE
SSTL	STAINLESS STEEL (OR S.S.)
STA	STATION
STD	STANDARD
STIFF	STIFFENER
STIR	STIRRUP
STL	STEEL
STOR	STORAGE
STR	STRUCTURAL
STRUCT	STRUCTURAL
SUSP	SUSPENDED
SV	SHEET VINYL
SVC	SERVICE
SW	SWITCH
SYM	SYMMETRICAL
T	
T	TREAD OR THICKNESS
T&B	TOP AND BOTTOM
TAS	TEXAS ACCESSIBILITY STANDARDS
TC	TOP OF CURB
TEL	TELEPHONE
TEMP	TEMPERATURE
TLT	TOILET
TOT	TOTAL
TOW	TOP OF WALL
TP	TOILET PARTITION
TRANS	TRANSVERSE OR TRANSITION
TS	TUBE STEEL
T-STAT	THERMOSTAT
TYP	TYPICAL
U	
UL	UNDERWRITERS LABORATORIES INC.
UR	URINAL
V	
V	VENT OR VOLT
VAC	VACUUM
VB	VINYL BASE
VCT	VINYL COMPOSITION TILE
VERT	VERTICAL
VF	VENTILATION FAN
VOL	VOLUME
VTR	VENT THROUGH ROOF
VWC	VINYL WALL COVERING
W	
W	WIDTH OR WASTE
W/	WITH
WC	WATER CLOSET
WD	WOOD
WDW	WINDOW
WH	WATER HEATER OR WALL HYDRANT
W/O	WITHOUT
WP	WEATHERPROOF OR WORKING POINT
WPFG	WATERPROOFING
WS	WATER STOP
WSCT	WAINSCOT
WT	WEIGHT
WV	WATER VALVE
WWF	WELDED WIRE FABRIC

GENERAL NOTES

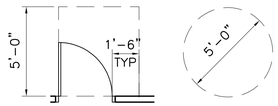
1. ALL DIMENSIONS ARE GIVEN TO:
   - A FACE OF CONCRETE OR MASONRY.
   - B CENTER LINE OF COLUMNS WHERE INDICATED.
   - C FINISHED FACE OF GYPSUM BOARD OR TILE WHERE INDICATED.
   - D CONCRETE FLOOR LINE.
2. REFER TO REFLECTED CEILING PLANS FOR PARTITIONS THAT EXTEND TO ROOF DECK. REFER TO A-2 FOR PARTITION TYPES.
3. ALL WOVEN WIRE MESH PARTITIONS, FRAMING, DOORS AND SHELVING MUST BE DESIGNED TO SUPPORT ALL APPLICABLE LOADS AND IN ACCORDANCE AND FULL COMPLIANCE WITH MOST CURRENT UNITED FACILITIES CRITERIA 4-171-05.
4. 10 GA GALVANIZED WOVEN WIRE MESH PARTITION IN 1½" x ⅛" THICK STEEL CHANNEL FRAMING, TYP.

PLAN GRAPHICS

REFERENCE

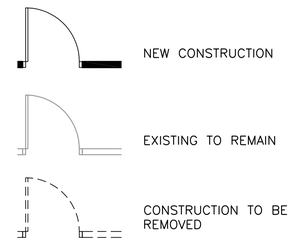


ACCESSIBILITY

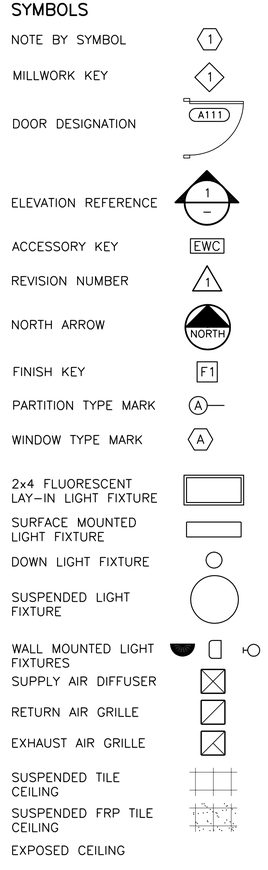


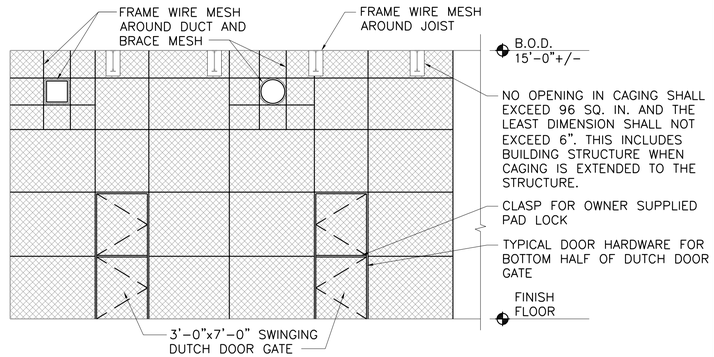
DASHED LINES INDICATE CLEAR SPACE REQUIREMENTS TO SATISFY TAS. NOT ALL CLEARANCE REQUIREMENTS ARE SHOWN ON PLANS.

LINEWORK



SYMBOLS





GENERAL NOTES

1. ALL WOVEN WIRE MESH PARTITIONS, FRAMING, DOORS AND SHELVING MUST BE DESIGNED TO SUPPORT ALL APPLICABLE LOADS AND IN ACCORDANCE AND FULL COMPLIANCE WITH MOST CURRENT UNITED FACILITIES CRITERIA 4-171-05.
2. 10 GA GALVANIZED WOVEN WIRE MESH PARTITION IN 1½"x ⅛" THICK STEEL CHANNEL FRAMING, TYP. CAGE FRAMES SHOULD BE NO MORE THAN 1" FROM THE FLOOR AND NO MORE THAN 2" FROM THE WALLS OR CEILINGS.

(10) 1/– WIRE MESH STORAGE ELEVATION

1/4" = 1'-0"

BID OPTIONS "○"

10. NEW STORAGE CAGING IN EXISTING NORTHEAST STORAGE AREA.



04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

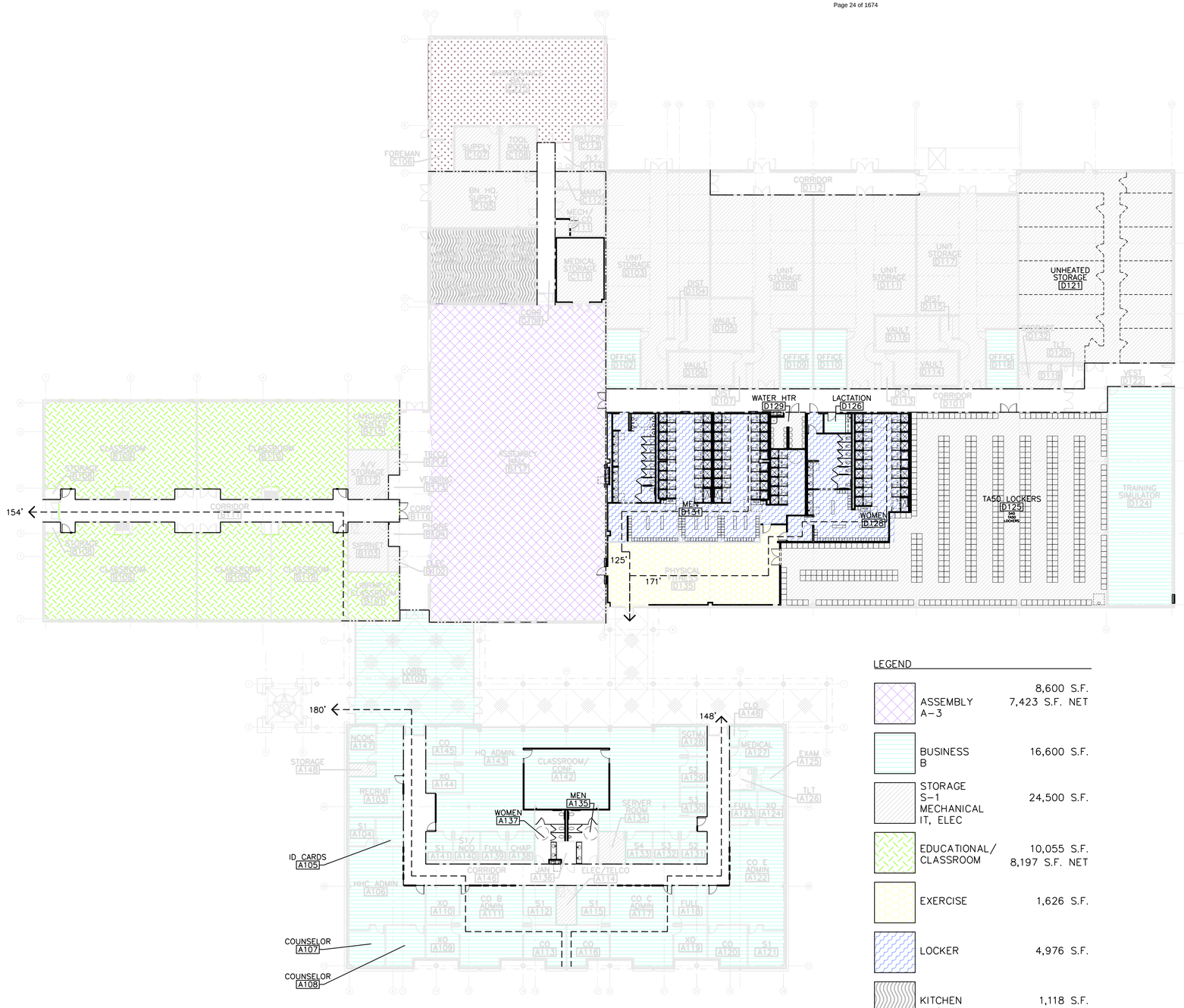
STAR CAMPAIGN FY18 - WESLACO RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL ABBREVIATIONS AND SYMBOLS

A-0

SHT. 7 of 129



EGRESS FLOOR PLAN

1" = 20'-0"

BID OPTIONS "◯"

1. TEMPORARY RESTROOM BUILDING.
2. TEMPORARY SHOWER BUILDING.
3. FULL IT SYSTEM INCLUDING CLASSROOM UPGRADES.
4. ADDITIONAL HVAC UPGRADES/ REPAIRS/ HVLS FANS.
5. RESTROOM/ CONFERENCE ROOM RENOVATION IN ADMIN WING.
6. EXTERIOR BUILDING/ PARKING IMPROVEMENTS/ BUILDING SIGN.
7. EXTERIOR EARTHWORK & DRAINAGE.
8. ELECTRICAL GENERATOR PROVISIONS.
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.
10. NEW STORAGE CAGING IN EXISTING NORTHEAST STORAGE AREA.
11. PROVIDE TA-50 LOCKERS FOR SECURE EQUIPMENT STORAGE.

LEGEND

ASSEMBLY A-3	8,600 S.F.	7,423 S.F. NET
BUSINESS B	16,600 S.F.	
STORAGE S-1 MECHANICAL IT, ELEC	24,500 S.F.	
EDUCATIONAL/ CLASSROOM	10,055 S.F.	8,197 S.F. NET
EXERCISE	1,626 S.F.	
LOCKER	4,976 S.F.	
KITCHEN A-2	1,118 S.F.	
FACTORY F-1	2,440 S.F.	

2 HR RATED WALL
1 HR RATED WALL
TRAVEL DISTANCE

CODE REVIEW – IBC 2015

PROJECT: WESLACO READINESS CENTER,
WESLACO, TEXAS

OCCUPANCIES:
A-3 ASSEMBLY OCCUPANCY
B BUSINESS OCCUPANCY
S-1 STORAGE OCCUPANCY
F-1 FACTORY OCCUPANCY

AUTOMATIC FIRE SUPPRESSION: REQUIRED BY IBC/UFC, NOT PROVIDED

BUILDING SIZE: 75,382 GROSS SF

TYPE OF CONSTRUCTION: IIB

BUILDING AREA BASED ON OCCUPANCY (TABLE 506.2):

	NS	S1(AREA FACTOR INCREASE)
B	= 23,000 SF	92,000 S.F
A-3	= 9,500 SF	38,000 S.F.
S-1	= 17,500 SF	70,000 S.F.
F-1	= 15,500 SF	62,000 S.F.

HEIGHT LIMITATIONS (TABLE 504.3):

A, B, S & F = 55'

STORIES (TABLE 504.4):

B = 3
A-3 = 2
S-1 = 2
F-1 = 2

FIRE RESISTIVE REQUIREMENTS (HR) (TABLE 601):

STRUCTURAL FRAME	= 0
BEARING WALL – INTERIOR/EXTERIOR	= 0
NON-BEARING WALLS AND PARTITIONS – INTERIOR	= 0
FLOOR CONSTRUCTION	= 0
ROOF CONSTRUCTION	= 0

NON-BEARING WALLS AND PARTITIONS – EXTERIOR (TABLE 602):

<5'	1 (A, B,) 2 (F-1,S-1)
>5' < 10'	1
>10' < 30'	0
> 30'	0

CORRIDOR RATING (A, B, S >30 OCCUPANTS) (TABLE 1020.1): = 1 HOUR

OCCUPANT LOAD (TABLE 1004.1.2):

ASSEMBLY W/ TABLES & CHAIRS	–15 SF NET
BUSINESS	–100 GROSS
STORAGE/MECHANICAL	–300 GROSS
EDUCATIONAL CLASSROOMS	– 20 SF NET

MINIMUM CORRIDOR WIDTH (TABLE 1020.2): 44" TYPICAL

NUMBER OF EXITS REQUIRED (TABLE 1006.3.1): 4 REQUIRED
TOTAL: 1,203 OCCUPANTS PER IBC 921 OCCUPANTS PER TMD

EXIT ACCESS TRAVEL DISTANCE (TABLE 1017.2): ASSEMBLY, BUSINESS AND STORAGE = 200'

MAXIMUM LENGTH OF DEAD END CORRIDORS (SECTION 1020.4):
ASSEMBLY, BUSINESS AND STORAGE = 20'

EGRESS WIDTH (SECTION 1005.3.2): = .20"/OCCUPANT
1,203 X .20 = 240.6" REQUIRED
= 936" PROVIDED

SEPERATION OF OCCUPANCIES (TABLE 508.4): A / B, S-1, OR F-1 = 2 HOURS

DOOR RATING: 20 MINUTES AT 1 HOUR RATED CORRIDORS
90 MINUTES AT 2 HOUR SEPERATION

MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES (TABLE 2902.1):

S-1 AND MECH	= 81 OCCUPANTS			
A-3	= 528 OCCUPANTS			
B	= 184 OCCUPANTS			
E	= 410 OCCUPANTS			
	1,203 OCCUPANTS			
S-1		TOILETS	LAVATORIES	EWC
81 X 50% = 41 (MALE)		0.41	0.41	0.08
81 X 50% = 41 (FEMALE)		0.41	0.41	
A-3		TOILETS	LAVATORIES	EWC
528 X 50% = 264 M		2.11	1.32	1.06
528 X 50% = 263 F		4.06	1.31	
B		TOILETS	LAVATORIES	EWC
184 X 50% = 92 M		2.84	2.15	1.84
184 X 50% = 92 F		2.84	2.15	
E		TOILETS	LAVATORIES	EWC
410 X 50% = 205 M		4.10	4.10	4.10
410 X 50% = 205 F		4.10	4.10	
TOTAL	M	9	8	7
	F	11	8	
		20 TOTAL	16 TOTAL	
PLUMBING FIXTURES (PER TMD)	M (2/3)	13	11	
	F (1/3)	7	5	

SHOWERS (PER TMD):

925 (1/15) =	62 SHOWERS TOTAL
925 X 67% = 620 M	42 SHOWERS
925 X 33% = 305 F	20 SHOWERS

0 10' 20' 40'
SCALE IN FEET

04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL EGRESS PLAN AND CODE REVIEW

A-1

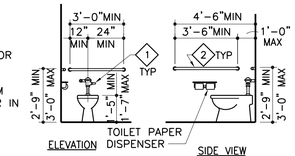
SHT. 8 of 129

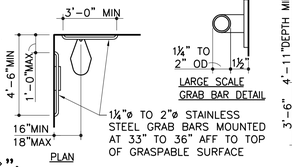
GENERAL NOTES:

1. ALL FIXTURE HEIGHTS AND MOUNTING DIMENSIONS SHALL COMPLY WITH REQUIREMENTS OF TAS (ADA). CONTRACTOR MUST VERIFY EACH SUCH DIMENSION.
2. ALL DOOR DIMENSIONS ARE CLEAR, FROM EDGE OF DOOR STOP TO EDGE OF DOOR IN 90° OPEN POSITION.
3. FAUCETS FOR SINKS SHALL HAVE LEVER HANDLES.
4. ANGLE STOPS, RISERS, TAIL PIECES & P-TRAPS NOT OTHERWISE ENCLOSED BY CABINETS OR OTHER ENCLOSURES SHALL HAVE ADA PROTECTIVE COVERS.
5. TOILET PARTITION DOORS AT ACCESSIBLE STALL MUST HAVE A MINIMUM CLEARANCE OF 32".
6. PROVIDE BLOCKING AS REQUIRED FOR ALL FIXTURES AND ACCESSORIES. REFER TO 12 & 13/A-22 FOR DETAILS.

NOTES BY SYMBOL "◇":

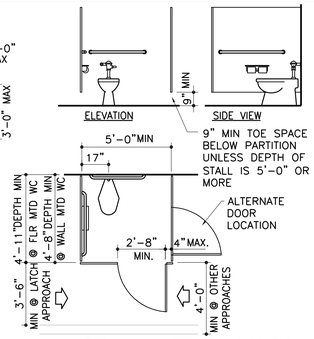
1. OPERATING HANDLE ON FLUSH TANK OR FLUSH VALVE WC MUST BE FURNISHED EITHER RIGHT OR LEFT HANDED SO THAT HANDLE OCCURS ON WIDE SIDE OF STALL OR SPACE AND SHALL BE MOUNTED BELOW THE GRAB BAR.
2. GRAB BARS AND ASSOCIATED BLOCKING, ANCHORS, AND FASTENERS SHALL BE CAPABLE OF RESISTING A DOWNWARD FORCE OF 250 LBS. APPLIED AT ANY POINT ALONG THE HANDRAIL.





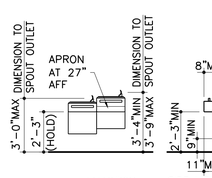
ACCESSIBLE TOILET TYPICAL DIMENSIONS

1/4"=1'-0"



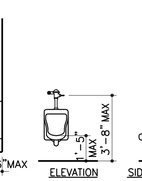
STANDARD ACCESSIBLE TOILET STALL

1/4"=1'-0"



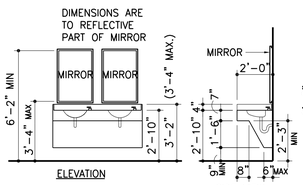
ACCESSIBLE WATER COOLER

1/4"=1'-0"



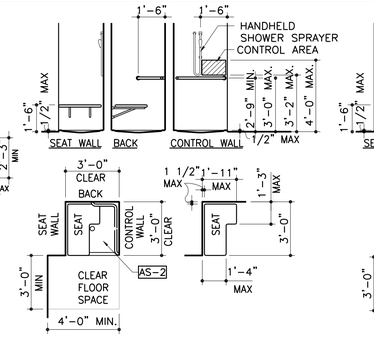
ACCESSIBLE URINAL

1/4"=1'-0"



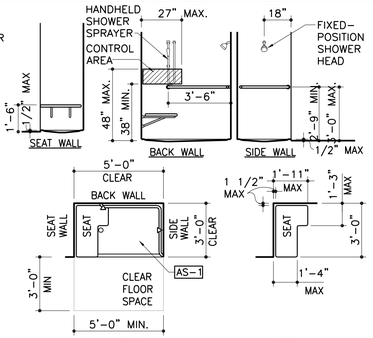
ACCESSIBLE COUNTER TOP LAV

1/4"=1'-0"



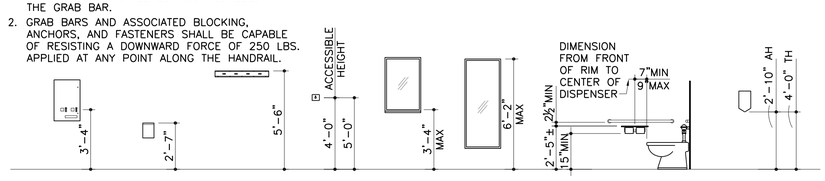
ACCESSIBLE SHOWER (36"x36")

1/4"=1'-0"



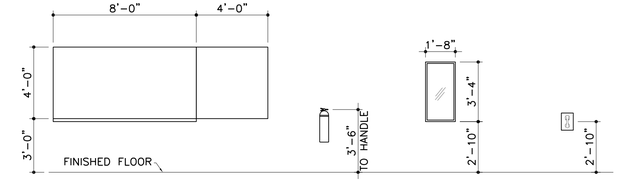
ACCESSIBLE SHOWER (60"x36")

1/4"=1'-0"



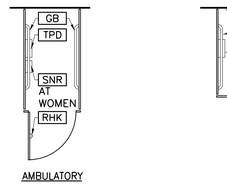
TOILET ACCESSORY MOUNTING HEIGHTS

1/4"=1'-0"

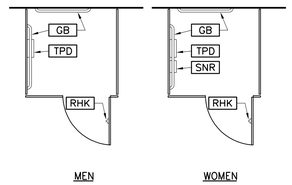


SPECIALTIES MOUNTING HEIGHTS

1/4"=1'-0"



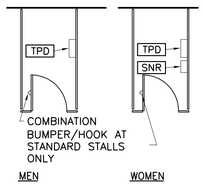
AMBULATORY ACCESSIBLE STALLS



STANDARD ACCESSIBLE STALLS

TYPICAL NOTES:

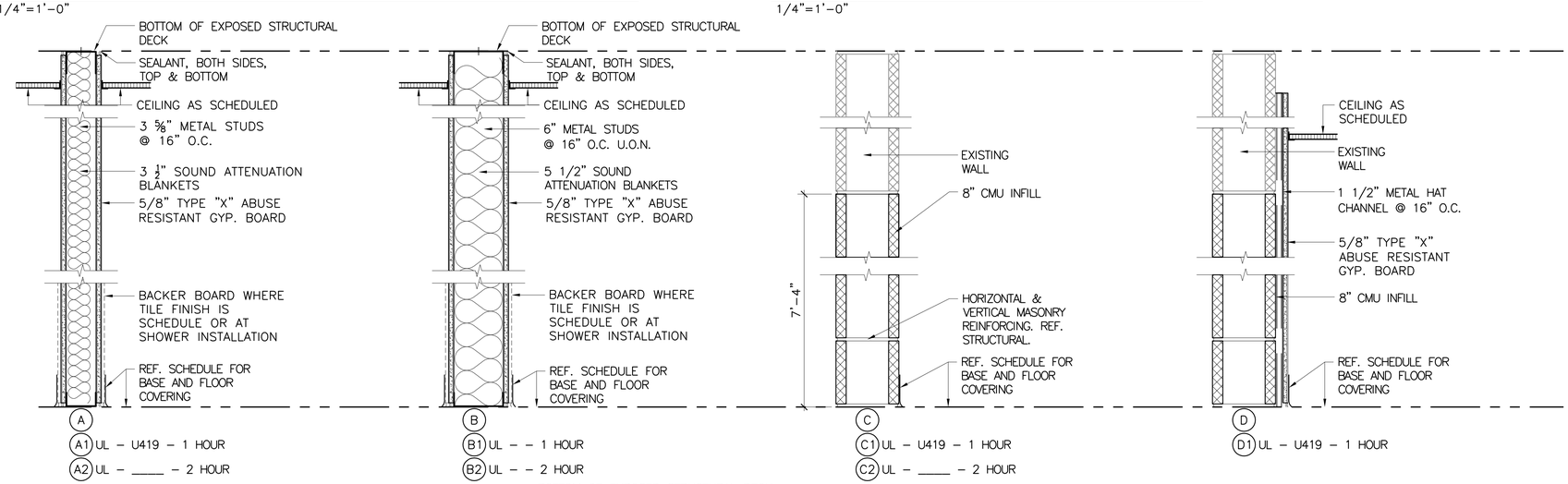
1. ALL TOILET STALLS SHALL HAVE THE ACCESSORIES AS SHOWN ABOVE.
2. REFER TO INTERIOR ELEVATIONS FOR PLACEMENT OF MIRRORS.
3. REFER TO FLOOR PLAN FOR LOCATION OF MOP HOLDERS, SANITARY NAPKIN DISPENSER, ELECTRIC WATER COOLERS, AND FIRE EXTINGUISHERS.
4. PROVIDE WATER CLOSET AT ACCESSIBLE HEIGHT AT AMBULATORY STALL.



STANDARD STALLS

TYPICAL TOILET STALL ACCESSORIES

1/4"=1'-0"



PARTITION TYPES

NTS

0 1' 2' 4' 8'

1/4"=1'-0"



THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

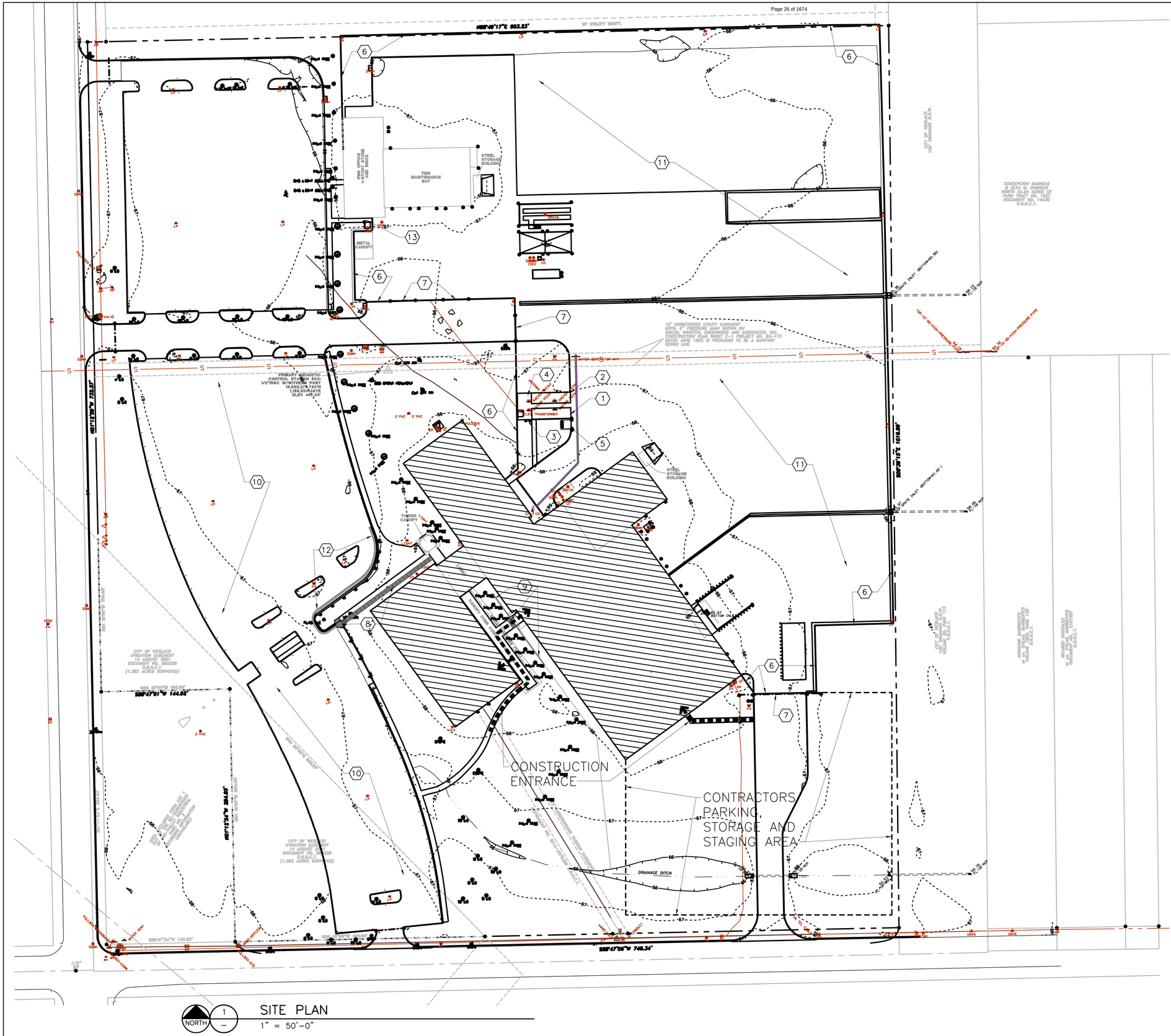
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

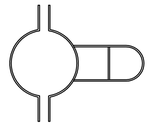
TXARNG CFMO

ARCHITECTURAL ACCESSIBILITY AND PARTITION SCHEDULE

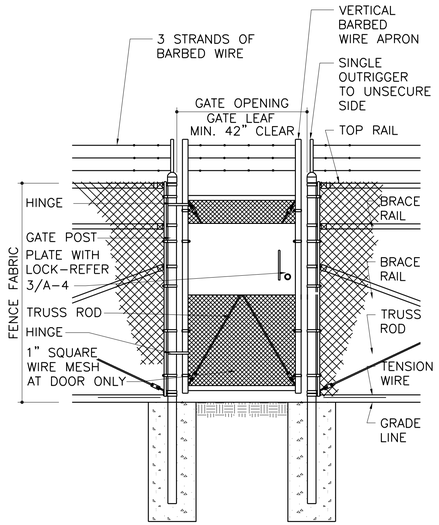
A-2

SHT. 9 of 129


N89°48'17"E 803.33'
12' UTILITY ESMT.
FIRE OFFICE & STORAGE 1-STORY CMU AND BRICK
FSRS MAINTENANCE BAY
STEEL STORAGE BUILDING
METAL CANOPY
GAZEBO
GAS VALVE
TRANSFORMER
STEEL STORAGE BUILDING
TOWER CANOPY
CONCRETE CANOPY
CONCEPCION GARNEAS & ELVA M. GARNEAS NORTH 24.24 ACRES OF FARM TRACT NO. 1037 DOCUMENT NO. 14430 O.R.A.C.T.
CITY OF WESLACO 100' DRAINAGE R.O.W.
15" UNRECORDED UTILITY EASEMENT NOTES: 8" PRESSURE MAIN SHOWN ON "WATER, SEWER & DRAINAGE ASSOCIATES, INC. CONSTRUCTION PLANS SHEET 1 OF 1 PROJECT NO. 93-173 DATED JUNE 1993 IS PRESUMED TO BE A SANITARY SEWER LINE
WATER, SEPTIC TANK
PRIMARY GEODETIC CONTROL STATION 5001 1/2"IRSC W/WITNESS POST 16,888,217.780'N 1,166,600.461'E ELEV =N/A'
S89°47'01"W 144.92'
N01°12'34"W 284.65'
CITY OF WESLACO AVIATION EASEMENT 14 AUGUST 2001 DOCUMENT NO. 950229 O.R.A.C.T. (1.382 ACRES SURVEYED)
S89°47'34"W 145.05'
S89°47'06"W 748.34'
CONSTRUCTION ENTRANCE
CONTRACTORS PARKING, STORAGE AND STAGING AREA
DRAINAGE DITCH
S00°30'13"E 1016.88'
10' GAS EASEMENT
10' UTILITY EASEMENT
FULL ACCESS DRIVEWAY
SITE TEXT
SITE KEYNOTE
SITE KEYNOTE
SITE KEYNOTE



STANDARD HINGE



GATE POSTS OUTSIDE DEIMENSION (NOMINAL) TO BE 2.875"

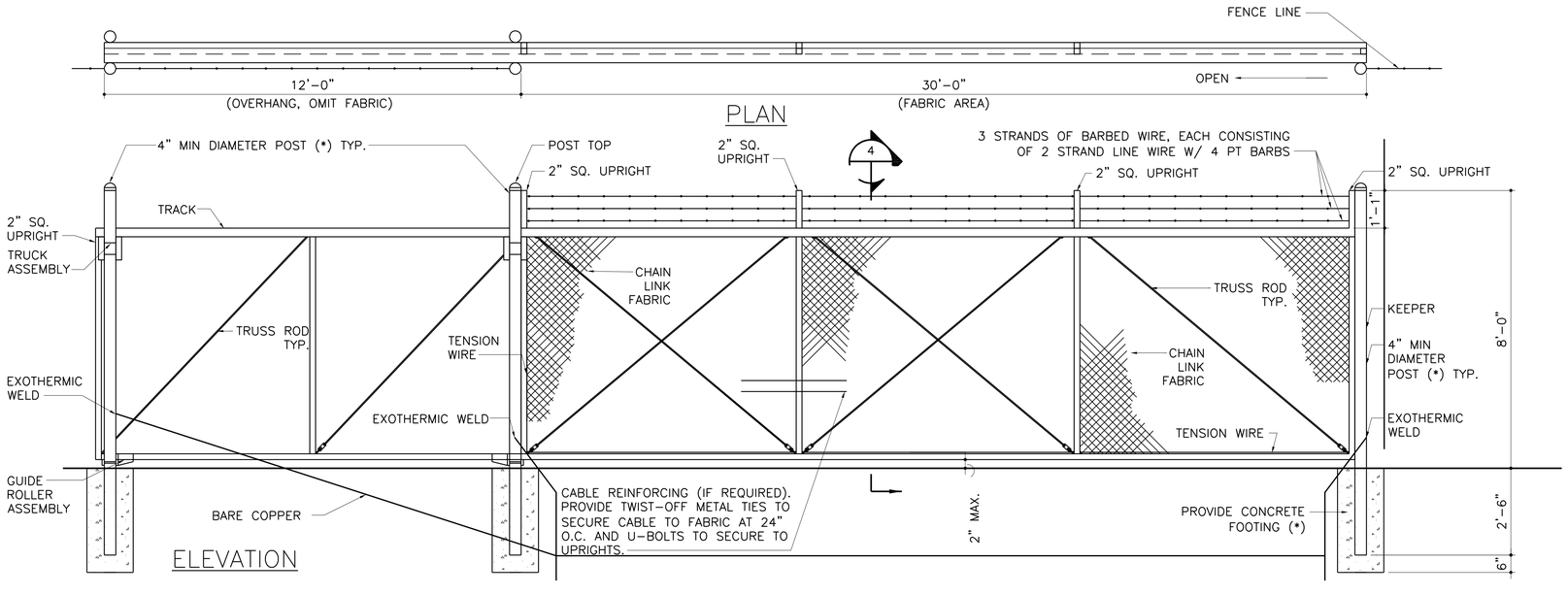
NOTES:

1. FOR NON-SENSORED FENCES, DETAILS SHOWN ARE TO CLARIFY REQUIREMENTS AND ARE NOT INTENDED TO LIMIT OTHER TYPE OF FENCE SECTIONS AND METHODS OF INSTALLATION WHICH COMPLY WITH THE SPECIFICATIONS.
2. SWING GATES SHALL BE CONSTRUCTED WITH DROP RODS, PADLOCKS, LATCH ASSEMBLY AND GATE KEEPERS EXCEPT AS NOTED.
3. ALL GATE FRAMES SHALL MEET THE
4. MINIMUM REQUIREMENTS OF ASTM F900 1.90" NOMINAL (ROUND) OR 2.00" NOMINAL (SQUARE). GATE FRAMES SHALL BE OF WELDED CONSTRUCTION OR SHALL BE ASSEMBLED USING HEAVY FITTINGS. AT CONTRACTOR'S OPTION A WELDED HORIZONTAL BRACE MAY BE USED IN LIEU OF TRUSS RODS TO BRACE ALL WELDED GATE FRAMES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER RIGID CONSTRUCTION OF ALL GATES SUPPLIED.
5. GATES SHALL BE DESIGNATED AS FOLLOWS:

FENCE TYPE	–	FE5, FE6, ETC.
FENCE HEIGHT	–	INCHES
TYPE OPENING	–	SO (SINGLE)
	–	DO (DOUBLE)
HINGE	–	RA (STANDARD)
	–	HO (OFFSET)
OPENING	–	FEET (CLEAR OPENING BETWEEN GATE POSTS)
EXAMPLES:		FE6-84-DO-RA-24
		FE5-48-SO-GO-6

6. UNLESS NOTED OTHERWISE, PROVIDE FE6-72-DO-HO-42.
7. SEE DRAWINGS PER NUMBER, WIDTH AND TYPE OF GATE OPENINGS.

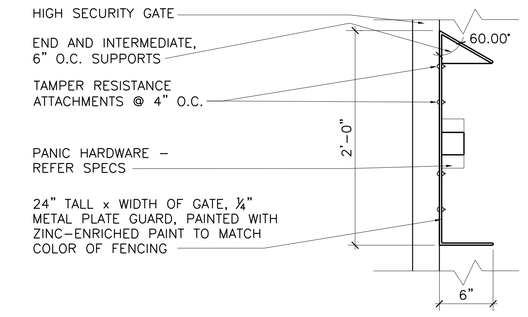
1 – PERSONNEL GATE TYPE FE-6 FENCE
NTS



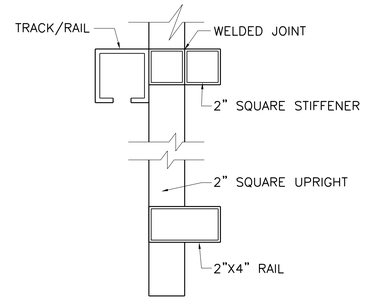
(*) POST SIZE AND ASSOCIATED FOOTING DIAMETER TO BE DETERMINED BY MANUFACTURER, BASED ON LEAF WEIGHT AND DIMENSION. MINIMUM FOOTING DIAMETERS (TO BE FILLED WITH 4000 PSI CONCRET: 40" DIAMETER FOR 8" POST; 36" DIAMETER FOR 6" POST; 24" DIAMETER FOR 4" POST; OTHER SIZES TO BE DESIGNED BY MANUFACTURER OR KTR. NO FOOTING WIDTH SHALL BE LESS THAN 4(X) THE POST WIDTH.

BARBED WIRE NOT SHOWN ON FENCE PORTION FOR CLARITY. SEE SHEET A-5 FOR FENCE DESIGN AND BARBED WIRE.

2 – SINGLE CANTILEVERED SLIDING GATE 3 FABRIC BAYS/2 WITHOUT
NTS



3 – PANIC HARDWARE GUARD AT PERSONNEL GATE
1 1/2" = 1'-0"



4 – SECTION (TYP)
NTS

BID OPTIONS "◯"

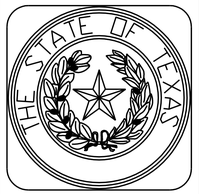
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.

0 4" 8" 1'
1-1/2"=1'-0"

0 6" 1' 2'
3/4"=1'-0

0 1' 2' 4' 8'
1/4"=1'-0"





PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

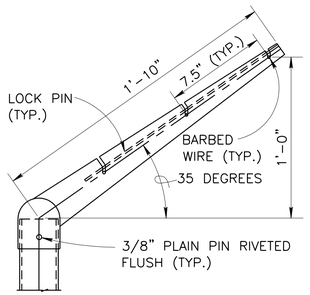
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

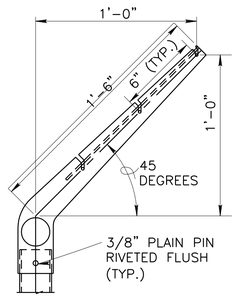
ARCHITECTURAL SITE DETAILS - BID OPTION 9

A-4

SHT. 11 of 129

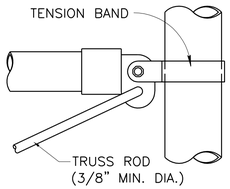


CORNER POST

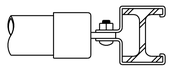


LINE POST

EXTENSION ARM DETAILS
NO SCALE

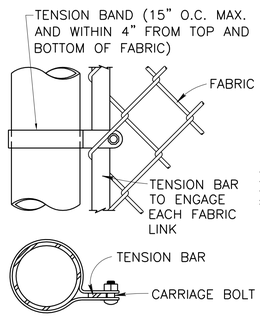


ROUND POST

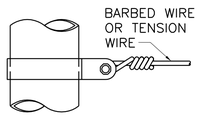


H-BEAM

BRACE RAIL CLAMP DETAILS

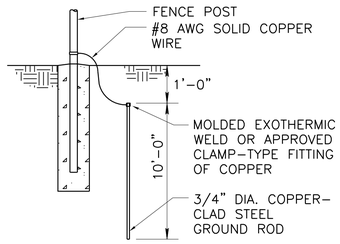


END OR GATE POST DETAIL

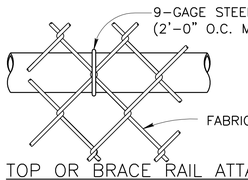


TENSION BAND DETAIL

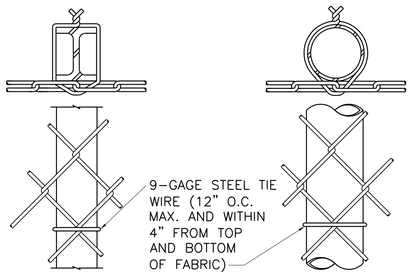
FASTENING DETAILS
NO SCALE



GROUNDING DETAIL
NO SCALE

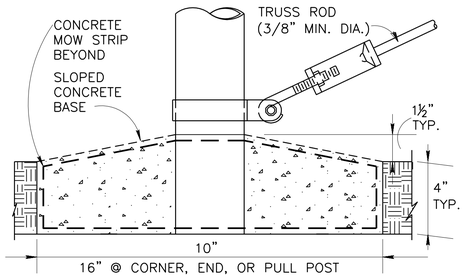


TOP OR BRACE RAIL ATTACHMENT

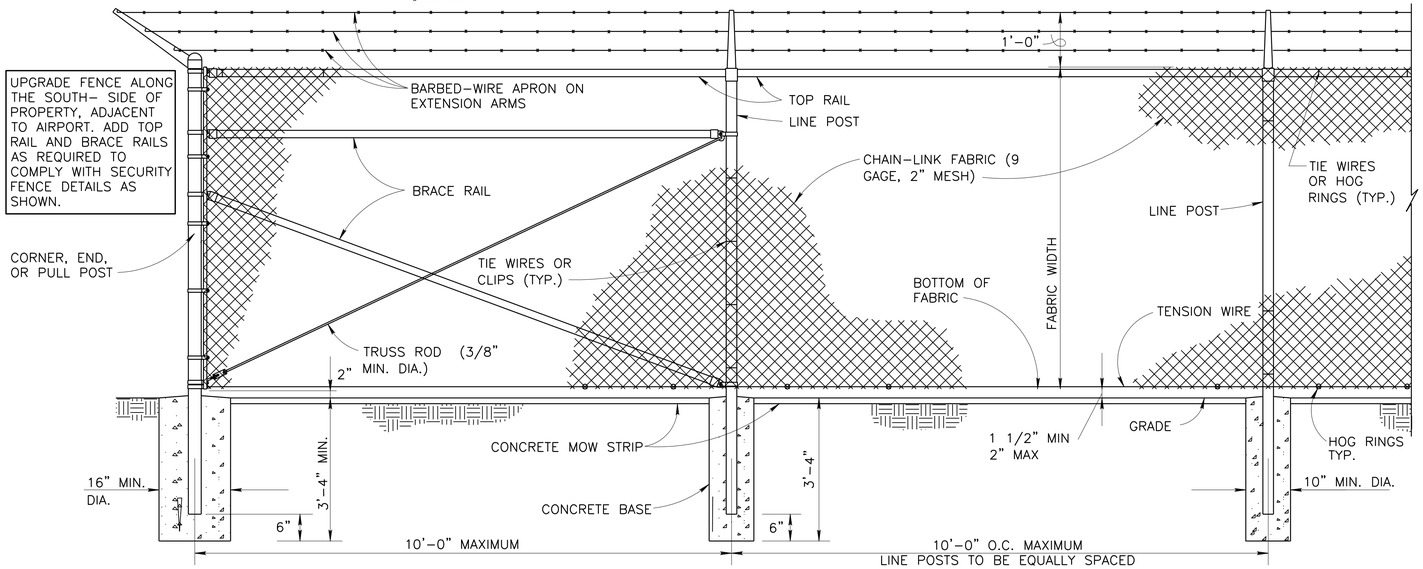


H-BEAM ROUND POST

LINE POST ATTACHMENTS
NO SCALE



TRUSS ROD AND BAND
NO SCALE



CHAIN-LINK SECURITY FENCE DETAIL
NO SCALE

STEEL POST SCHEDULE

USE AND SECTION	MINIMUM OUTSIDE DIMENSIONS (NOMINAL)		
	FABRIC WIDTH < 72"	FABRIC WIDTH 84" TO 96"	FABRIC WIDTH >108"
CORNER, END & PULL POSTS			
TUBULAR – ROUND	2.375" O.D.	2.875" O.D.	4.00" O.D.
TUBULAR – SQUARE	2.00" SQ.	2.50" SQ.	3.00" SQ.
C-SECTION (ROLL-FORMED)	3.50" X 3.50"	3.50" X 3.50"	———
LINE POSTS			
TUBULAR – ROUND	1.90" O.D.	2.375" O.D.	2.875" O.D.
H-SECTION	2.25" X 1.70"	2.25" X 1.70"	2.25" X 1.70"
C-SECTION (ROLL-FORMED)	1.875" X 1.625"	2.25" X 1.70"	———
TOP, BOTTOM & BRACE RAILS			
TUBULAR – ROUND	1.66" O.D.		
TUBULAR – SQUARE	1.50" SQ.		
H-SECTION	1.625" X 1.50"		
C-SECTION (ROLL-FORMED)	1.625" X 1.25"		

NOTES:

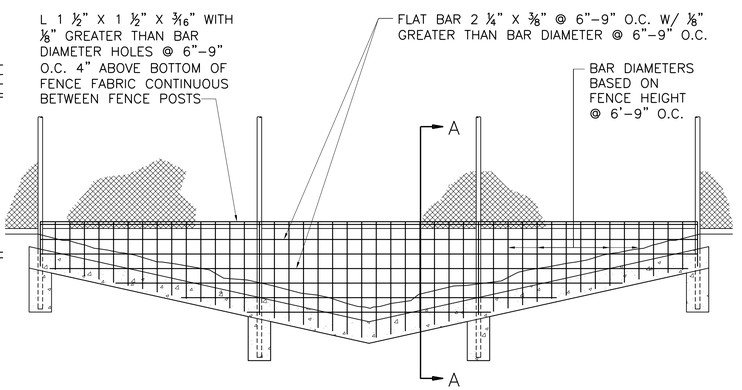
1. U.N.O. PROVIDE FENCE TYPE FE6, TR
2. DETAILS SHOWN ARE TO CLARIFY REQUIREMENTS AND ARE NOT INTENDED TO LIMIT OTHER TYPES OF FENCE SECTIONS AND METHODS OF INSTALLATION THAT COMPLY WITH THE SPECIFICATIONS.
3. WIRE TIES, RAILS, POSTS, AND BRACES SHALL BE CONSTRUCTED ON THE SECURE SIDE OF THE FENCE ALIGNMENT. CHAIN-LINK FABRIC SHALL BE PLACED ON THE SIDE OPPOSITE THE SECURE AREA.
4. UNLESS SPECIFICALLY SHOWN OR SPECIFIED, ALL FE6 FENCE SHALL HAVE AN APRON EXTENDED OUTWARD FROM THE AREA BEING PROTECTED.
5. C-SECTION POSTS SHALL BE INSTALLED SO THAT THE VOID INSIDE THE POST IS COMPLETELY FILLED WITH CONCRETE UP TO THE TOP OF THE FOUNDATION.
6. MODIFY FENCING AT SWALES AND GRADE DIPS PER UFC STANDARDS. COORDINATE WITH OWNER.

FENCE LEGEND:

TYPE FE5 – CHAIN-LINK FENCE WITHOUT BARBED-WIRE APRON
TYPE FE6 – CHAIN-LINK FENCE W/BARBED-WIRE ON SINGLE OUTRIGGER
TYPE FE7 – CHAIN-LINK FENCE W/BARBED WIRE ON DOUBLE OUTRIGGER
TYPE FE8 – CHAIN-LINK FENCE W/BARBED-WIRE AND BARBED-TAPE ON DOUBLE OUTRIGGER
TR – FENCE WITH TOP RAIL AND TENSION WIRE AT BOTTOM
TBR – FENCE WITH TOP AND BOTTOM RAILS
TWB – TENSION WIRE TOP AND BOTTOM
TWBR – FENCE WITH TOP TENSION WIRE AND BOTTOM RAIL
FINAL NUMBER IS FABRIC WIDTH IN INCHES.

EXAMPLES

FE6-TR-72 – CHAIN-LINK SECURITY FENCE WITH BARBED-WIRE ON SINGLE OUTRIGGER, TOP RAIL, AND 72 INCH FABRIC WIDTH.
FE5-TWB-84 – CHAIN-LINK SECURITY FENCE WITH NO APRON, TOP AND BOTTOM TENSION WIRE, AND
84 INCH FABRIC WIDTH.

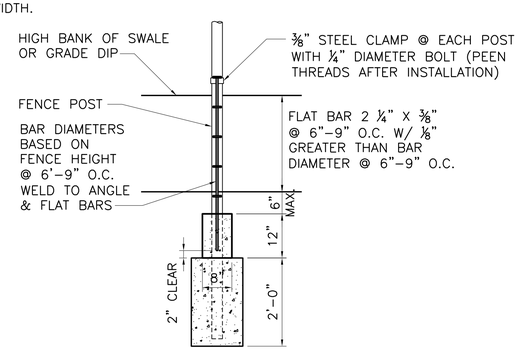


BRACE PANEL DETAIL
NO SCALE

NOTE: PROVIDE BRACE PANEL WHENEVER STRAIGHT RUNS EXCEED 500 FEET.

ELEVATION

FENCE SECURITY BARRIER AT SWALE OR GRADE DIP
NO SCALE



SECTION A-A

BID OPTIONS "◯"

9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.



THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

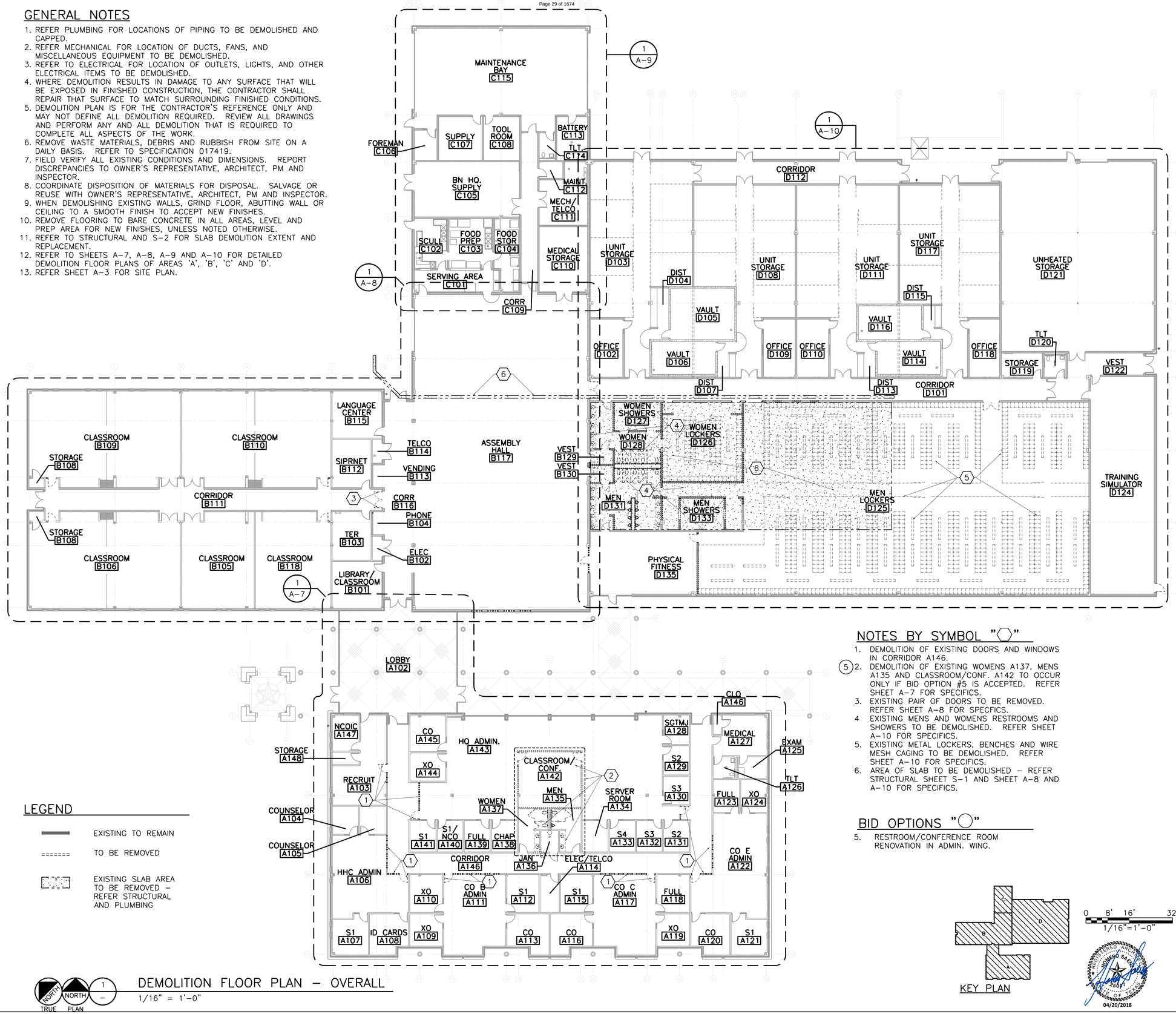
ARCHITECTURAL SECURITY FENCING DETAILS - BID OPTION 9

A-5

SHT. 12 of 129

GENERAL NOTES

1. REFER PLUMBING FOR LOCATIONS OF PIPING TO BE DEMOLISHED AND CAPPED.
2. REFER MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
3. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
4. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
5. DEMOLITION PLAN IS FOR THE CONTRACTOR'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS AND PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
6. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
7. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
9. WHEN DEMOLISHING EXISTING WALLS, GRIND FLOOR, ABUTTING WALL OR CEILING TO A SMOOTH FINISH TO ACCEPT NEW FINISHES.
10. REMOVE FLOORING TO BARE CONCRETE IN ALL AREAS, LEVEL AND PREP AREA FOR NEW FINISHES, UNLESS NOTED OTHERWISE.
11. REFER TO STRUCTURAL AND S-2 FOR SLAB DEMOLITION EXTENT AND REPLACEMENT.
12. REFER TO SHEETS A-7, A-8, A-9 AND A-10 FOR DETAILED DEMOLITION FLOOR PLANS OF AREAS 'A', 'B', 'C' AND 'D'.
13. REFER SHEET A-3 FOR SITE PLAN.



NOTES BY SYMBOL "⬡"

1. DEMOLITION OF EXISTING DOORS AND WINDOWS IN CORRIDOR A146.
5. 2. DEMOLITION OF EXISTING WOMENS A137, MENS A135 AND CLASSROOM/CONF. A142 TO OCCUR ONLY IF BID OPTION #5 IS ACCEPTED. REFER SHEET A-7 FOR SPECIFICS.
3. EXISTING PAIR OF DOORS TO BE REMOVED. REFER SHEET A-8 FOR SPECFICS.
4. EXISTING MENS AND WOMENS RESTROOMS AND SHOWERS TO BE DEMOLISHED. REFER SHEET A-10 FOR SPECIFICS.
5. EXISTING METAL LOCKERS, BENCHES AND WIRE MESH CAGING TO BE DEMOLISHED. REFER SHEET A-10 FOR SPECIFICS.
6. AREA OF SLAB TO BE DEMOLISHED – REFER STRUCTURAL SHEET S-1 AND SHEET A-8 AND A-10 FOR SPECIFICS.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING.

LEGEND

- EXISTING TO REMAIN
- TO BE REMOVED
- EXISTING SLAB AREA TO BE REMOVED – REFER STRUCTURAL AND PLUMBING

KEY PLAN

0 8' 16' 32'
1/16"=1'-0"

NORTH TRUE NORTH 1 – PLAN

DEMOLITION FLOOR PLAN – OVERALL

1/16" = 1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

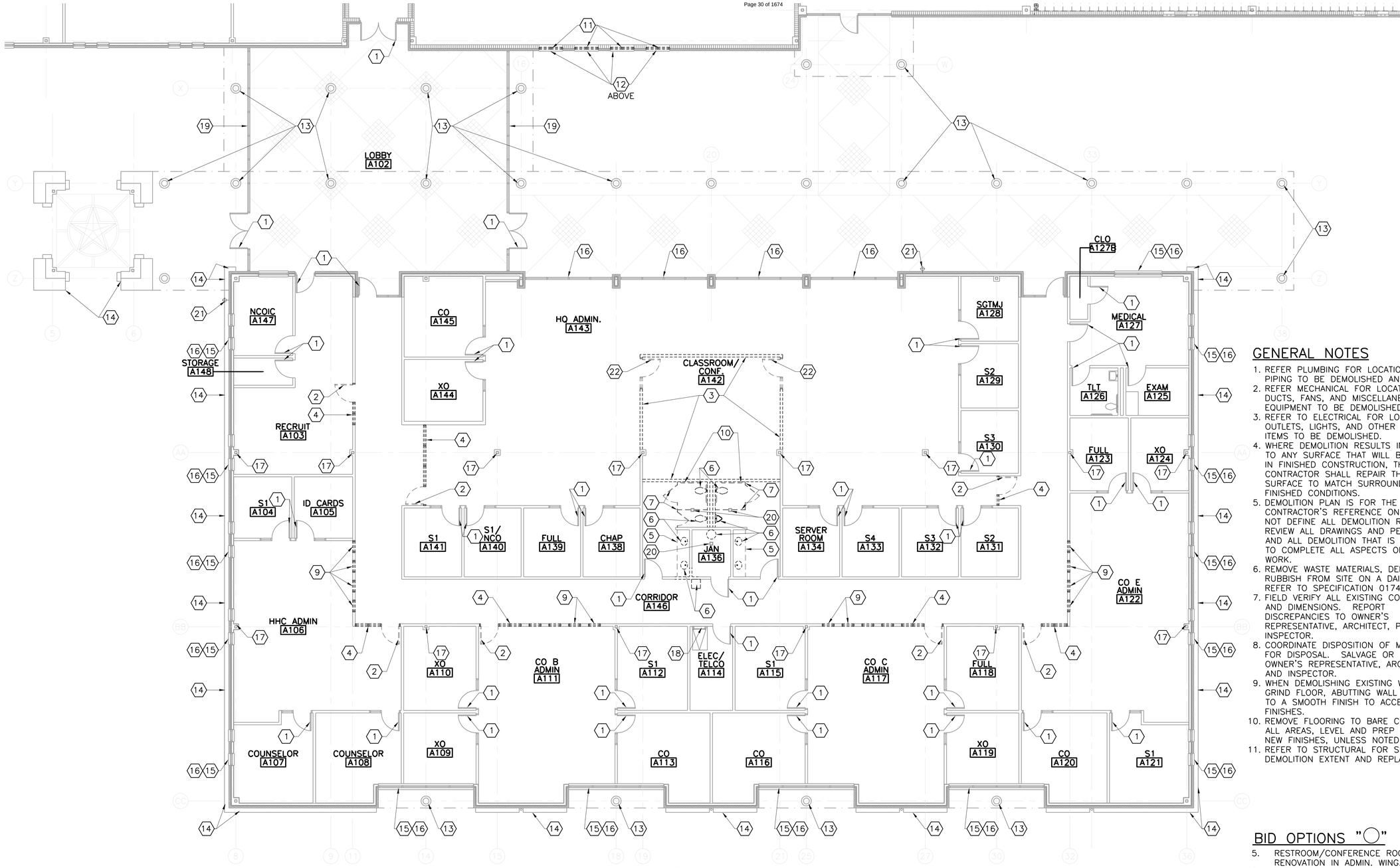
TXARNG CFMO

ARCHITECTURAL OVERALL DEMOLITION FLOOR PLAN

A-6

SHT. 13 of 129

04/20/2018



GENERAL NOTES

1. REFER PLUMBING FOR LOCATIONS OF PIPING TO BE DEMOLISHED AND CAPPED.
2. REFER MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
3. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
4. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
5. DEMOLITION PLAN IS FOR THE CONTRACTOR'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS AND PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
6. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
7. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL, SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
9. WHEN DEMOLISHING EXISTING WALLS, GRIND FLOOR, ABUTTING WALL OR CEILING TO A SMOOTH FINISH TO ACCEPT NEW FINISHES.
10. REMOVE FLOORING TO BARE CONCRETE IN ALL AREAS, LEVEL AND PREP AREA FOR NEW FINISHES, UNLESS NOTED OTHERWISE.
11. REFER TO STRUCTURAL FOR SLAB DEMOLITION EXTENT AND REPLACEMENT.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING.
6. EXTERIOR BUILDING IMPROVEMENTS.

NORTH TRUE NORTH PLAN — 1

DEMOLITION FLOOR PLAN – AREA "A"

1/8" = 1'-0"

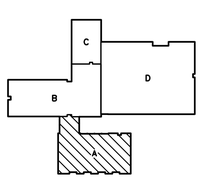
LEGEND

EXISTING TO REMAIN

TO BE REMOVED

NOTES BY SYMBOL "⬡"

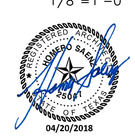
1. EXISTING DOOR TO REMAIN.
2. REMOVE EXISTING DOOR AND FRAME.
3. REMOVE EXISTING WALL.
4. REMOVE EXISTING SIDELIGHT AND FRAME.
5. REMOVE EXISTING MILLWORK COUNTERTOP.
6. REMOVE EXISTING PLUMBING. REF: PLUMBING.
7. REMOVE EXISTING TOILET PARTITIONS.
8. DEMOLISH FLOOR AS NOTED. REF: STRUCTURAL.
9. REMOVE EXISTING 2'X2' WINDOW.
10. REMOVE EXISTING WALL MOUNTED GRAB BARS.
11. REMOVE EXISTING LOUVER AND FRAME.
12. REMOVE EXISTING PORTION OF WALL ABOVE FOR NEW LOUVER.
13. EXISTING COLUMNS TO REMAIN.
14. EXISTING LIMESTONE WAINSCOT, CLEAN AND RESEAL.–TYP.
15. EXISTING LIMESTONE WINDOW HEADS AND SILLS, CLEAN AND RESEAL.–TYP.
16. EXISTING WINDOWS TO REMAIN
17. EXISTING STEEL COLUMN TO REMAIN.
18. EXISTING ROOF ACCESS LADDER AND HATCH TO REMAIN.
19. EXISTING STOREFRONT TO REMAIN.
20. EXISTING FLOOR DRAIN TO REMAIN – REFER PLUMBING.
21. DEMOLISH EXISTING HOSE BIB – REFER PLUMBING.
22. REMOVE EXISTING DOOR, FRAME AND SIDELIGHT, SALVAGE FOR REUSE.



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"



04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		
9		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

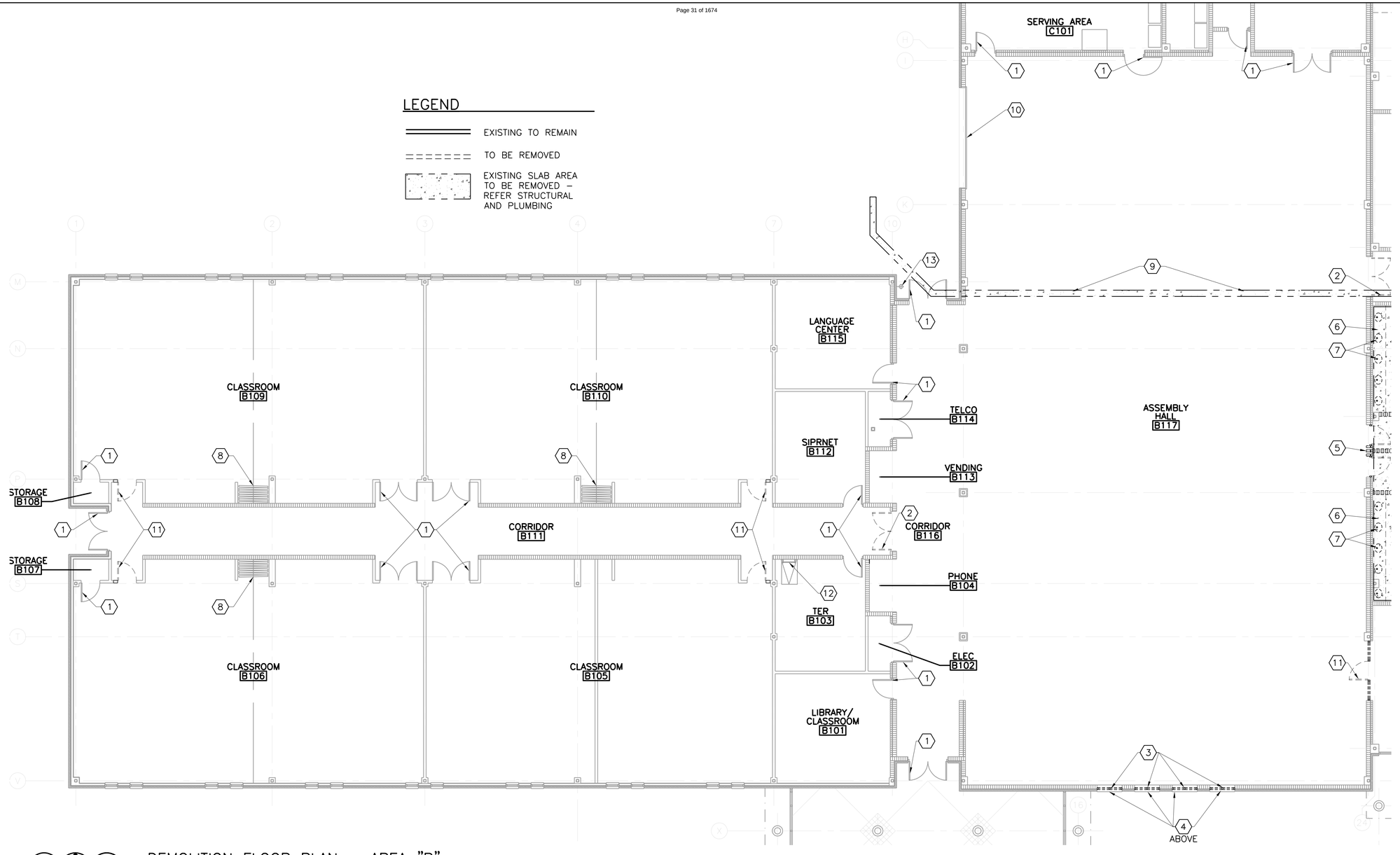
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL DEMOLITION FLOOR PLAN - AREA 'A'

A-7

SHT. 14 of 129



DEMOLITION FLOOR PLAN – AREA "B"

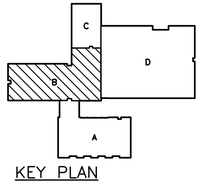
1/8" = 1'-0"

GENERAL NOTES

1. REFER PLUMBING FOR LOCATIONS OF PIPING TO BE DEMOLISHED AND CAPPED.
2. REFER MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
3. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
4. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
5. DEMOLITION PLAN IS FOR THE CONTRACTOR'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS AND PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
6. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
7. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
9. WHEN DEMOLISHING EXISTING WALLS, GRIND FLOOR, ABUTTING WALL OR CEILING TO A SMOOTH FINISH TO ACCEPT NEW FINISHES.
10. REMOVE FLOORING TO BARE CONCRETE IN ALL AREAS, LEVEL AND PREP AREA FOR NEW FINISHES, UNLESS NOTED OTHERWISE.

NOTES BY SYMBOL "⬡"

1. EXISTING DOOR TO REMAIN.
2. REMOVE EXISTING PAIR OF DOORS AND FRAME.
3. REMOVE EXISTING LOUVER AND FRAME.
4. REMOVE EXISTING PORTION OF WALL ABOVE FOR NEW LOUVER.
5. REMOVE EXISTING WALL. REF: STRUCTURAL.
6. REMOVE EXISTING MILLWORK COUNTERTOP.
7. REMOVE EXISTING PLUMBING. REF: PLUMBING.
8. EXISTING ROOM DIVIDER TO REMAIN.
9. DEMOLISH FLOOR AS NOTED. REF: STRUCTURAL.
10. EXISTING OVERHEAD DOOR TO REMAIN.
11. REMOVE EXISTING DOOR AND FRAME AND PORTION OF WALL AS SHOWN. SALVAGE DOOR AND FRAME FOR RE-USE.
12. EXISTING ROOF ACCESS LADDER AND HATCH TO REMAIN.
13. DEMOLISH EXISTING HOSE BIB – REFER PLUMBING.



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6151 FAX (512) 782-1481

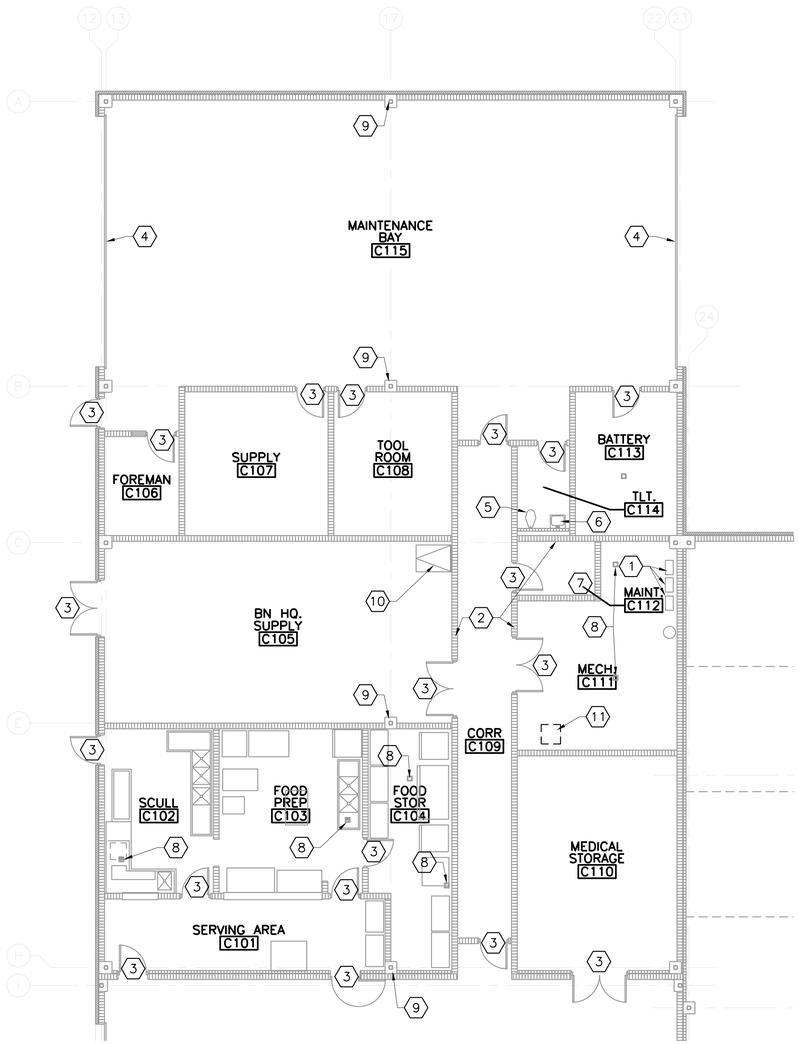
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL DEMOLITION FLOOR PLAN - AREA 'B'

A-8

SHT. 15 of 129



NORTH TRUE NORTH PLAN

1 — DEMOLITION FLOOR PLAN – AREA "C"

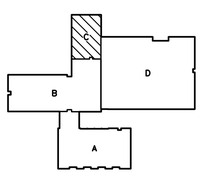
1/8" = 1'-0"

GENERAL NOTES

1. REFER PLUMBING FOR LOCATIONS OF PIPING TO BE DEMOLISHED AND CAPPED.
2. REFER MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
3. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
4. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
5. DEMOLITION PLAN IS FOR THE CONTRACTOR'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS AND PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
6. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
7. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
9. WHEN DEMOLISHING EXISTING WALLS, GRIND FLOOR, ABUTTING WALL OR CEILING TO A SMOOTH FINISH TO ACCEPT NEW FINISHES.
10. REMOVE FLOORING TO BARE CONCRETE IN ALL AREAS, LEVEL AND PREP AREA FOR NEW FINISHES, UNLESS NOTED OTHERWISE.

NOTES BY SYMBOL "⬡"

1. EXISTING WATER HEATERS TO BE DEMOLISHED – REFER PLUMBING.
2. EXISTING CMU WALLS TO REMAIN.
3. EXISTING DOOR TO REMAIN.
4. EXISTING OVERHEAD DOOR TO REMAIN.
5. EXISTING WATER CLOSET TO REMAIN – REFER PLUMBING.
6. EXISTING SINK TO REMAIN – REFER PLUMBING.
7. EXISTING MOP SINK TO REMAIN – REFER PLUMBING.
8. EXISTING FLOOR DRAIN TO REMAIN – REFER PLUMBING.
9. EXISTING COLUMN TO REMAIN.
10. EXISTING ROOF ACCESS LADDER AND HATCH TO REMAIN.
11. EXISTING TRANSFORMER TO BE RELOCATED – REFER ELECTRICAL.



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"



04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481
CAMP MABRY P.O. BOX 5218
(512) 782-6131

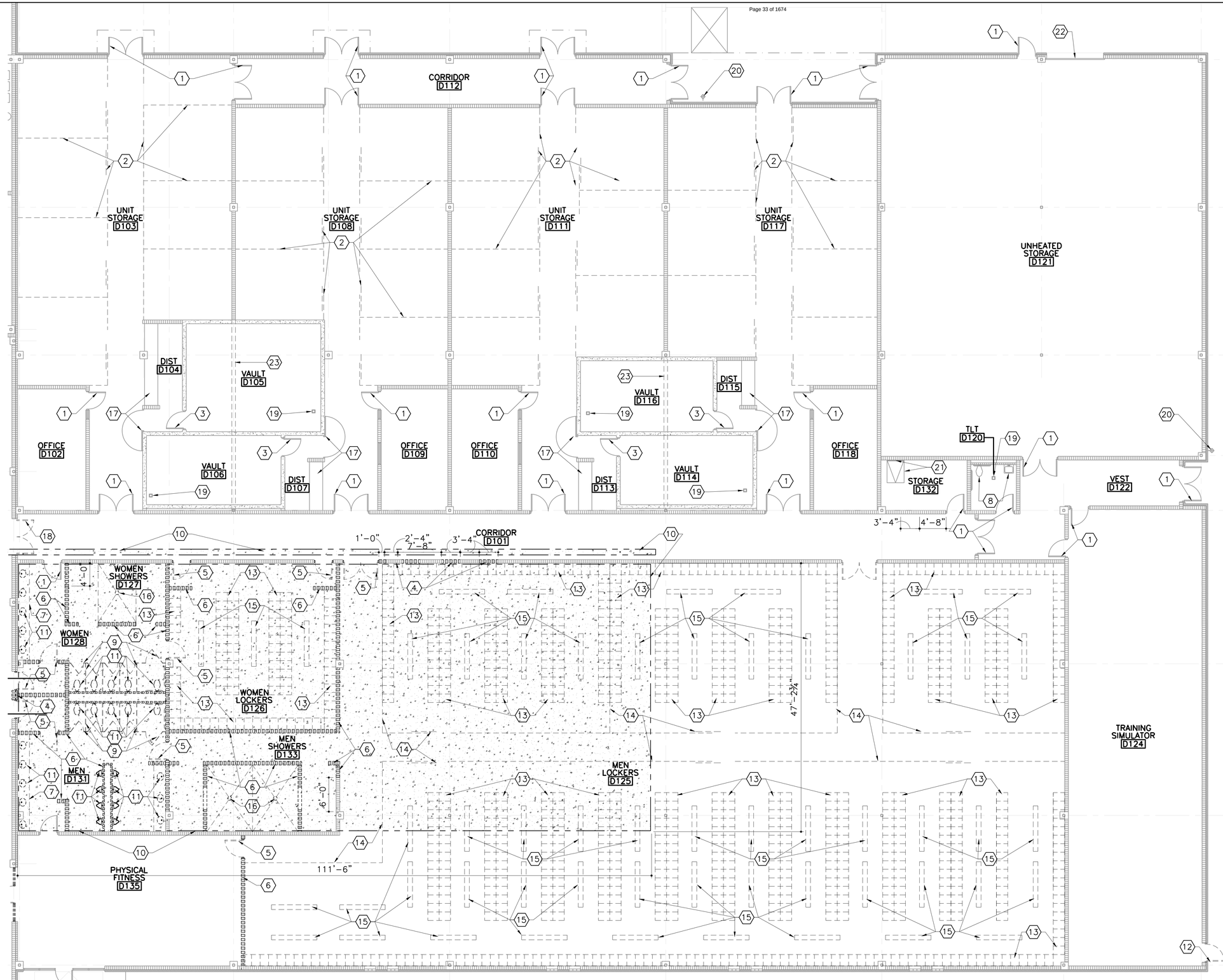
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL DEMOLITION FLOOR PLAN - AREA 'C'

A-9

SHT. 16 of 129

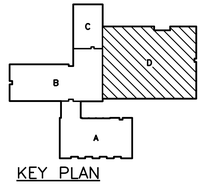


GENERAL NOTES

1. REFER PLUMBING FOR LOCATIONS OF PIPING TO BE DEMOLISHED AND CAPPED.
2. REFER MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
3. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
4. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
5. DEMOLITION PLAN IS FOR THE CONTRACTOR'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS AND PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
6. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
7. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
9. WHEN DEMOLISHING EXISTING WALLS, GRIND FLOOR, ABUTTING WALL OR CEILING TO A SMOOTH FINISH TO ACCEPT NEW FINISHES.
10. REMOVE FLOORING TO BARE CONCRETE IN ALL AREAS, LEVEL AND PREP AREA FOR NEW FINISHES, UNLESS NOTED OTHERWISE.
11. REFER TO STRUCTURAL AND S-1 FOR SLAB DEMOLITION EXTENT AND REPLACEMENT.

NOTES BY SYMBOL "⬡"

1. EXISTING DOOR TO REMAIN.
2. EXISTING WIRE MESH, DOOR AND PANEL TO REMAIN.
3. EXISTING VAULT DOOR TO REMAIN.
4. REMOVE PORTION OF WALL FOR NEW OPENING. REF: STRUCTURAL.
5. REMOVE EXISTING DOOR AND FRAME.
6. REMOVE EXISTING CMU WALL.
7. REMOVE EXISTING COUNTERTOP.
8. EXISTING PLUMBING TO REMAIN. REF: PLUMBING.
9. REMOVE EXISTING TOILET PARTITIONS.
10. DEMOLISH FLOOR AS NOTED. REF: STRUCTURAL.
11. REMOVE EXISTING PLUMBING FIXTURE AND ASSOCIATED PIPING. REF: PLUMBING.
12. REMOVE EXISTING ACCESS DOOR AND FRAME.
13. REMOVE EXISTING METAL LOCKERS.
14. REMOVE EXISTING WIRE MESH PANELS AND DOORS.
15. REMOVE EXISTING FLOOR MOUNTED BENCH.
16. REMOVE EXISTING GANG SHOWER PEDESTAL.
17. ISSUE COUNTER AND GATE TO REMAIN.
18. REMOVE DOORS, FRAME TO REMAIN.
19. EXISTING FLOOR DRAIN TO REMAIN.
20. EXISTING HOSE BIB TO BE DEMOLISHED. REF: PLUMBING.
21. EXISTING ROOF ACCESS HATCH AND WALL MOUNTED LADDER TO REMAIN.
22. EXISTING OVERHEAD DOOR TO REMAIN.
23. EXISTING 8" CMU WALL CONTINUES ACROSS THE TOP OF VAULT AREA TO THE BOTTOM OF DECK.



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

LEGEND

EXISTING TO REMAIN

TO BE REMOVED

EXISTING SLAB AREA TO BE REMOVED - REFER STRUCTURAL AND PLUMBING

NORTH TRUE NORTH PLAN 1 –

DEMOLITION FLOOR PLAN – AREA "D"

1/8" = 1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL DEMOLITION FLOOR PLAN - AREA 'D'

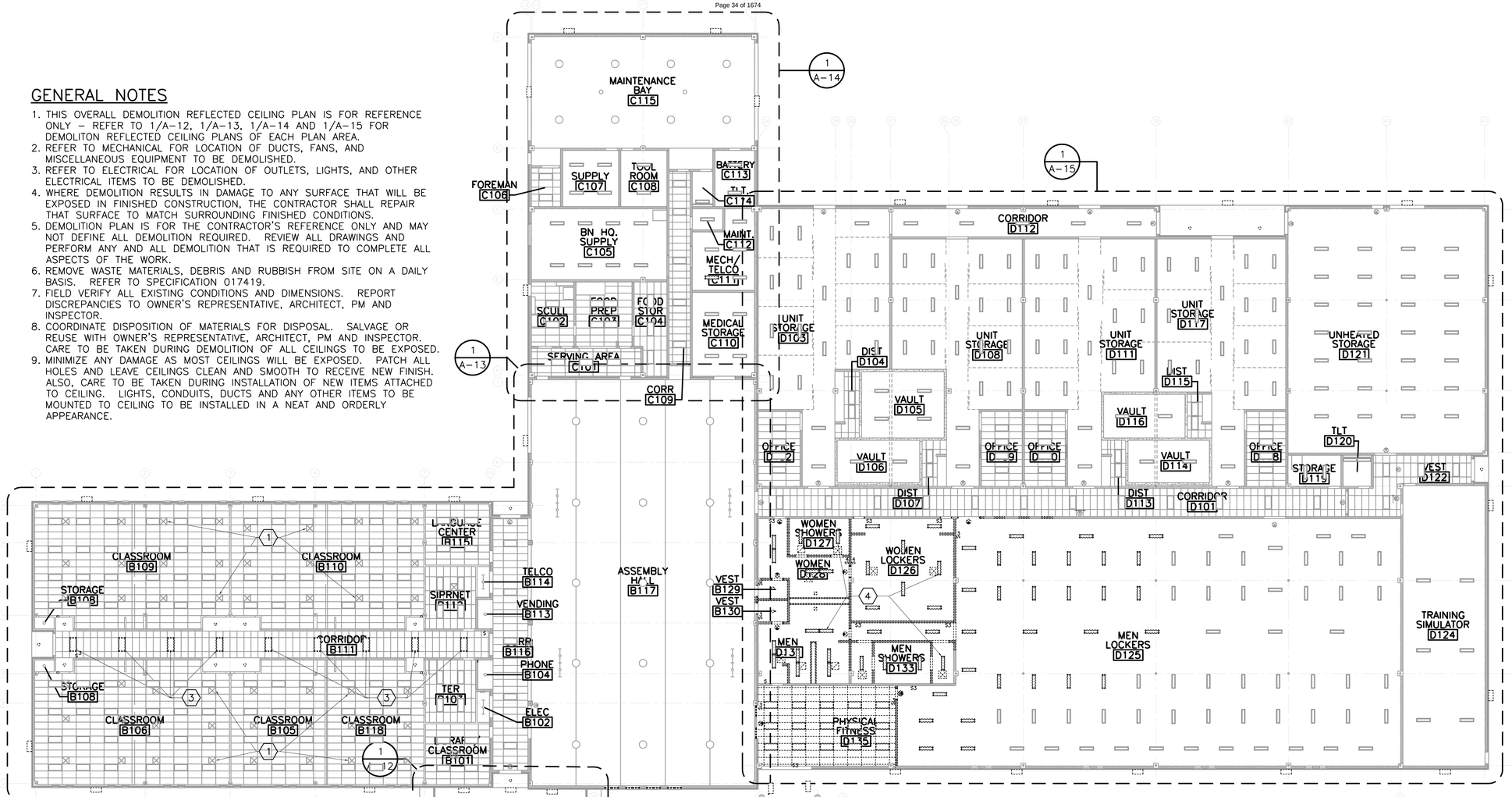
A-10

SHT. 17 of 129



GENERAL NOTES

1. THIS OVERALL DEMOLITION REFLECTED CEILING PLAN IS FOR REFERENCE ONLY – REFER TO 1/A–12, 1/A–13, 1/A–14 AND 1/A–15 FOR DEMOLITON REFLECTED CEILING PLANS OF EACH PLAN AREA.
2. REFER TO MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
3. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
4. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
5. DEMOLITION PLAN IS FOR THE CONTRACTOR'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS AND PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
6. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
7. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR. CARE TO BE TAKEN DURING DEMOLITION OF ALL CEILINGS TO BE EXPOSED.
9. MINIMIZE ANY DAMAGE AS MOST CEILINGS WILL BE EXPOSED. PATCH ALL HOLES AND LEAVE CEILINGS CLEAN AND SMOOTH TO RECEIVE NEW FINISH. ALSO, CARE TO BE TAKEN DURING INSTALLATION OF NEW ITEMS ATTACHED TO CEILING. LIGHTS, CONDUITS, DUCTS AND ANY OTHER ITEMS TO BE MOUNTED TO CEILING TO BE INSTALLED IN A NEAT AND ORDERLY APPEARANCE.



LEGEND

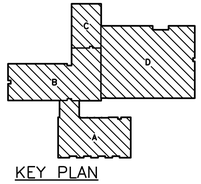
- EXISTING 2X4 ACOUSTICAL TILE GRID TO REMAIN
- EXISTING 1X4 LIGHT FIXTURE TO REMAIN
- EXISTING 2X4 LIGHT FIXTURE TO REMAIN
- EXISTING HI–BAY LIGHT FIXTURE TO REMAIN
- EXISTING CAN LIGHT FIXTURE TO REMAIN
- EXISTING HVAC DIFFUSER TO REMAIN
- EXISTING 2X4 ACOUSTICAL TILE GRID TO BE DEMOLISHED
- EXISTING 1X4 LIGHT FIXTURE TO BE DEMOLISHED
- EXISTING 2X4 LIGHT FIXTURE TO BE DEMOLISHED
- EXISTING HI–BAY LIGHT FIXTURE TO BE DEMOLISHED
- EXISTING CAN LIGHT FIXTURE TO BE DEMOLISHED
- EXISTING HVAC DIFFUSER TO BE DEMOLISHED

NOTES BY SYMBOL "⬡"

1. EXISTING HVAC DIFFUSERS TO REMAIN – REFER MECHANICAL.
5 2. DEMOLITION OF EXISTING WOMENS A137, MENS A135 AND CLASSROOM/CONF. A142 TO OCCUR ONLY IF BID OPTION #5 IS ACCEPTED. REFER SHEET A–12 FOR SPECIFICS.
3. EXISTING LIGHTS TO BE DEMOLISHED. REFER SHEET A–13 FOR SPECFICS.
4 EXISTING CEILINGS AND LIGHT FIXTURES MENS AND WOMENS RESTROOMS AND SHOWERS TO BE DEMOLISHED. REFER ELECTRICAL AND SHEET A–15 FOR SPECIFICS.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING.
6. EXTERIOR BUILDING IMPROVEMENTS



KEY PLAN

0 8' 16' 32'
1/16"=1'–0"

DEMOLITION REFLECTED CEILING PLAN – OVERALL

1/16" = 1'–0"

TRUE NORTH / PLAN NORTH — 1 / –

04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
(512) 782–6131
AUSTIN, TEXAS 78763–5218
FAX (512) 782–1481

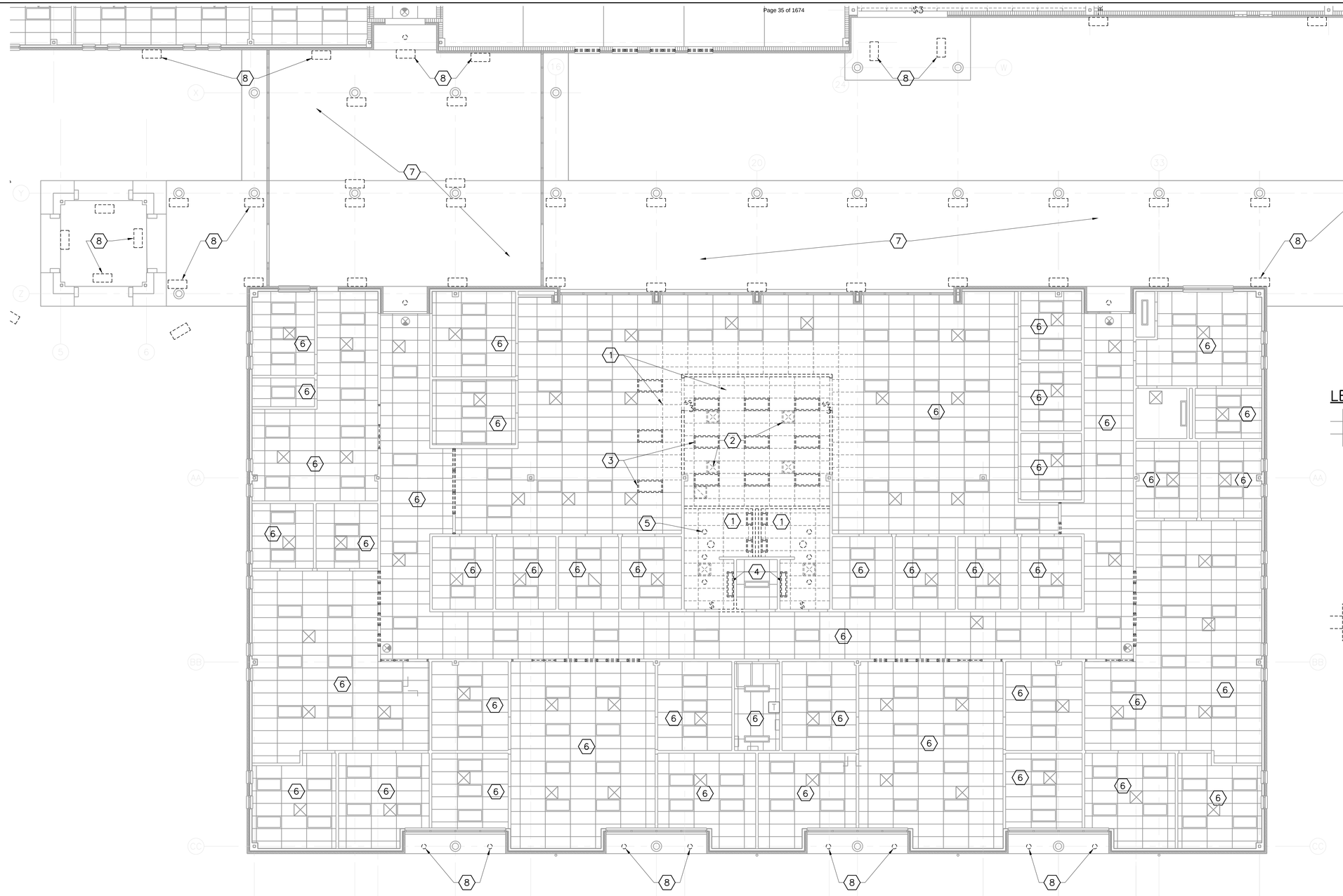
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL OVERALL DEMOLITION REFLECTED CLNG PLAN

A-11

SHT. 18 of 129



DEMOLITION REFLECTED CEILING PLAN – AREA "A"

1/8" = 1'-0"

GENERAL NOTES

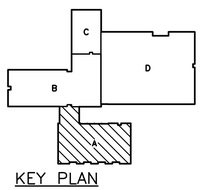
1. REFER TO MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
2. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
3. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
4. DEMOLITION PLAN IS FOR THE G.C.'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS, PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
5. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
6. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
7. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. CARE TO BE TAKEN DURING DEMOLITION OF ALL CEILINGS TO BE EXPOSED. PATCH ALL HOLES AND LEAVE CEILINGS CLEAN AND SMOOTH TO RECEIVE NEW FINISH. ALSO, CARE TO BE TAKEN DURING INSTALLATION OF NEW ITEMS ATTACHED TO CEILING. LIGHTS, CONDUITS, DUCTS AND ANY OTHER ITEMS TO BE MOUNTED TO CEILING TO BE INSTALLED IN A NEAT AND ORDERLY APPEARANCE.

NOTES BY SYMBOL "⬡"

(5) 1. DEMO EXISTING CEILING GRID AND TILES.
(5) 2. DEMO EXISTING HVAC DIFFUSER – RE: MECHANICAL.
(5) 3. DEMO EXISTING 2X4 LIGHT FIXTURE – RE: ELECTRICAL.
(5) 4. DEMO EXISTING 1X4 STRIP LIGHT FIXTURE – RE: ELECTRICAL.
(5) 5. DEMO EXISTING CAN LIGHT FIXTURE – RE: ELECTRICAL.
6. EXISTING CEILING GRID AND TILES TO BE REMOVED AND REPLACED AS NEEDED.
7. EXISTING EXPOSED STRUCTURE TO REMAIN.
(6) 8. IF BID OPTION#6 IS SELECTED, DEMOLISH EXISTING EXTERIOR LIGHT FIXTURE, OTHERWISE EXISTING EXTERIOR LIGHT FIXTURES ARE TO REMAIN.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING.
6. EXTERIOR BUILDING IMPROVEMENTS



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

REGISTERED ARCHITECT HOMER SAENZ 25611 STATE OF TEXAS
04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

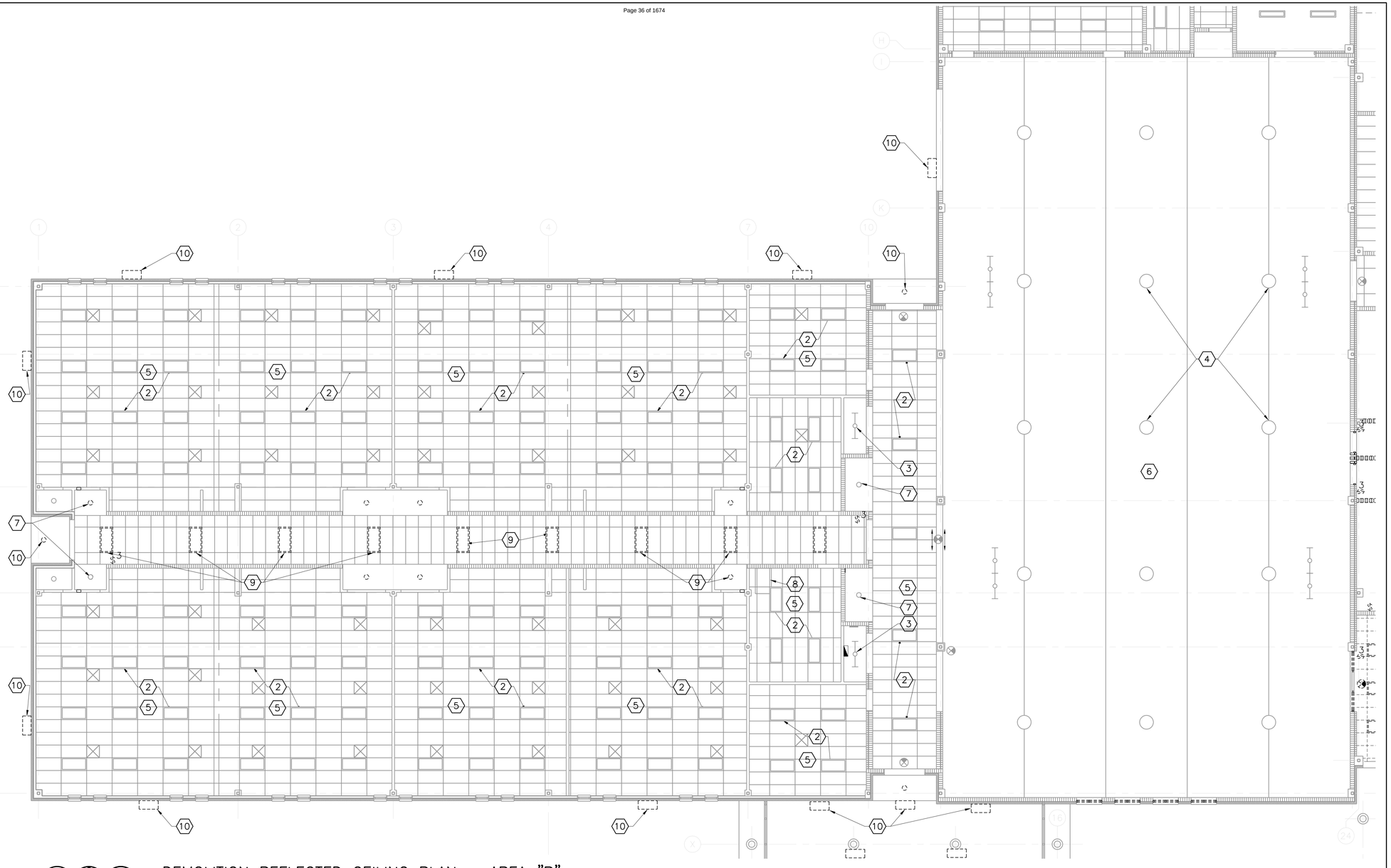
TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481
STAR CAMPAIGN FY18 - WESLACO RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL DEMOLITION REFLECTED CEILING PLAN - AREA 'A'

A-12

SHT. 19 of 129



DEMOLITION REFLECTED CEILING PLAN – AREA "B"

1/8" = 1'-0"

GENERAL NOTES

1. REFER TO MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
2. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
3. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
4. DEMOLITION PLAN IS FOR THE G.C.'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS, PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
5. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
6. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
7. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. CARE TO BE TAKEN DURING DEMOLITION OF ALL CEILINGS TO BE EXPOSED. PATCH ALL HOLES AND LEAVE CEILINGS CLEAN AND SMOOTH TO RECEIVE NEW FINISH. ALSO, CARE TO BE TAKEN DURING INSTALLATION OF NEW ITEMS ATTACHED TO CEILING. LIGHTS, CONDUITS, DUCTS AND ANY OTHER ITEMS TO BE MOUNTED TO CEILING TO BE INSTALLED IN A NEAT AND ORDERLY APPEARANCE.

NOTES BY SYMBOL "⬡"

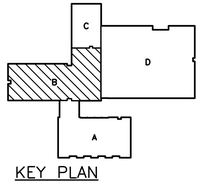
1. EXISTING HVAC DIFFUSER – RE: MECHANICAL.
2. EXISTING 2X4 LIGHT FIXTURE – RE: ELECTRICAL.
3. EXISTING 1X4 STRIP LIGHT FIXTURE – RE: ELECTRICAL.
4. EXISTING HI–BAY LIGHT FIXTURE – RE: ELECTRICAL.
5. EXISTING CEILING GRID AND TILES TO BE REMOVED AND REPLACED AS NEEDED.
6. EXISTING EXPOSED STRUCTURE TO REMAIN.
7. EXISTING CAN LIGHT TO REMAIN.
8. EXISTING ROOF ACCESS HATCH TO REMAIN.
9. DEMOLISH LIGHT FIXTURE. RE: ELECTRICAL.
10. IF BID OPTION#6 IS SELECTED, DEMOLISH EXISTING EXTERIOR LIGHT FIXTURE, OTHERWISE EXISTING EXTERIOR LIGHT FIXTURES ARE TO REMAIN.

LEGEND

- EXISTING 2X4 ACOUSTICAL TILE GRID TO REMAIN
- EXISTING 1X4 LIGHT FIXTURE TO REMAIN
- EXISTING 2X4 LIGHT FIXTURE TO REMAIN
- EXISTING HI–BAY LIGHT FIXTURE TO REMAIN
- EXISTING CAN LIGHT FIXTURE TO REMAIN
- EXISTING HVAC DIFFUSER TO REMAIN
- EXISTING 2X4 LIGHT FIXTURE TO BE DEMOLISHED

BID OPTIONS "◯"

6. EXTERIOR BUILDING IMPROVEMENTS



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"



04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763–5218
(512) 782–6131
FAX (512) 782–1481

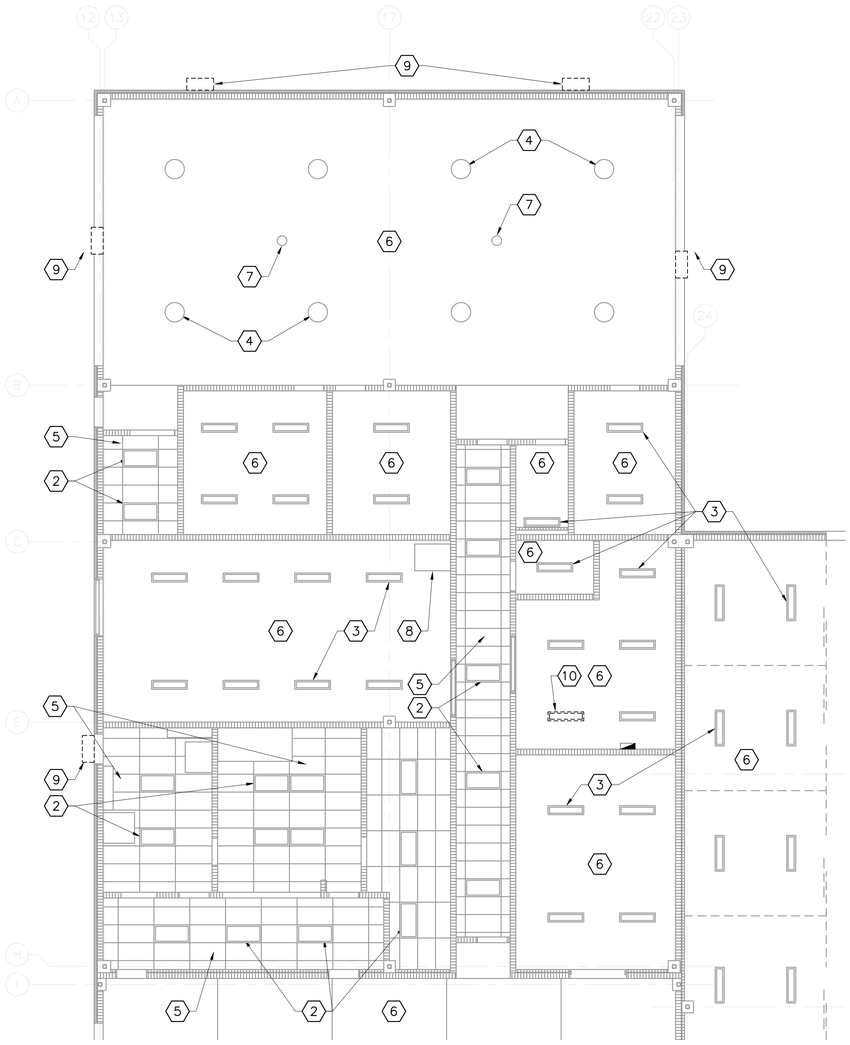
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL DEMOLITION REFLECTED CEILING PLAN - AREA 'B'

A-13

SHT. 20 of 129



LEGEND

- EXISTING 2X4 ACOUSTICAL TILE GRID TO REMAIN
- EXISTING 1X4 LIGHT FIXTURE TO REMAIN
- EXISTING 2X4 LIGHT FIXTURE TO REMAIN
- EXISTING HI-BAY LIGHT FIXTURE TO REMAIN
- EXISTING 1X4 LIGHT FIXTURE TO BE DEMOLISHED

DEMOLITION REFLECTED CEILING PLAN – AREA "C"

1/8" = 1'-0"

GENERAL NOTES

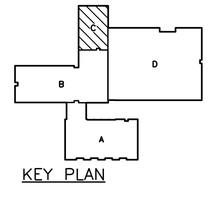
1. REFER TO MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
2. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
3. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
4. DEMOLITION PLAN IS FOR THE G.C.'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS, PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
5. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
6. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
7. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. CARE TO BE TAKEN DURING DEMOLITION OF ALL CEILINGS TO BE EXPOSED. PATCH ALL HOLES AND LEAVE CEILINGS CLEAN AND SMOOTH TO RECEIVE NEW FINISH. ALSO, CARE TO BE TAKEN DURING INSTALLATION OF NEW ITEMS ATTACHED TO CEILING. LIGHTS, CONDUITS, DUCTS AND ANY OTHER ITEMS TO BE MOUNTED TO CEILING TO BE INSTALLED IN A NEAT AND ORDERLY APPEARANCE.

NOTES BY SYMBOL "⬡"

1. EXISTING HVAC DIFFUSER – RE: MECHANICAL.
2. EXISTING 2X4 LIGHT FIXTURE – RE: ELECTRICAL.
3. EXISTING 1X4 STRIP LIGHT FIXTURE – RE: ELECTRICAL.
4. EXISTING HI-BAY LIGHT FIXTURE – RE: ELECTRICAL.
5. EXISTING CEILING GRID AND TILES TO REMAIN.
6. EXISTING EXPOSED STRUCTURE TO REMAIN.
7. EXISTING SPEAKER TO REMAIN.
8. EXISTING ROOF ACCESS HATCH TO REMAIN.
9. IF BID OPTION#6 IS SELECTED, DEMOLISH EXISTING EXTERIOR LIGHT FIXTURE, OTHERWISE EXISTING EXTERIOR LIGHT FIXTURES ARE TO REMAIN.
10. EXISTING 1X4 LIGHT FIXTURE TO BE DEMOLISHED – RE: ELECTRICAL

BID OPTIONS "◯"

6. EXTERIOR BUILDING IMPROVEMENTS



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL DEMOLITION REFLECTED CEILING PLAN - AREA 'C'

A-14

SHT. 21 of 129



GENERAL NOTES

1. RE: MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
2. RE: ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
3. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE G.C. SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
4. DEMOLITION PLAN IS FOR THE G.C.'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS, PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO
5. COMPLETE ALL ASPECTS OF THE WORK. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
6. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
7. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. CARE TO BE TAKEN DURING DEMOLITION OF ALL CEILINGS TO BE EXPOSED. PATCH ALL HOLES AND LEAVE CEILINGS CLEAN AND SMOOTH TO RECEIVE NEW FINISH. ALSO, CARE TO BE TAKEN DURING INSTALLATION OF NEW ITEMS ATTACHED TO CEILING. LIGHTS, CONDUITS, DUCTS AND ANY OTHER ITEMS TO BE MOUNTED TO CEILING TO BE INSTALLED IN A NEAT AND ORDERLY APPEARANCE.

LEGEND

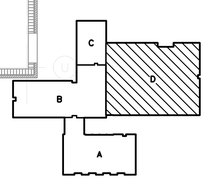
- EXISTING 2X4 ACOUSTICAL TILE GRID TO REMAIN
- EXISTING 1X4 LIGHT FIXTURE TO REMAIN
- EXISTING 2X4 LIGHT FIXTURE TO REMAIN
- EXISTING CAN LIGHT FIXTURE TO REMAIN
- EXISTING HVAC DIFFUSER TO REMAIN
- EXISTING 2X4 ACOUSTICAL TILE GRID TO BE DEMOLISHED
- EXISTING 1X4 LIGHT FIXTURE TO BE DEMOLISHED
- EXISTING 2X4 LIGHT FIXTURE TO BE DEMOLISHED
- EXISTING CAN LIGHT FIXTURE TO BE DEMOLISHED
- EXISTING HVAC DIFFUSER TO BE DEMOLISHED

BID OPTIONS "⬡"

6. EXTERIOR BUILDING IMPROVEMENTS

NOTES BY SYMBOL "⬡"

1. DEMO EXISTING CEILING GRID AND TILES.
2. DEMO EXISTING HVAC DIFFUSER – RE: MECHANICAL.
3. DEMO EXISTING 2X4 LIGHT FIXTURE – RE: ELECTRICAL.
4. DEMO EXISTING 1X4 STRIP LIGHT FIXTURE – RE: ELECTRICAL.
5. DEMO EXISTING CAN LIGHT FIXTURE – RE: ELECTRICAL.
6. EXISTING CEILING GRID AND TILES TO BE REMOVED AND REPLACED AS NEEDED.
7. EXISTING EXPOSED STRUCTURE TO REMAIN.
8. EXISTING 2X4 LIGHT FIXTURE TO REMAIN – RE: ELECTRICAL.
9. EXISTING 1X4 STRIP LIGHT FIXTURE TO REMAIN – RE: ELECTRICAL.
10. EXISTING CAN LIGHT FIXTURE TO REMAIN – RE: ELECTRICAL.
11. IF BID OPTION#6 IS SELECTED, DEMOLISH EXISTING EXTERIOR LIGHT FIXTURE, OTHERWISE EXISTING EXTERIOR LIGHT FIXTURES ARE TO REMAIN.
12. EXISTING ROOF ACCESS HATCH TO REMAIN.



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

04/20/2018

NORTH TRUE NORTH PLAN 1 –

DEMOLITION REFLECTED CEILING PLAN – AREA "D"
1/8" = 1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS, 78763-5218
(512) 782-6131 FAX (512) 782-1481

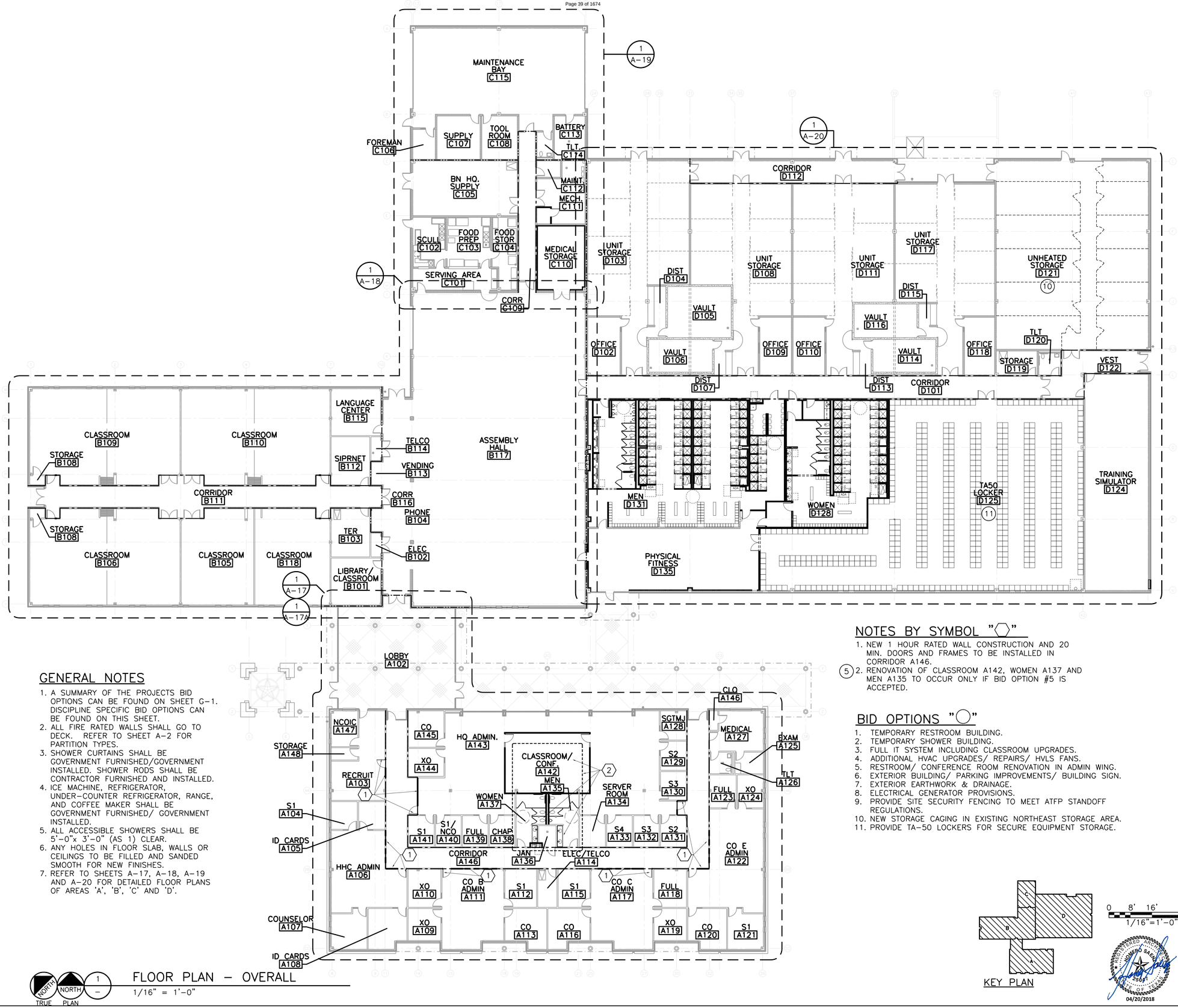
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL
DEMOLITION REFLECTED CEILING PLAN - AREA 'D'

A-15

SHT. 22 of 129



GENERAL NOTES

1. A SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. ALL FIRE RATED WALLS SHALL GO TO DECK. REFER TO SHEET A-2 FOR PARTITION TYPES.
3. SHOWER CURTAINS SHALL BE GOVERNMENT FURNISHED/GOVERNMENT INSTALLED. SHOWER RODS SHALL BE CONTRACTOR FURNISHED AND INSTALLED.
4. ICE MACHINE, REFRIGERATOR, UNDER-COUNTER REFRIGERATOR, RANGE, AND COFFEE MAKER SHALL BE GOVERNMENT FURNISHED/ GOVERNMENT INSTALLED.
5. ALL ACCESSIBLE SHOWERS SHALL BE 5'-0"x 3'-0" (AS 1) CLEAR.
6. ANY HOLES IN FLOOR SLAB, WALLS OR CEILINGS TO BE FILLED AND SANDED SMOOTH FOR NEW FINISHES.
7. REFER TO SHEETS A-17, A-18, A-19 AND A-20 FOR DETAILED FLOOR PLANS OF AREAS 'A', 'B', 'C' AND 'D'.

NOTES BY SYMBOL "⬡"

1. NEW 1 HOUR RATED WALL CONSTRUCTION AND 20 MIN. DOORS AND FRAMES TO BE INSTALLED IN CORRIDOR A146.
(5) 2. RENOVATION OF CLASSROOM A142, WOMEN A137 AND MEN A135 TO OCCUR ONLY IF BID OPTION #5 IS ACCEPTED.

BID OPTIONS "◯"

1. TEMPORARY RESTROOM BUILDING.
2. TEMPORARY SHOWER BUILDING.
3. FULL IT SYSTEM INCLUDING CLASSROOM UPGRADES.
4. ADDITIONAL HVAC UPGRADES/ REPAIRS/ HVLS FANS.
5. RESTROOM/ CONFERENCE ROOM RENOVATION IN ADMIN WING.
6. EXTERIOR BUILDING/ PARKING IMPROVEMENTS/ BUILDING SIGN.
7. EXTERIOR EARTHWORK & DRAINAGE.
8. ELECTRICAL GENERATOR PROVISIONS.
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.
10. NEW STORAGE CAGING IN EXISTING NORTHEAST STORAGE AREA.
11. PROVIDE TA-50 LOCKERS FOR SECURE EQUIPMENT STORAGE.

KEY PLAN

0 8' 16' 32'
1/16"=1'-0"

1 NORTH TRUE NORTH PLAN
FLOOR PLAN – OVERALL
1/16" = 1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

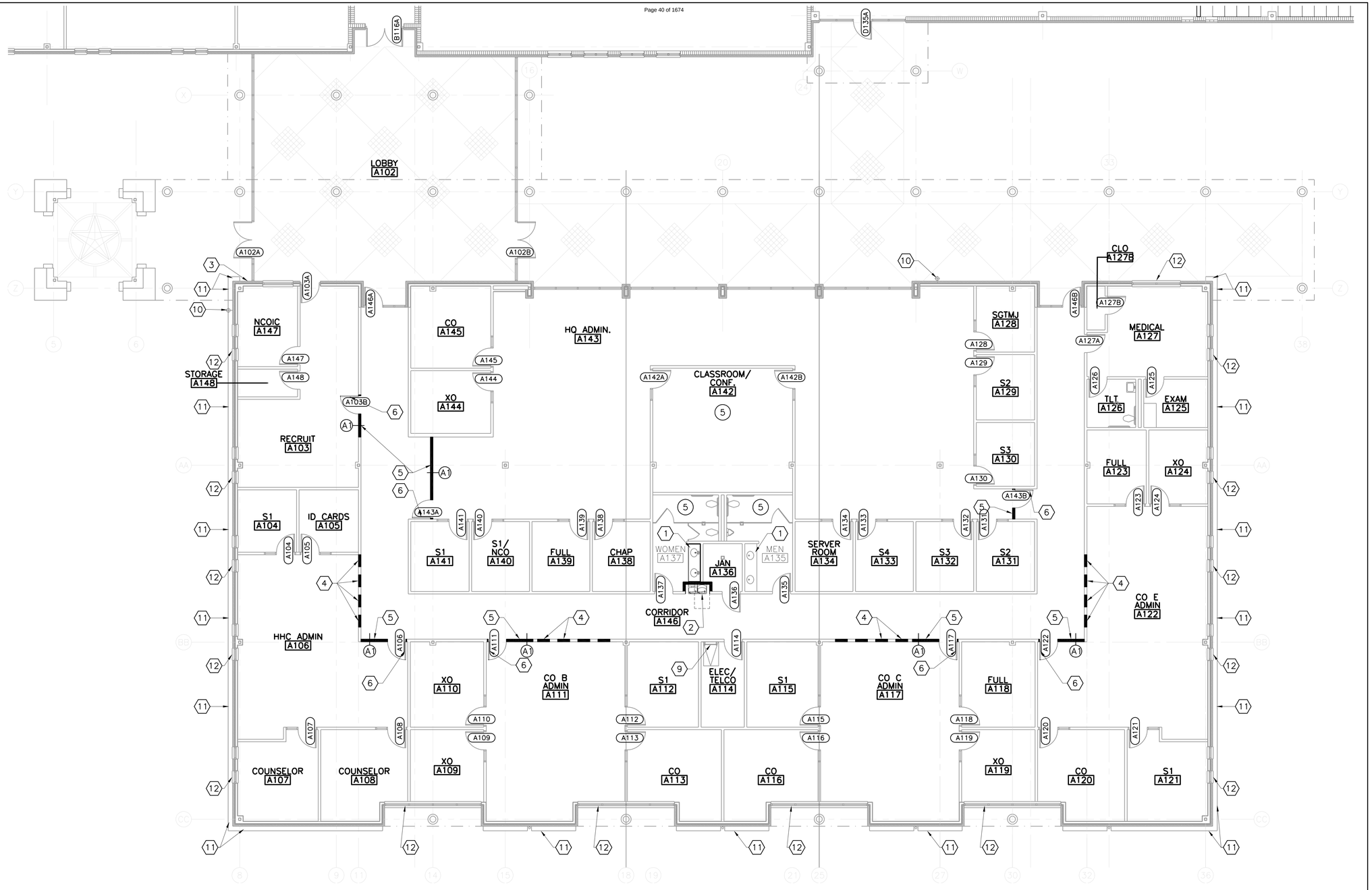
TXARNG CFMO

ARCHITECTURAL OVERALL FLOOR PLAN

A-16

SHT. 23 of 129

REGISTERED ARCHITECT HOMER SAENZ 25021 STATE OF TEXAS
04/20/2018



FLOOR PLAN – AREA "A"

1/8" = 1'-0"

GENERAL NOTES

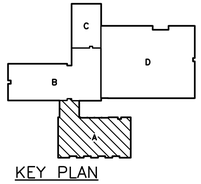
1. A SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. ALL FIRE RATED WALLS SHALL GO TO DECK. REFER TO SHEET A-2 FOR PARTITION TYPES.
3. REFER SHEET A-17A FOR BID OPTION # 5 – RESTROOM / CONFERENCE ROOM RENOVATION.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING. REFER TO SHEET A-17A FOR BID OPTION.
6. EXTERIOR BUILDING IMPROVEMENTS.

NOTES BY SYMBOL "⬡"

1. SOLID SURFACE LAVATORY COUNTERTOP AND BACKSPLASH.
2. HI/LO ELECTRIC WATER COOLER WITH SKIRT OPTION FOR CANE DETECTION.
3. KNOX BOX – 3200 SERIES, UL1037, SURFACE MOUNTED.
4. INFILL 1 HOUR RATED WALL INFILL TO MATCH EXISTING ADJACENT FINISHES AT DEMOLISHED 2'-0" X 2'-0" WINDOWS.
5. NEW 1 HOUR WALL INFILL AT DEMOLISHED SIDELIGHT WINDOWS.
6. NEW 20 MIN. RATED DOOR.
7. NOT USED.
8. NOT USED.
9. EXISTING ROOF ACCESS LADDER AND HATCH TO REMAIN.
10. NEW HOSE BIB – REFER PLUMBING.
11. EXISTING LIMESTONE WAINSCOT, CLEAN AND RESEAL.
12. EXISTING LIMESTONE WINDOW HEADS AND SILLS, CLEAN AND RESEAL.



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		
9		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

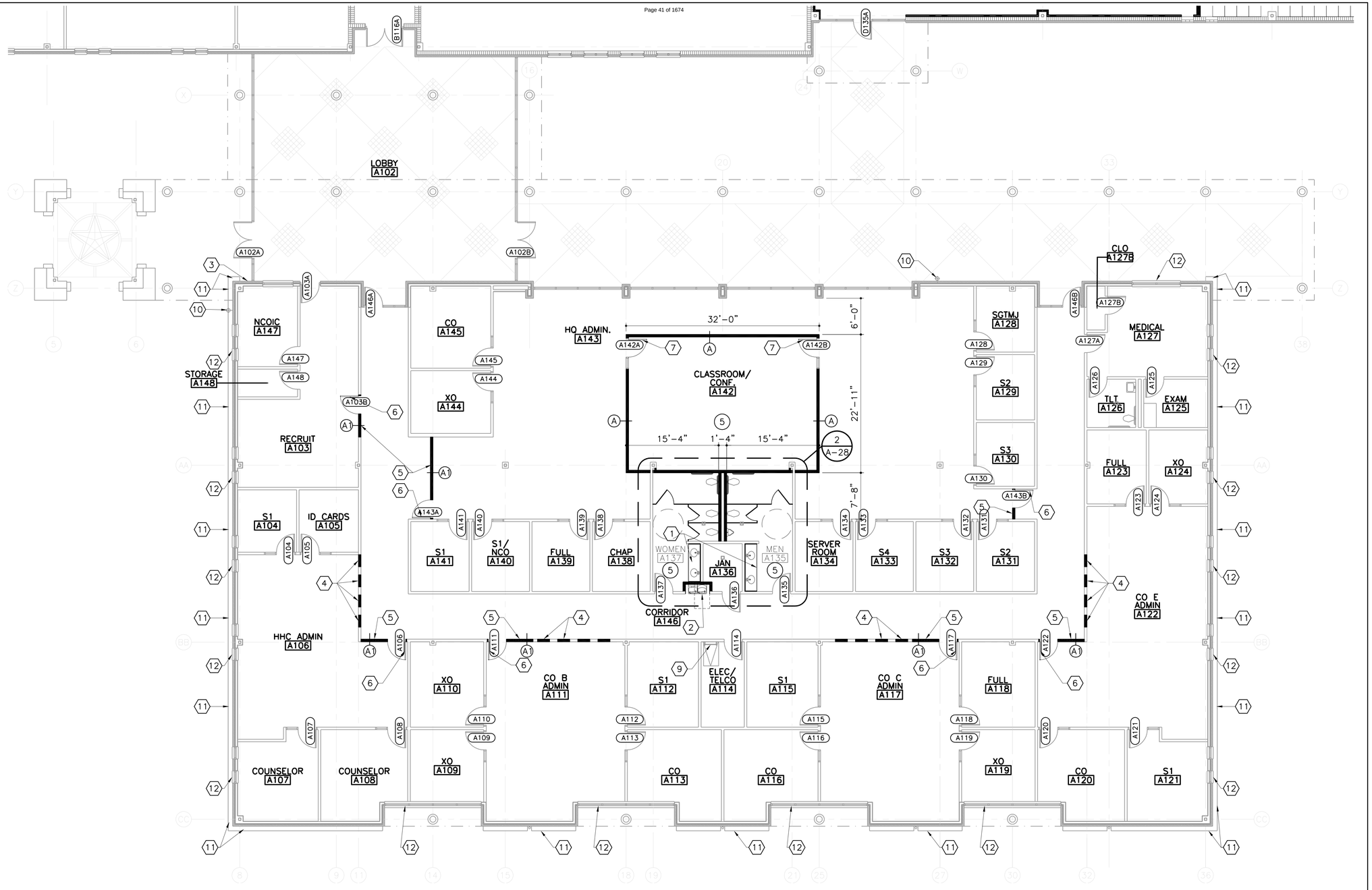
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL FLOOR PLAN AREA 'A'

A-17

SHT. 24 of 129



NORTH TRUE / NORTH PLAN — 1 — FLOOR PLAN – AREA "A"

1/8" = 1'-0"

GENERAL NOTES

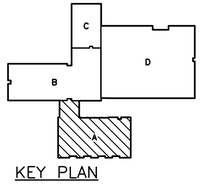
1. A SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. ALL FIRE RATED WALLS SHALL GO TO DECK. REFER TO SHEET A-2 FOR PARTITION TYPES.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING.
6. EXTERIOR BUILDING IMPROVEMENTS.

NOTES BY SYMBOL "⬡"

1. SOLID SURFACE LAVATORY COUNTERTOP AND BACKSPLASH.
2. HI/LO ELECTRIC WATER COOLER WITH SKIRT OPTION FOR CANE DETECTION.
3. KNOX BOX – 3200 SERIES, UL1037, SURFACE MOUNTED.
4. INFILL 1 HOUR RATED WALL INFILL TO MATCH EXISTING ADJACENT FINISHES AT DEMOLISHED 2'-0" X 2'-0" WINDOWS.
5. NEW 1 HOUR WALL INFILL AT DEMOLISHED SIDELIGHT WINDOWS.
6. NEW 20 MIN. RATED DOOR.
7. REINSTALL EXISTING DOOR AND FRAME.
8. NOT USED.
9. EXISTING ROOF ACCESS LADDER AND HATCH TO REMAIN.
10. NEW HOSE BIB – REFER PLUMBING.
11. EXISTING LIMESTONE WAINSCOT, CLEAN AND RESEAL.
12. EXISTING LIMESTONE WINDOW HEADS AND SILLS, CLEAN AND RESEAL.



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		
9		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

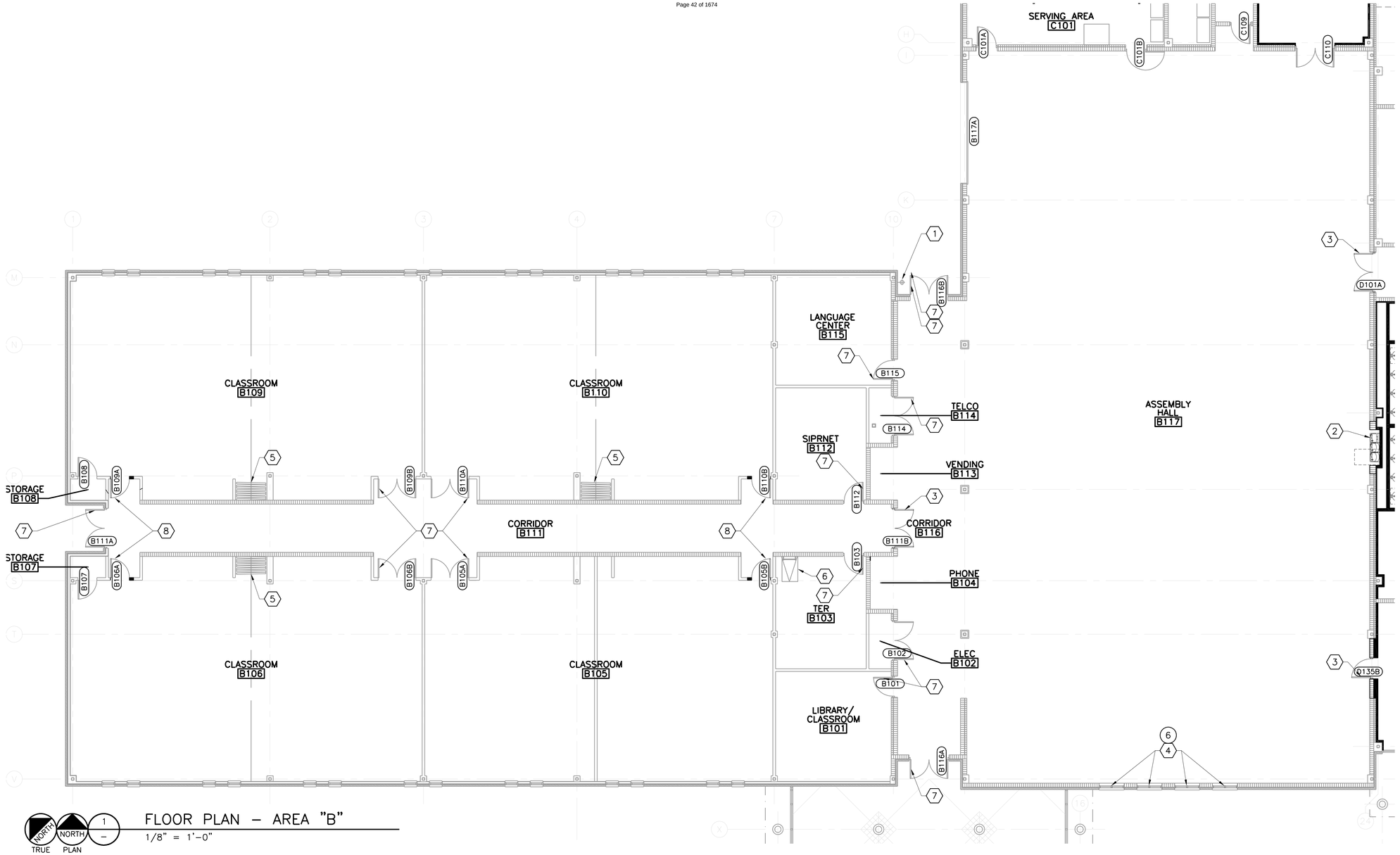
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL FLOOR PLAN - BID OPTION 5

A-17A

SHT. 25 of 129



FLOOR PLAN – AREA "B"

1/8" = 1'-0"

GENERAL NOTES

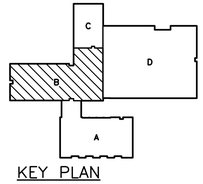
1. A SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. ALL FIRE RATED WALLS SHALL GO TO DECK. REFER TO SHEET A-2 FOR PARTITION TYPES.

NOTES BY SYMBOL "⬡"

1. NEW HOSE BIB. RE: PLUMBING.
2. HI/LO ELECTRIC WATER COOLER WITH SKIRT OPTION FOR CANE DETECTION.
3. NEW 90 MIN. LABEL DOOR AND FRAME.
4. NEW LOUVERS – REFER MECHANICAL.
5. EXISTING ROOM DIVIDER TO REMAIN.
6. EXISTING ROOF ACCESS LADDER AND HATCH TO REMAIN.
7. EXISTING DOOR TO REMAIN.
8. EXISTING DOOR TO BE REINSTALLED AS SHOWN, TO BE 2012 TAS COMPLIANT.

BID OPTIONS "◯"

6. EXTERIOR BUILDING IMPROVEMENTS.



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6151 FAX (512) 782-1481

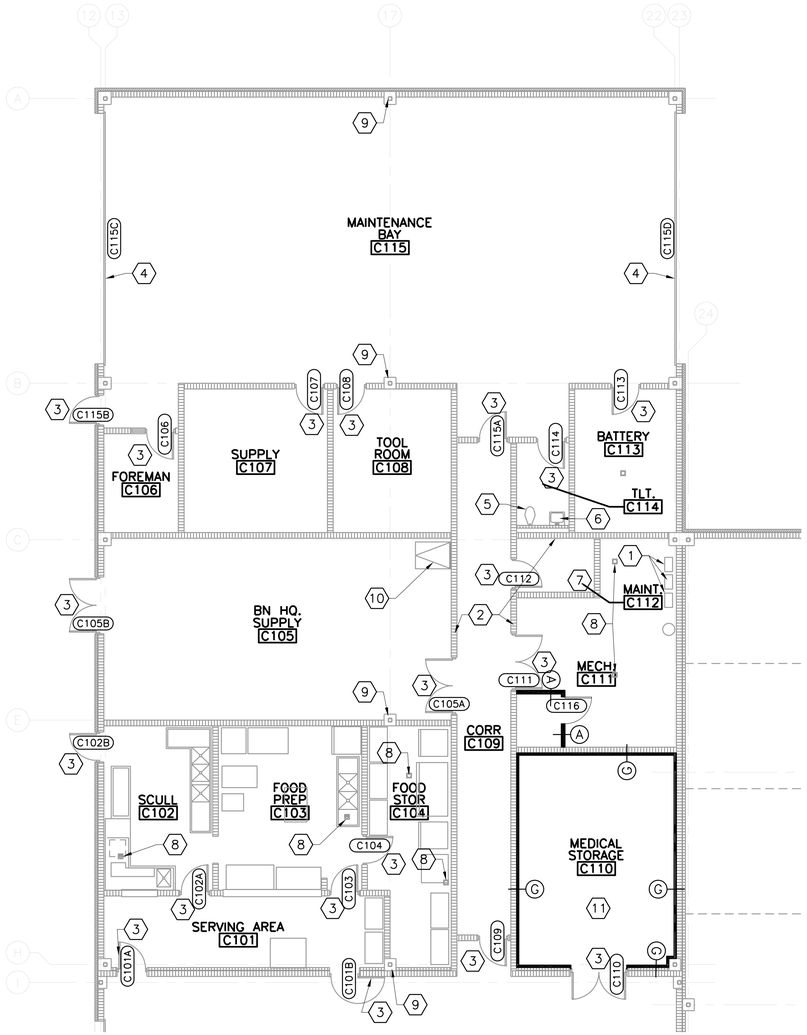
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL FLOOR PLAN AREA 'B'

A-18

SHT. 26 of 129



NORTH TRUE NORTH PLAN 1 –

FLOOR PLAN – AREA "C"

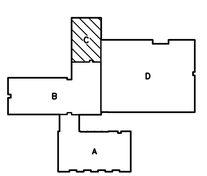
1/8" = 1'-0"

GENERAL NOTES

1. A SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. ALL FIRE RATED WALLS SHALL GO TO DECK. REFER TO SHEET A-2 FOR PARTITION TYPES.

NOTES BY SYMBOL "⬡"

1. EXISTING WATER HEATERS TO BE DEMOLISHED – REFER PLUMBING.
2. EXISTING CMU WALLS TO REMAIN.
3. EXISTING DOOR TO REMAIN.
4. EXISTING OVERHEAD DOOR TO REMAIN.
5. EXISTING WATER CLOSET TO REMAIN – REFER PLUMBING.
6. EXISTING SINK TO REMAIN – REFER PLUMBING.
7. EXISTING MOP SINK TO REMAIN – REFER PLUMBING.
8. EXISTING FLOOR DRAIN TO REMAIN – REFER PLUMBING.
9. EXISTING COLUMN TO REMAIN.
10. EXISTING ROOF ACCESS LADDER AND HATCH TO REMAIN.
11. INSTALL CONTINUOUS INSULATION AT PERIMETER WALLS AS SHOWN IN PARTITION TYPE AND SPRAY ON CLOSED CELL INSULATION WITH INTUMESCENT COATING AT ROOF DECK ABOVE.



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL FLOOR PLAN AREA 'C'

A-19

SHT. 27 of 129

TLT. C114
MAINT. C112
UNIT STORAGE D103
UNIT STORAGE D108
UNIT STORAGE D111
UNIT STORAGE D117
UNHEATED STORAGE D121
CORRIDOR D112
CORRIDOR D101
DIST D104
VAULT D105
VAULT D106
DIST D107
OFFICE D102
OFFICE D109
OFFICE D110
VAULT D116
DIST D115
DIST D113
VAULT D114
OFFICE D118
TLT D120
STORAGE D132
VEST D122
WATER HTR D129
LACTATION D126
MEN D131
WOMEN D128
ADA
TA50 LOCKERS D125
TRAINING SIMULATOR D124
PHYSICAL FITNESS D135

GENERAL NOTES

1. A SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. ALL FIRE RATED WALLS SHALL GO TO DECK. REFER TO SHEET A-2 FOR PARTITION TYPES.
3. REFER SHEET A-32 FOR SPECIFICS ON RESTROOM/SHOWER/LOCKER ROOM AREAS.

NOTES BY SYMBOL "⬡"

1. NEW WIRE MESH STORAGE CAGING – REFER DETAIL 1/A-0.
2. NEW WIRE MESH DUTCH DOOR – REFER DETAIL 1/A-0.
3. NEW TA-50 LOCKER.
4. CMU/ BRICK WALL INFILL AT DEMOLISHED ACCESS DOOR – REFER DETAIL 9/A-33.
5. EXISTING 8" CMU WALL CONTINUES ACROSS THE TOP OF VAULT AREA TO THE BOTTOM OF DECK.
6. INSTALL CONTINUOUS INSULATION AT PERIMETER WALLS AS SHOWN IN PARTITION TYPE AND SPRAY ON CLOSED CELL INSULATION WITH INTUMESCENT COATING AT ROOF DECK ABOVE.

BID OPTIONS "◯"

10. PROVIDE NEW STORAGE CAGING IN EXISTING NORTHEAST STORAGE AREA.
11. PROVIDE TA-50 LOCKERS FOR SECURE EQUIPMENT STORAGE.

KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

NORTH TRUE / NORTH PLAN

1 – FLOOR PLAN – AREA "D"
1/8" = 1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

REGISTERED ARCHITECT HOMERO SAENZ 25081 STATE OF TEXAS
04/20/2018

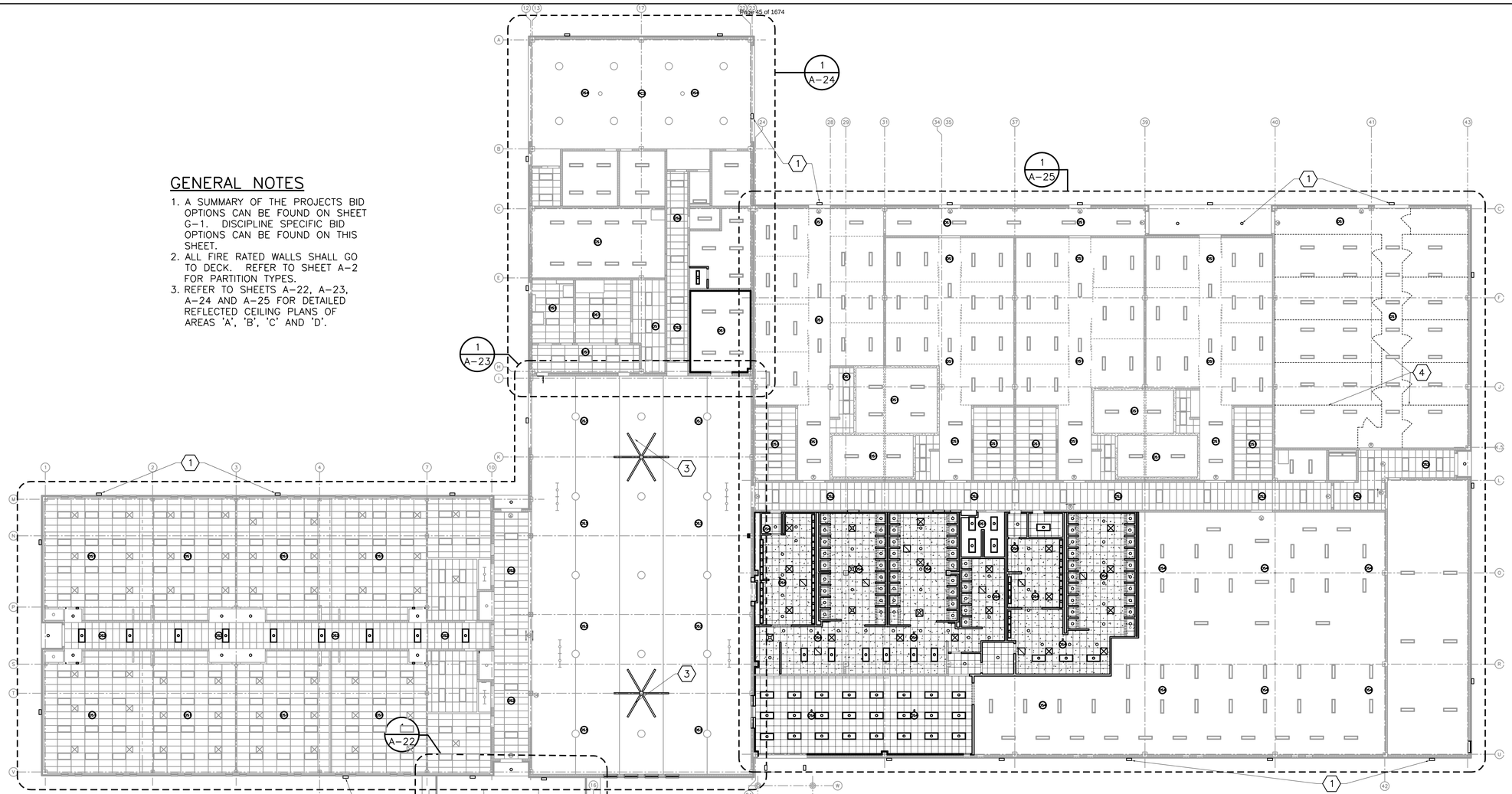
ARCHITECTURAL FLOOR PLAN AREA 'D'

A-20

SHT. 28 of 129

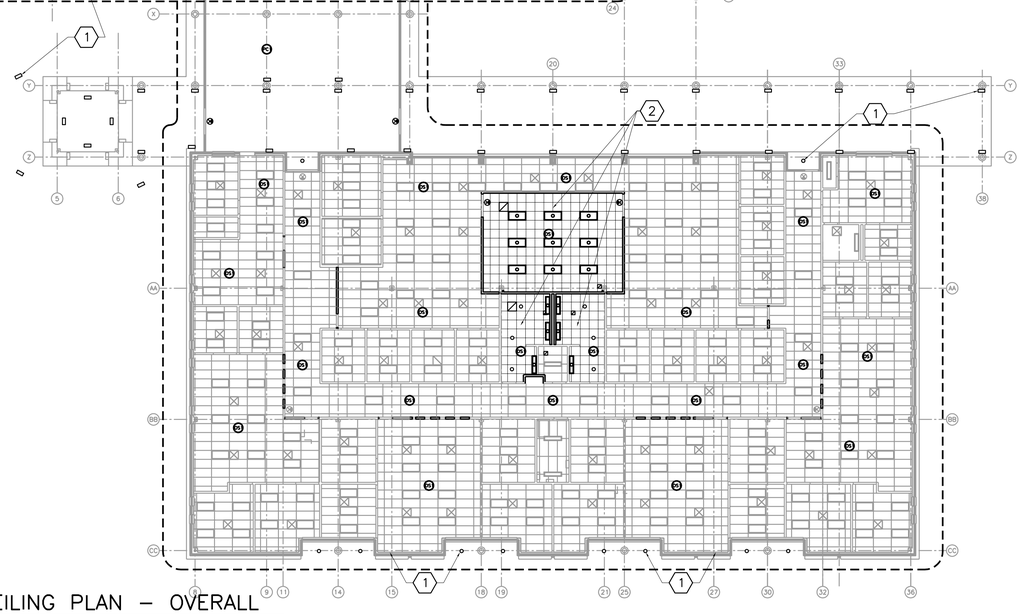
GENERAL NOTES

1. A SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. ALL FIRE RATED WALLS SHALL GO TO DECK. REFER TO SHEET A-2 FOR PARTITION TYPES.
3. REFER TO SHEETS A-22, A-23, A-24 AND A-25 FOR DETAILED REFLECTED CEILING PLANS OF AREAS 'A', 'B', 'C' AND 'D'.



LEGEND

- EXISTING 2X4 ACOUSTICAL TILE GRID TO REMAIN
- EXISTING 1X4 LIGHT FIXTURE TO REMAIN
- EXISTING 2X4 LIGHT FIXTURE TO REMAIN
- EXISTING HI-BAY LIGHT FIXTURE TO REMAIN
- EXISTING CAN LIGHT FIXTURE TO REMAIN
- EXISTING HVAC DIFFUSER TO REMAIN
- NEW 2X2 ACOUSTICAL TILE CEILING
- NEW 2X2 FRP ACOUSTICAL TILE CEILING
- NEW 1X4 LIGHT FIXTURE – REFER ELECTRICAL
- NEW 2X4 LIGHT FIXTURE – REFER ELECTRICAL
- NEW CAN LIGHT FIXTURE – REFER ELECTRICAL
- NEW EXIT LIGHT – REFER ELECTRICAL
- (6) NEW LIGHT FIXTURE – REFER ELECTRICAL
- NEW OCCUPANCY SENSOR – REFER ELECTRICAL



NORTH TRUE NORTH PLAN 1 –

REFLECTED CEILING PLAN – OVERALL

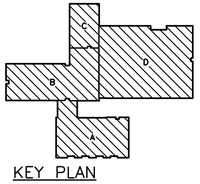
1/16" = 1'-0"

NOTES BY SYMBOL "⬡"

(6) 1. NEW EXTERIOR LIGHT FIXTURE, IF BID OPTION #6 IS ACCEPTED.
(5) 2. NEW CEILING IN LIGHTS IN CLASSROOM A142, WOMEN A137, AND MEN A135 IF BID OPTION #5 IS ACCEPTED.
(4) 3. NEW HVLS FAN IF BID OPTION #4 IS ACCEPTED.
(10) 4. NEW WIRE MESH STORAGE CAGING – REFER DETAIL 1/A-0, IF BID OPTION #10 IS ACCEPTED.

BID OPTIONS "○"

4. ADDITIONAL HVAC UPGRADES/ REPAIRS/ HVLS FANS.
5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING.
6. EXTERIOR BUILDING IMPROVEMENTS.
10. PROVIDE NEW STORAGE CAGING IN EXISTING NORTHEAST STORAGE AREA.



KEY PLAN

0 8' 16' 32'
1/16"=1'-0"

REGISTERED ARCHITECT HOMERO SAENZ 25047 STATE OF TEXAS
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

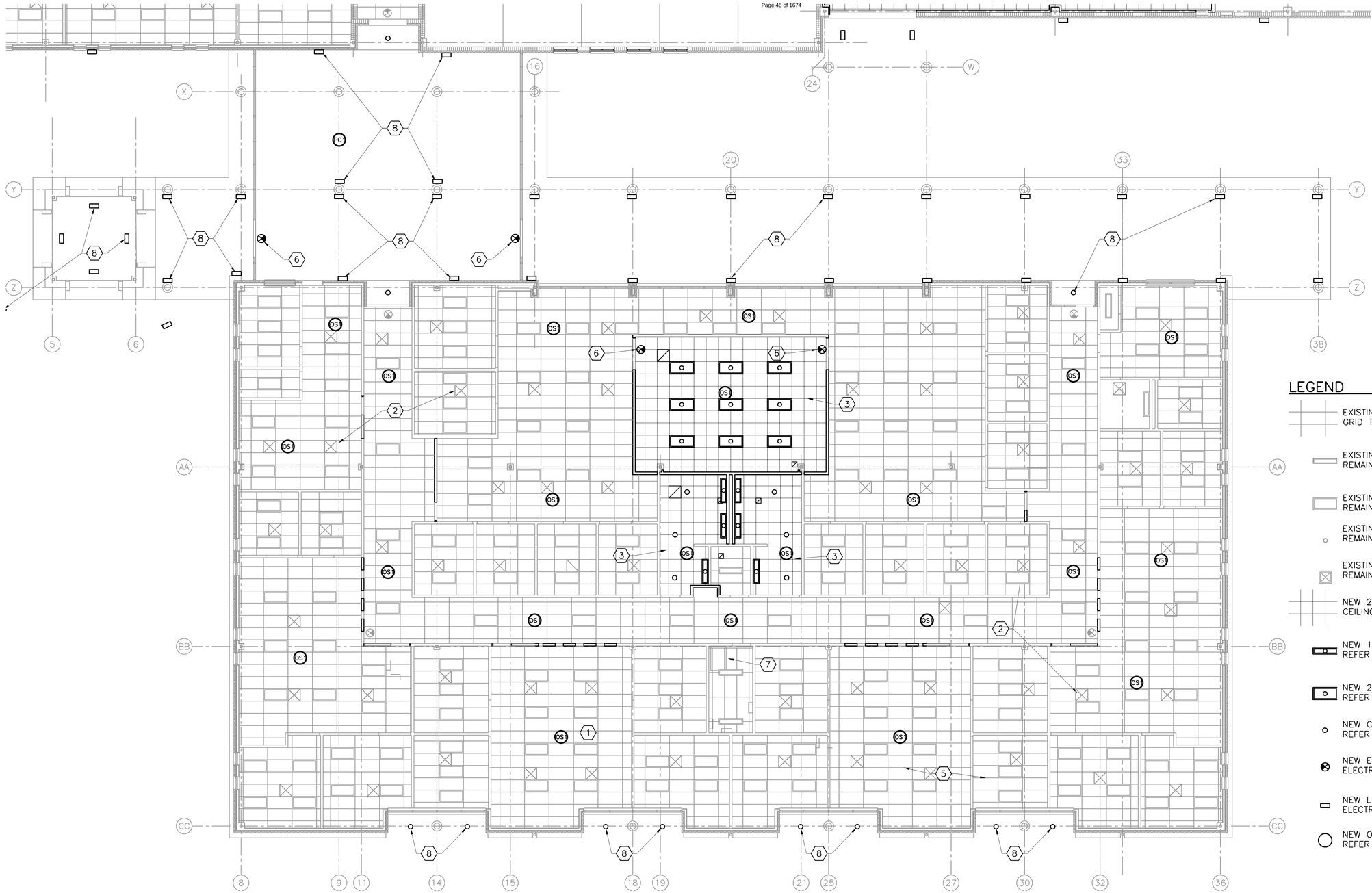
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL PLAN - OVERALL REFLECTED CEILING

A-21

SHT. 29 of 129



LEGEND

- EXISTING 2X4 ACOUSTICAL TILE GRID TO REMAIN
- EXISTING 1X4 LIGHT FIXTURE TO REMAIN
- EXISTING 2X4 LIGHT FIXTURE TO REMAIN
- EXISTING CAN LIGHT FIXTURE TO REMAIN
- EXISTING HVAC DIFFUSER TO REMAIN
- NEW 2X2 ACOUSTICAL TILE CEILING
- NEW 1X4 LIGHT FIXTURE – REFER ELECTRICAL
- NEW 2X4 LIGHT FIXTURE – REFER ELECTRICAL
- NEW CAN LIGHT FIXTURE – REFER ELECTRICAL
- NEW EXIT LIGHT – REFER ELECTRICAL
- NEW LIGHT FIXTURE – REFER ELECTRICAL
- NEW OCCUPANCY SENSOR – REFER ELECTRICAL

NORTH TRUE / NORTH PLAN

1 / –

REFLECTED CEILING PLAN – AREA "A"

1/8" = 1'-0"

GENERAL NOTES

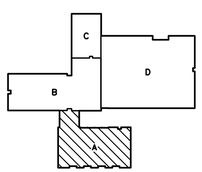
1. REFER TO SHEETS A-23, A-24, AND A-25 FOR CONTINUATION OF REFLECTED CEILING PLAN.
2. A SUMMARY OF THE PROJECT BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
3. REFER TO OTHER DISCIPLINE'S DRAWINGS FOR ADDITIONAL INFORMATION.

NOTES BY SYMBOL "⬡"

1. EXISTING CEILING AND LIGHTS TO REMAIN.
2. EXISTING HVAC DIFFUSER. RE: MECHANICAL.
3. (5) NEW 2'X2' ACT.
4. (5) NEW LIGHT FIXTURE. RE: ELECTRICAL.
5. NEW OCCUPANCY SENSOR. RE: ELECTRICAL.
6. NEW EXIT LIGHT. RE: ELECTRICAL.
7. EXISTING ROOF HATCH AND LADDER.
8. (6) NEW EXTERIOR LIGHT FIXTURE.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING.
6. EXTERIOR BUILDING IMPROVEMENTS.



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

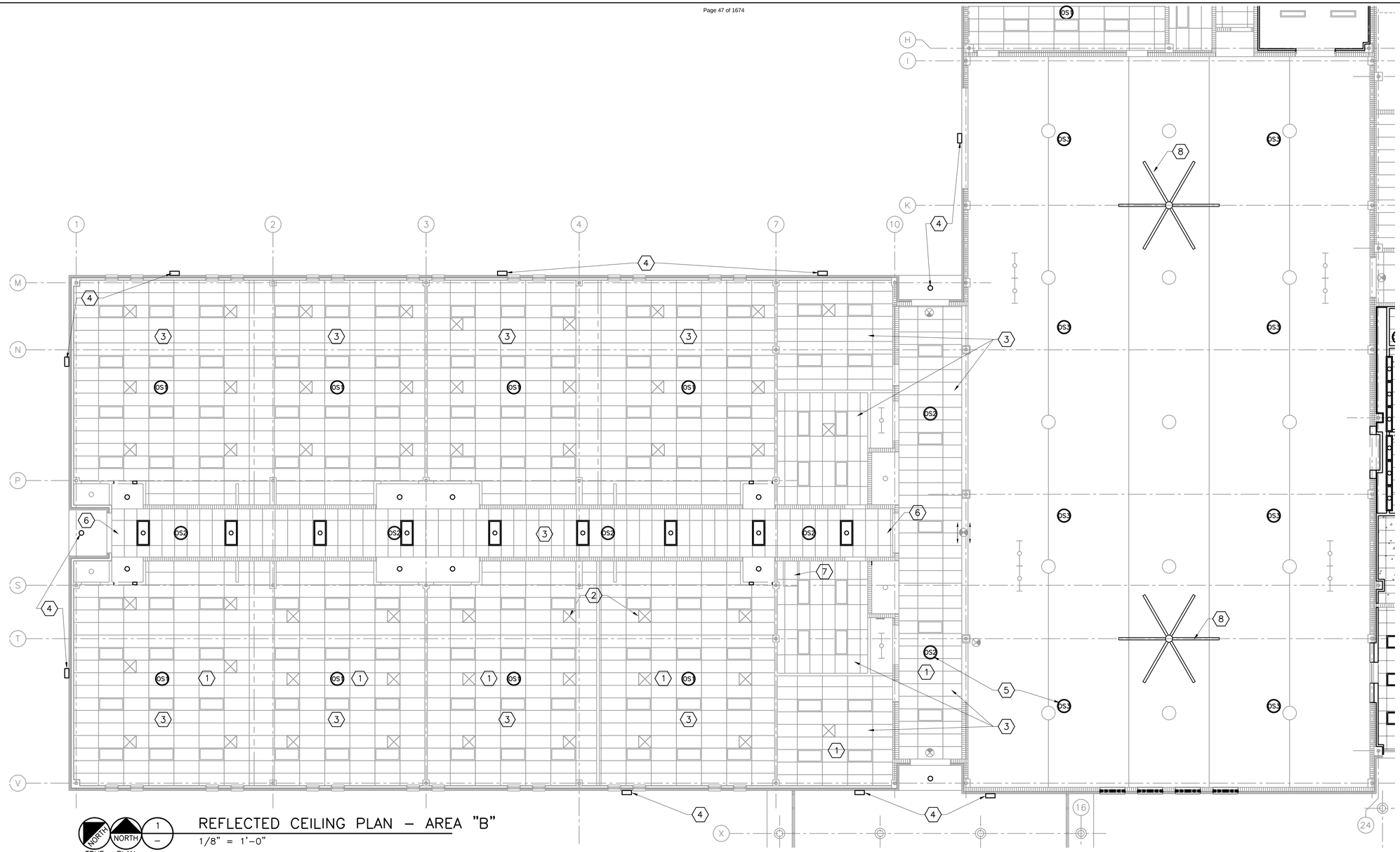
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL REFLECTED CEILING PLAN - AREA 'A'

A-22

SHT. 30 of 129



REFLECTED CEILING PLAN – AREA "B"

1/8" = 1'-0"

GENERAL NOTES

1. REFER TO SHEETS A-22, A-24, AND A-25 FOR CONTINUATION OF REFLECTED CEILING PLAN.
2. A SUMMARY OF THE PROJECT BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
3. REFER TO OTHER DISCIPLINE'S DRAWINGS FOR ADDITIONAL INFORMATION.

NOTES BY SYMBOL "⬡"

1. EXISTING CEILING AND LIGHTS TO REMAIN.
2. HVAC DIFFUSER. RE: MECHANICAL.
3. EXISTING 2'X4' ACT TO REMAIN.
6. 4. NEW EXTERIOR LIGHT FIXTURE. RE: ELECTRICAL.
5. NEW OCCUPANCY SENSOR. RE: ELECTRICAL.
6. NEW EXIT LIGHT. RE: ELECTRICAL.
7. EXISTING ROOF HATCH AND LADDER.
4. 8. NEW HVLS FAN. RE: MECHANICAL SHEET M-6.

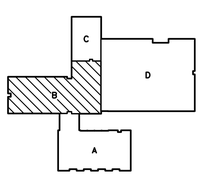
LEGEND

- EXISTING 2X4 ACOUSTICAL TILE GRID TO REMAIN
- EXISTING 1X4 LIGHT FIXTURE TO REMAIN
- EXISTING 2X4 LIGHT FIXTURE TO REMAIN
- EXISTING HI-BAY LIGHT FIXTURE TO REMAIN
- EXISTING CAN LIGHT FIXTURE TO REMAIN
- EXISTING HVAC DIFFUSER TO REMAIN
- NEW 2X4 LIGHT FIXTURE – REFER ELECTRICAL
- NEW EXIT LIGHT – REFER ELECTRICAL
- NEW LIGHT FIXTURE – REFER ELECTRICAL
- NEW OCCUPANCY SENSOR – REFER ELECTRICAL

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/ REPAIRS/ HVLS FANS.
6. EXTERIOR BUILDING IMPROVEMENTS.

KEY PLAN



0 4' 8' 16'

1/8"=1'-0"

REGISTERED ARCHITECT HOMER SAENZ 25061 STATE OF TENNESSEE

04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481
CAMP MABRY P.O. BOX 5218
(512) 782-6131

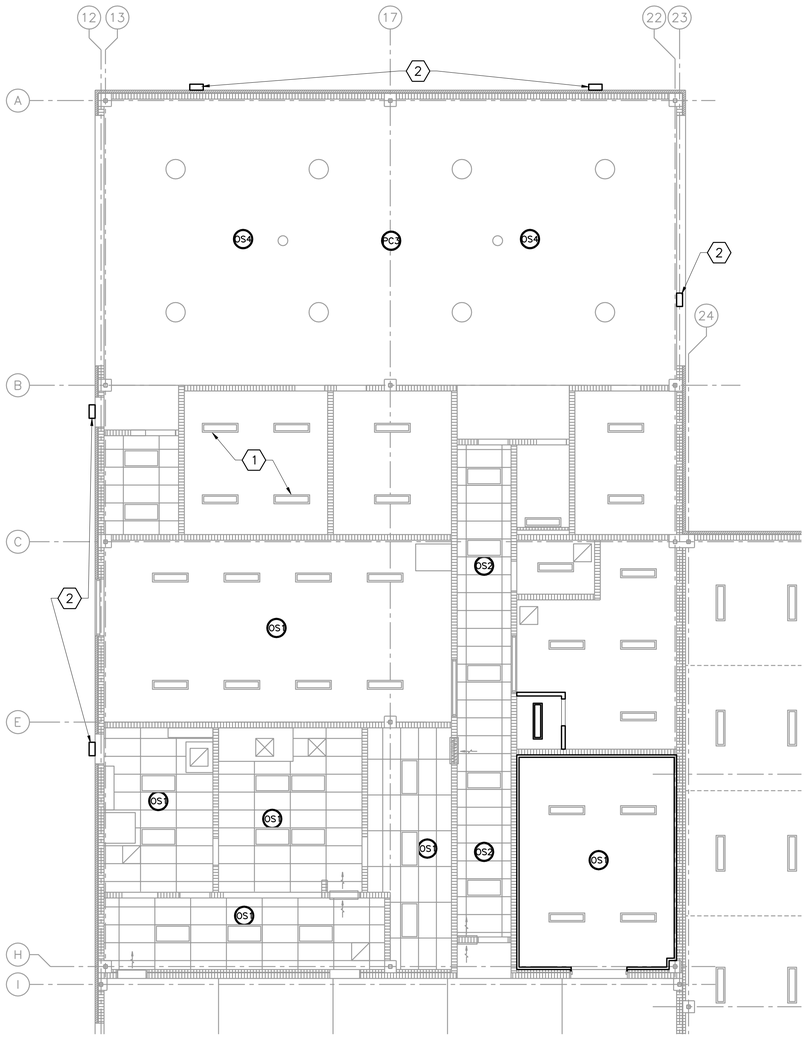
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL REFLECTED CEILING PLAN - AREA 'B'

A-23

SHT. 31 of 129



REFLECTED CEILING PLAN – AREA "C"
1/8" = 1'-0"

GENERAL NOTES

1. REFER TO SHEETS A-22, A-23, AND A-25 FOR CONTINUATION OF REFLECTED CEILING PLAN.
2. A SUMMARY OF THE PROJECT BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
3. REFER TO OTHER DISCIPLINE'S DRAWINGS FOR ADDITIONAL INFORMATION.

NOTES BY SYMBOL "⬡"

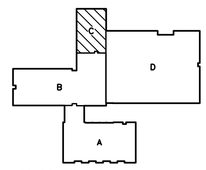
1. EXISTING LIGHTING TO REMAIN.
6. 2. NEW EXTERIOR LIGHT FIXTURE – REFER ELECTRICAL.

BID OPTIONS "◯"

6. EXTERIOR BUILDING IMPROVEMENTS

LEGEND

- EXISTING 2X4 ACOUSTICAL TILE GRID TO REMAIN
- EXISTING 1X4 LIGHT FIXTURE TO REMAIN
- EXISTING 2X4 LIGHT FIXTURE TO REMAIN
- EXISTING HI-BAY LIGHT FIXTURE TO REMAIN
- EXISTING CAN LIGHT FIXTURE TO REMAIN
- EXISTING HVAC DIFFUSER TO REMAIN
- OS NEW OCCUPANCY SENSOR – REFER ELECTRICAL



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

ROMEO SAENZ REGISTERED ARCHITECT 25067 STATE OF TEXAS
04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL REFLECTED CEILING PLAN - AREA 'C'

A-24

SHT. 32 of 129



REFLECTED CEILING PLAN – AREA "D"
1/8" = 1'-0"

GENERAL NOTES

1. REFER TO SHEETS A-22, A-23, AND A-24 FOR CONTINUATION OF REFLECTED CEILING PLAN.
2. A SUMMARY OF THE PROJECT BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
3. REFER TO OTHER DISCIPLINE'S DRAWINGS FOR ADDITIONAL INFORMATION.

NOTES BY SYMBOL "⬡"

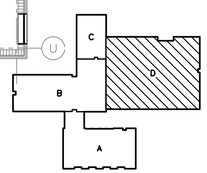
1. EXISTING 1X4 LIGHT FIXTURE TO REMAIN.
2. NEW 2X4 LIGHT FIXTURE. RE: ELECTRICAL.
3. NEW CAN LIGHT FIXTURE. RE: ELECTRICAL.
4. INFILL EXISTING OPENINGS IN PRECAST HOLLOW CORE CONC. PLANK – MAINTAIN NON-COMBUSTIBLE ROOF DECK CONSTRUCTION. REFER DETAIL 8/A-33.
5. EXISTING 8" CMU WALL CONTINUES ACROSS THE TOP OF THE VAULT AREA TO BOTTOM OF DECK.
6. NEW WOVEN WIRE MESH PARTITIONS PER DETAIL 1/A-0.
7. NEW EXTERIOR LIGHT FIXTURE. RE: ELECTRICAL.

LEGEND

- EXISTING 2X4 ACOUSTICAL TILE GRID TO REMAIN
- EXISTING 1X4 LIGHT FIXTURE TO REMAIN
- EXISTING 2X4 LIGHT FIXTURE TO REMAIN
- EXISTING CAN LIGHT FIXTURE TO REMAIN
- NEW HVAC SUPPLY AIR DIFFUSER – REFER MECHANICAL
- NEW HVAC RETURN AIR DIFFUSER – REFER MECHANICAL
- NEW 2X2 ACOUSTICAL TILE CEILING
- NEW 2X2 FRP ACOUSTICAL TILE CEILING
- NEW 2X4 LIGHT FIXTURE – REFER ELECTRICAL
- NEW CAN LIGHT FIXTURE – REFER ELECTRICAL
- NEW EXIT LIGHT – REFER ELECTRICAL
- NEW LIGHT FIXTURE – REFER ELECTRICAL
- NEW OCCUPANCY SENSOR – REFER ELECTRICAL

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/ REPAIRS/ HVLS FANS.
6. EXTERIOR BUILDING IMPROVEMENTS
10. PROVIDE NEW STORAGE CAGING IN EXISTING NORTHEAST STORAGE AREA.



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL REFLECTED CEILING PLAN - AREA 'D'

A-25

SHT. 33 of 129

ROOM FINISH SCHEDULE

ROOM NO.	ROOM NAME	FLOOR	BASE	WALLS				CEILING	HEIGHT	NOTES
				NORTH	EAST	SOUTH	WEST			
A102	LOBBY	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A103	RECRUIT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A104	COUNSELOR	CPT-1	RB-1	PT-1	PT-1	PT-1	PT-1	ACT-1	8'-8"	
A105	COUNSELOR	CPT-1	RB-1	PT-1	PT-1	PT-1	PT-1	ACT-1	8'-8"	
A106	HHC ADMIN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A107	S1	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A108	ID CARDS	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A109	XO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A110	XO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A111	CO B ADMIN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A112	S1	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A113	CO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A114	ELEC/ TELCO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A115	S1	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A116	CO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A117	CO C ADMIN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A118	FULL	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A119	ZO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A120	CO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A121	S1	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A122	CO E ADMIN	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A123	FULL	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A124	XO	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A125	EXAM	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A126	TLT	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A127	MEDICAL	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A127B	CLO	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A128	SGTMJ	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A129	S2	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A130	S3	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A131	S2	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A132	S3	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A133	S4	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A134	SERVER ROOM	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A135	MEN	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-2	8'-8"	
A136	JAN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A137	WOMEN	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-2	8'-8"	
A138	CHAP	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A139	FULL	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A140	S1/ NCO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A141	S1	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A142	CLASSROOM/ CONF.	CPT-1	RB-1	PT-1	PT-1	PT-1	PT-1	ACT-1	8'-8"	
A143	HQ ADMIN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A144	XO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A145	CO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A146	CLO	ETR	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A147	NCOIC	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A148	STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B101	LIBRARY/ CLASSROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B102	ELEC	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B103	TANG. AND STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B104	PHONE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B105	CLASSROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B106	CLASSROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B107	STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B108	STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B109	CLASSROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B110	CLASSROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B111	CORRIDOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B112	A/V STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B113	VENDING	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B114	TELCO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B115	LANGUAGE CENTER	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B116	CORRIDOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B117	ASSEMBLY HALL	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C101	SERVING AREA	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C102	SCULL	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C103	FOOD PREP	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C104	FOOD STOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C105	BN HQ. SUPPLY	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C106	FOREMAN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C107	SUPPLY	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C108	TOOL ROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C109	CORRIDOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C110	TABLE/CHAIR STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	

ROOM FINISH SCHEDULE

ROOM NO.	ROOM NAME	FLOOR	BASE	WALLS				CEILING	HEIGHT	NOTES
				NORTH	EAST	SOUTH	WEST			
C111	MECH/ TELCO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C112	MAINT.	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C113	BATTERY	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C114	TLT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C115	MAINTENANCE BAY	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C116	TER	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D101	CORRIDOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D102	OFFICE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D103	UNIT STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D104	DIST	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D105	VAULT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D106	VAULT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D107	DIST	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D108	UNIT STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D109	OFFICE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D110	OFFICE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D111	UNIT STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D112	CORRIDOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D113	DIST	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D114	VAULT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D115	DIST	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D116	VAULT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D117	UNIT STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D118	OFFICE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D119	STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D120	TLT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D121	UNHEATED STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D122	VEST	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D124	TRAINING SIMULATOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D125	TA50 LOCKERS	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D126	LACTATION	VCT-1	RB-1	PT-1	PT-1	PT-1	PT-1	ACT-1	8'-8"	
D128	WOMEN	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-2	8'-8"	
D128A	VESTIBULE	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-1	8'-8"	
D128B	VESTIBULE	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-1	8'-8"	
D129	WATER HTR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D131	MEN	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-2	8'-8"	
D135	PHYSICAL FITNESS	RAF/SC-1	RB-1	PT-1	PT-1	PT-1	PT-1	ESFP	8'-8"	

INTERIOR MATERIAL SCHEDULE

MARK	ITEM	DESCRIPTION/COLOR	NOTES
ACT-1	CEILING TILE	ARMSTRONG FINE FISSURED 1729 2X2	
ACT-2	CEILING TILE, FRP	2x2 FIBERCORR BY NUDO, WHITE, SMOOTH	
CG-1	CORNER GUARD	2½"x2½" STAINLESS STEEL	
CPT-1	CARPET TILE	MOHAWK	
CT-1	CERAMIC TILE, 2x2	DALTILE, DESERT GRAY SPECKLE, D200	
CT-2	CERAMIC TILE, 4¼x4¼	DALTILE, DESERT GRAY, X114	
CTB-1	CERAMIC TILE BASE	DALTILE, DESERT GRAY 4x4 COVED	
ETR	EXISTING TO REMAIN		
ES	EXPOSED STRUCTURE	EXISTING TO REMAIN, PT-1 FINISH	
ESFP	EXPOSED STRUCTURE W/ SPRAYED ON FIREPROOFING	EXISTING TO REMAIN, SPRAYED ON FIREPROOFING	REPAIR/REPLACE SPRAY ON FIREPROOFING AS REQUIRED
FRP-1	FRP WAINSCOT	NUDO, FIBERLITE WHITE, SMOOTH	
GB-1	GYPSUM BOARD	PT-1 FINISH	
PL-1	PLASTIC LAMINATE	WILSONART, COSMIC STRANDZ, 4941K-18	CABINETS
PL-2	PLASTIC LAMINATE	WILSONART, NORTH SEA D90-60	RESTROOM APRONS
PT-1	ACRYLIC PAINT - SATIN	SHERWIN WILLIAMS, SW 7006, EXTRA WHITE	
PT-2	ACRYLIC PAINT - SEMI-GLOSS	SHERWIN WILLIAMS, SW 7065, ARGOS	METAL DOORS & FRAMES
PT-3	ACRYLIC PAINT - SEMI-GLOSS	SHERWIN WILLIAMS, SW 7061, NITE OWL	
PD-1	HDPE	AMPCO, NORTH SEA D90-60	TOILET, URINAL & SHOWER DRESS COMPARTMENT SCREENS
RB-1	RUBBER BASE	ROPPE, 150 DARK GREY, STANDARD TOE	
SC-1	SEALED CONCRETE	CHEM MASTERS SAFE CURE AND SEAL 309	
SS-1	SOLID SURFACE	DUPONT ZODIAC, MYSTIC BLACK	
SS-2	SOLID SURFACE	DUPONT ZODIAC, STORM GREY	LACTATION
VCT-1	VINYL COMPOSITION TILE	ARMSTRONG, 12X12 POLAR WHITE STANDARD EXCELON	
VCT-2	VCT-ANTI STATIC	ARMSTRONG, PEARL WHITE 51953	WITH GROUNDING WIRES AND MASTIC
QT	QUARRY TILE	MATCH EXISTING	
CMU	CONCRETE MASONRY UNITS	PT-1 FINISH	
OPW	OPERABLE WALL PARTITION		
RAF	RUBBER ATHLETIC FLOORING	ROPPE, RECOIL TILES 36"X36", 100 BLACK	

NOTES:

1. STRIP EXISTING FLOOR. SAND SMOOTH, CLEAN AND RESEAL.
2. APPLY PT-1 FINISH AT DRYWALL PARTITIONS NEW AND EXISTING. CLEAN AND REPAINT EXISTING MASONRY
3. PARTITIONS. APPLY BLOCK FILLER & PAINT NEW MASONRY PARTITIONS, PT-1 FINISH.



04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481
CAMP MABRY P.O. BOX 5218
(512) 782-6131

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL ROOM FINISH SCHEDULE

A-26

SHT. 34 of 129

DOOR AND FRAME SCHEDULE

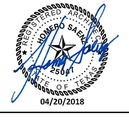
MARK	DOOR DESCRIPTION			FRAME DESCRIPTION						UL LABEL	REMARKS
	SIZE	MAT	TYPE	MAT	TYPE	DOOR DETAILS					
	WIDTH x HEIGHT x THICKNESS					HEAD	JAMB	JAMB	SILL		
A102A	(2) 3'-0"x7'-6"x1¾"	ALUM	EXIST	ALUM	EXIST						
A102B	(2) 3'-0"x7'-6"x1¾"	ALUM	EXIST	ALUM	EXIST						
A103A	3'-0"x7'-2½"x1¾"	ALUM	EXIST	ALUM	EXIST						
A103B	3'-0"x7'-0"x1¾"	WOOD	B	HM	HM-2	3/A-33	4/A-33	4/A-33	–	20 MIN	4
A104	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A105	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A106	3'-0"x7'-0"x1¾"	WOOD	B	HM	HM-2	3/A-33	4/A-33	4/A-33	–	20 MIN	4
A107	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A108	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A109	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A110	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A111	3'-0"x7'-0"x1¾"	WOOD	B	HM	HM-2	3/A-33	4/A-33	4/A-33	–	20 MIN	4
A112	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A113	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A114	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A115	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A116	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A117	3'-0"x7'-0"x1¾"	WOOD	B	HM	HM-2	3/A-33	4/A-33	4/A-33	–	20 MIN	4
A118	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A119	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A120	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A121	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A122	3'-0"x7'-0"x1¾"	WOOD	B	HM	HM-2	3/A-33	4/A-33	4/A-33	–	20 MIN	4
A123	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A124	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A125	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A126	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A127A	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A127B	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A128	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A129	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A130	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A131	3'-0"x7'-2½"x1¾"	WOOD	EXIST	IA	EXIST						
A132	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A133	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A134	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A135	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A136	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						3
A137	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A138	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A139	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A140	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A141	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A142A	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST	3/A-33	4/A-33	4/A-33	–	20 MIN	5
A142B	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST	3/A-33	4/A-33	4/A-33	–	20 MIN	5
A143A	3'-0"x7'-0"x1¾"	WOOD	B	HM	HM-2	3/A-33	4/A-33	4/A-33	–	20 MIN	4
A143B	3'-0"x7'-0"x1¾"	WOOD	B	HM	HM-2	3/A-33	4/A-33	4/A-33	–	20 MIN	4
A144	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A145	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A146A	3'-0"x7'-0"x1¾"	ALUM	EXIST	ALUM	EXIST						
A146B	3'-0"x7'-0"x1¾"	ALUM	EXIST	ALUM	EXIST						
A147	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
A148	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B101	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						2
B102	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						2
B103	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
B105A	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B105B	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B106A	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B106B	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B107	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B108	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B109A	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B109B	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B110A	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						

DOOR REMARKS:

1. INSULATED.
2. CLEAN AND PREP DOOR & FRAME. REPAIR AS REQUIRED AND REPAINT.
3. REMOVE LOCKSET, PROVIDE BEST CYLINDRICAL LEVER LOCKSET.
4. VISION PANEL. – PROVIDE FIRE RATED GLASS AT RATED DOORS, LAMINATED CLEAR GLASS AT NON-RATED DOORS.
5. CLEAN DOOR AND FRAME. REPAIR AND REPAINT HOLLOW METAL DOOR FRAME. REFINISH WOOD DOOR.
6. ADD CIPHER LOCK (CDX09) TO SIPRNET ROOM DOOR.

DOOR AND FRAME SCHEDULE

MARK	DOOR DESCRIPTION			FRAME DESCRIPTION						UL LABEL	REMARKS
	SIZE	MAT	TYPE	MAT	TYPE	DOOR DETAILS					
	WIDTH x HEIGHT x THICKNESS					HEAD	JAMB	JAMB	SILL		
B110B	3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B111A	(2) 3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
B111B	(2) 3'-0"x7'-0"x1¾"	WOOD	B	HM	HM-1	1/A-33	2/A-33	2/A-33	–	90 MIN	1,4
B112	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						6
B114	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						2
B115	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						2
B116A	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	IA	EXIST						
B116B	(2) 3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
B117A	16'-0"x14'-0"x1¾"	STL	EXIST	STL	EXIST						
C101A	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C101B	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C102A	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C102B	3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
C103	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C104	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C105A	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C105B	(2) 3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
C106	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C107	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C108	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C109	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						3
C110	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C111	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C112	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C113	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C114	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
C115A	3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						3
C115B	3'-0"x7'-0"x1¾"	HD	EXIST	HM	EXIST						
C115C	28'-0"x14'-0"x1¾"	STL	EXIST	STL	EXIST						
C115D	28'-0"x14'-0"x1¾"	STL	EXIST	STL	EXIST						
C116	3'-0"x7'-0"x1¾"	WOOD	A	HM	HM-2	3/A-33	4/A-33	4/A-33	–		1
D101A	(2) 3'-0"x7'-0"x1¾"	WOOD	B	HM	HM-1	1/A-33	2/A-33	2/A-33	–		4
D101B	(2) 3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D102	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D103A	(2) 3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D103B	(2) 3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D103C	(2) 3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D104	3'-6"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D105	4'-4"x7'-¼"x1¾" VAULT		EXIST		EXIST						
D106	4'-4"x7'-¼"x1¾" VAULT		EXIST		EXIST						
D107	3'-6"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D108A	(2) 3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D108B	(2) 3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D109	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D110	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D111A	(2) 2'-10"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D111B	(2) 2'-10"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D112A	(2) 2'-10"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D112B	(2) 2'-10"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D112C	(2) 2'-10"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D113	3'-6"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D114	4'-4"x7'-¼"x1¾" VAULT		EXIST		EXIST						
D115	3'-6"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D116	4'-4"x7'-¼"x1¾" VAULT		EXIST		EXIST						
D117A	(2) 2'-10"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D117B	(2) 2'-10"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D118	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D119	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D120	3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D121A	(2) 2'-10"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D121B	(2) 2'-10"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D121C	3'-0"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D121D	10'-0"x10'-0"x1¾"	STL	EXIST	STL	EXIST						
D122	(2) 2'-10"x7'-0"x1¾"	HM	EXIST	HM	EXIST						
D124A	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D124B	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D125A	(2) 2'-10"x7'-0"x1¾"	WOOD	A	HM	HM-2	3/A-33	4/A-33	4/A-33	–		
D125B	(2) 2'-10"x7'-0"x1¾"	WOOD	A	HM	EXIST	1/A-33	2/A-33	2/A-33	–		
D126	3'-0"x7'-0"x1¾"	WOOD	A	HM	HM-1	1/A-33	2/A-33	2/A-33	–	20 MIN	
D128A	3'-0"x7'-0"x1¾"	WOOD	A	HM	HM-2	3/A-33	4/A-33	4/A-33	–		
D128B	3'-0"x7'-0"x1¾"	WOOD	X	HM	HM-2	3/A-33	4/A-33	4/A-33	–	20 MIN	
D128C	3'-0"x7'-0"x1¾"	WOOD	A	HM	HM-1	1/A-33	2/A-33	2/A-33	–		
D128D	3'-0"x7'-0"x1¾"	WOOD	X	HM	HM-2	3/A-33	4/A-33	4/A-33	–		
D129	3'-0"x7'-0"x1¾"	WOOD	A	HM	HM-1	1/A-33	2/A-33	2/A-33	–	20 MIN	
D131A	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D131B	3'-0"x7'-0"x1¾"	WOOD	A	HM	HM-2	3/A-33	4/A-33	4/A-33	–	20 MIN	
D131C	3'-0"x7'-0"x1¾"	WOOD	EXIST	HM	EXIST						
D135A	3'-0"x7'-0"x1¾"	ALUM	EXIST	ALUM	EXIST						
D135B	3'-0"x7'-0"x1¾"	WOOD	B	HM	HM-1	1/A-33	2/A-33	2/A-33	–	90 MIN	1,4



04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6151
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

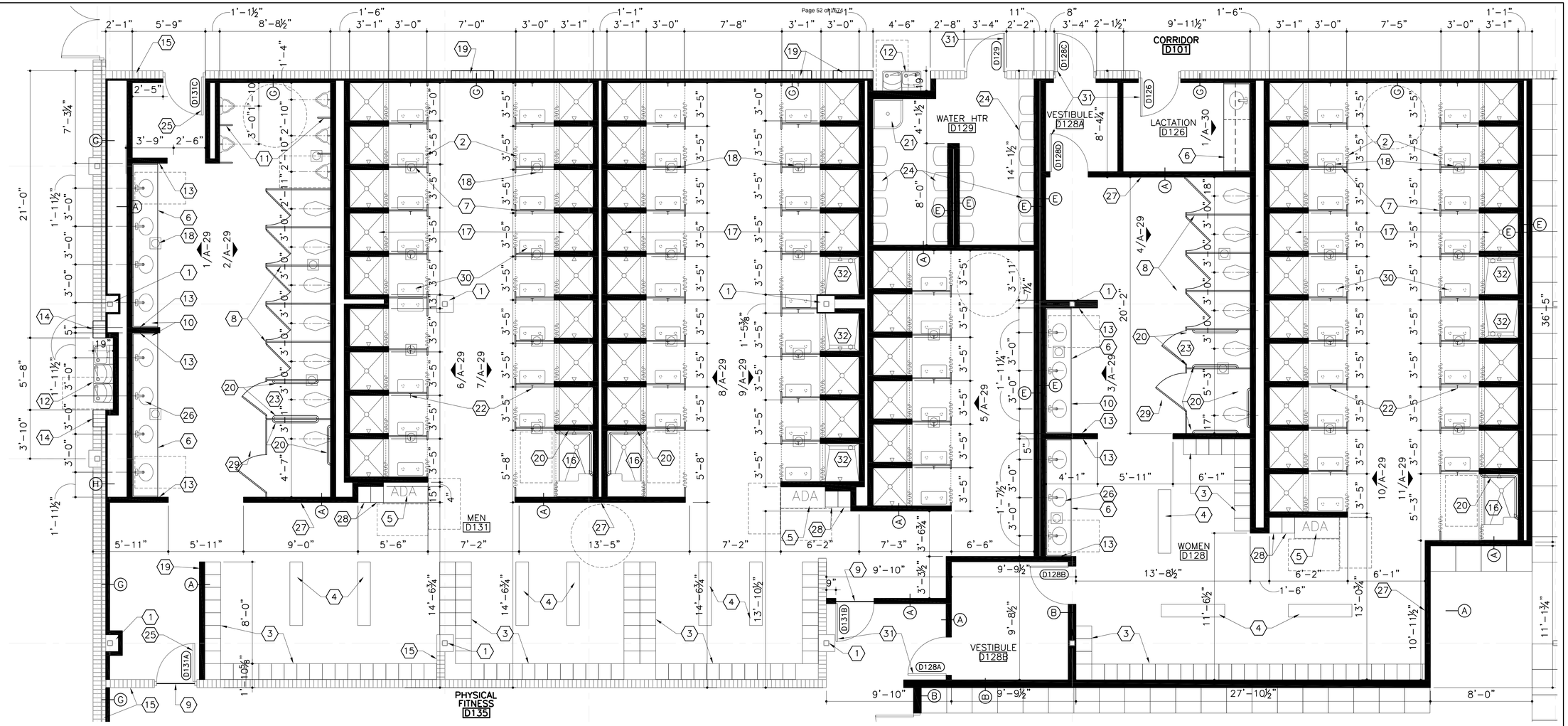
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL DOOR SCHEDULE AND TYPES

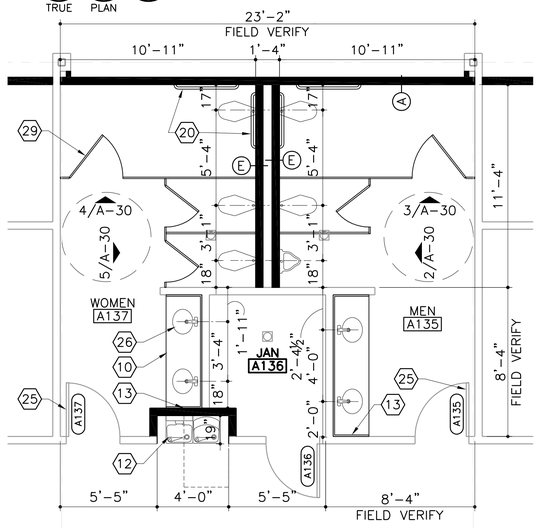
A-27

SHT. 35 of 129



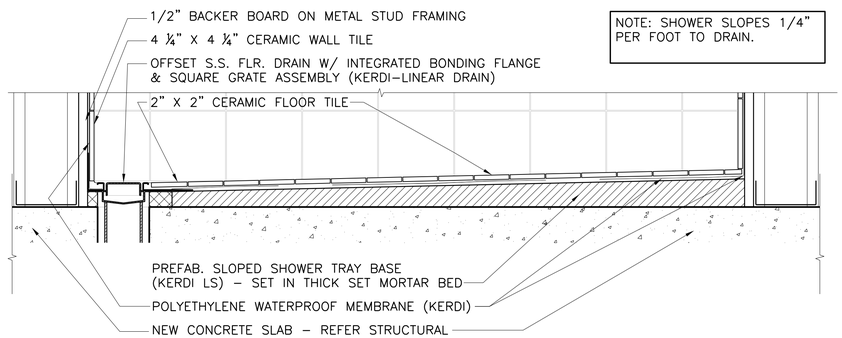
ENLARGED FLOOR PLAN – AREA "D" SHOWER/LOCKER ROOMS

1/4" = 1'-0"



ENLARGED FLOOR PLAN – AREA "A" RESTROOMS

1/4" = 1'-0"



NOTE: SHOWER SLOPES 1/4" PER FOOT TO DRAIN.

SHOWER BASE DETAIL W/ OFFSET DRAIN

3" = 1'-0"

NOTES BY SYMBOL "⬡"

1. EXISTING COLUMN TO REMAIN.
2. SHOWER CURTAIN BY OWNER, ROD CONTRACTOR FURNISHED/INSTALLED. MOUNT ROD AT 7'-8" A.F.F. MINIMUM – AT SHOWER AND SHOWER DRESS COMPARMENT.
3. 12"X15"x36" DOUBLE TIER METAL LOCKER WITH SLOPED TOP ON 4" CONCRETE BASE.
4. WOOD BENCHES (12"X48")
5. ADA BENCH (20"X42"). PROVIDE 2 ROBE HOOKS/TOWEL PINS ABOVE BENCH @ 48" A.F.F.
6. SOLID SURFACE COUNTER – PROVIDE UPPER PLAM CABINETS.
7. HDPE TOILET PARTITION & SHOWER DRESS COMPARTMENT, TYPICAL.
8. HDPE TOILET PARTITION DOOR (26"X60").
9. LIMITS OF TILE FLOORING.
10. SOLID SURFACE COUNTER.
11. HDPE URINAL SCREEN, TYPICAL.
12. ELECTRIC WATER COOLER.
13. ELECTRIC HAND DRYER.
14. INFILL MASONRY
15. EXISTING CMU WALL TO REMAIN.
16. ACCESSIBLE TILE SHOWER COMPARTMENT – RE: 2/A-31 FOR ADDITIONAL INFORMATION.
17. STANDARD TILE SHOWER COMPARTMENT – REFER TO SHEET 1/A-31 FOR ADDITIONAL INFORMATION.
18. FLOOR DRAIN, TYPICAL.
19. NEW CMU WALL – REFER SHEET A-2 FOR PARTITION TYPES.
20. GRAB BAR.
21. MOP SINK – REFER PLUMBING.
22. ROBE HOOK.
23. AMBULATORY STALL.
24. TANKLESS WATER HEATER – REFER PLUMBING.
25. EXISTING DOOR TO REMAIN.
26. SINK – REFER PLUMBING.
27. FULL LENGTH FRAMED MIRROR (24"X54")
28. ADA LOCKER: 12"X15"X72" FULL HEIGHT METAL LOCKER W/ SLOPE TOP ON 4" CONC. BASE – REFER 7/A-33.
29. HDPE TOILET PARTITION DOOR AT ADA STALL (36"X60")
30. WOOD BENCH AT SHOWER DRESS COMPARTMENT (10"X24")
31. NEW DOOR.
32. TILE SHOWER COMPARTMENT WITH OFFSET DRAIN – RE: 5/A-28.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING.

0 1' 2' 4' 8'
1/4"=1'-0"

04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		
9		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

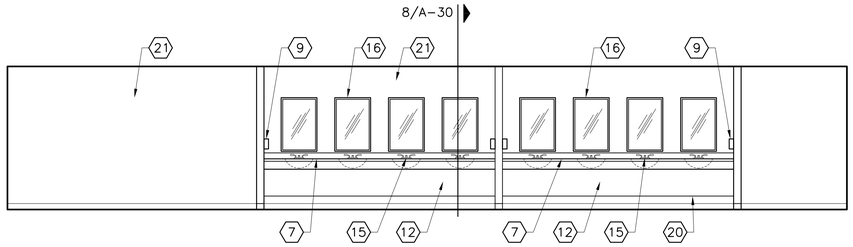
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

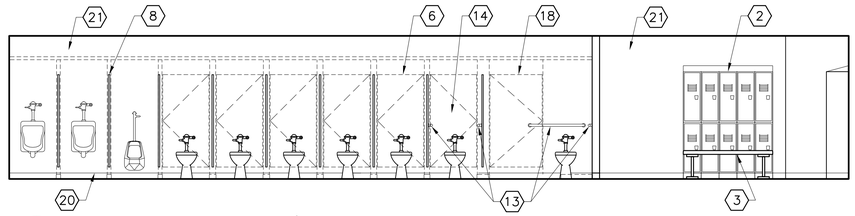
ARCHITECTURAL ENLARGED FLOOR PLANS

A-28

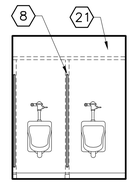
SHT. 36 of 129



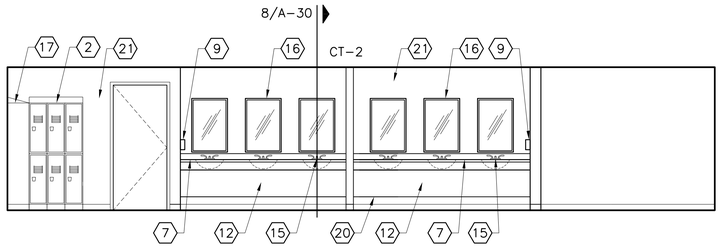
1 – ELEVATION – MEN'S LATRINE
1/4" = 1'-0"



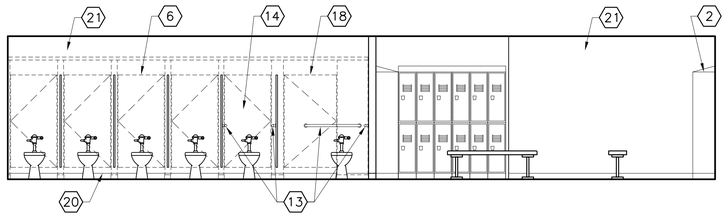
2 – ELEVATION – MEN'S LATRINE
1/4" = 1'-0"



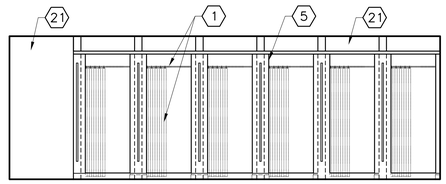
2 – ELEVATION – MEN'S LATRINE
1/4" = 1'-0"



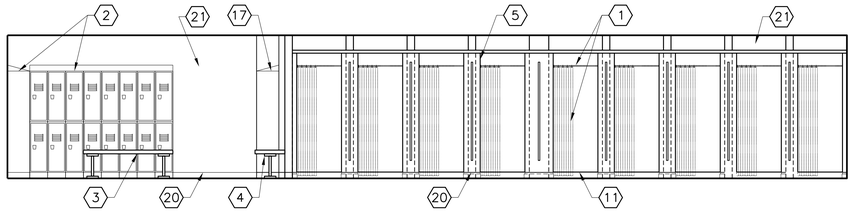
3 – ELEVATION – WOMEN'S LATRINE
1/4" = 1'-0"



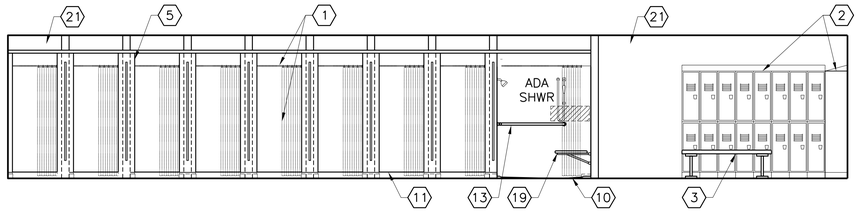
4 – ELEVATION – WOMEN'S LATRINE
1/4" = 1'-0"



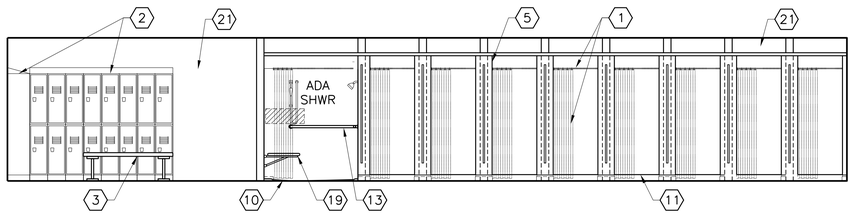
5 – ELEVATION – MEN'S SHOWERS
1/4" = 1'-0"



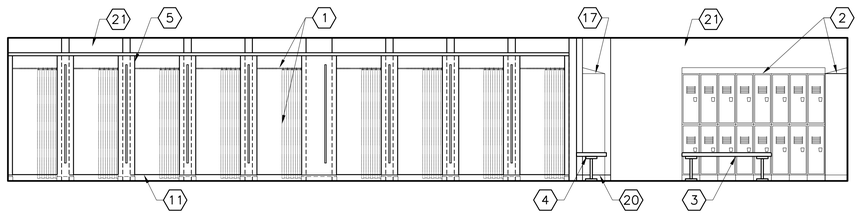
6 – ELEVATION – MEN'S SHOWERS
1/4" = 1'-0"



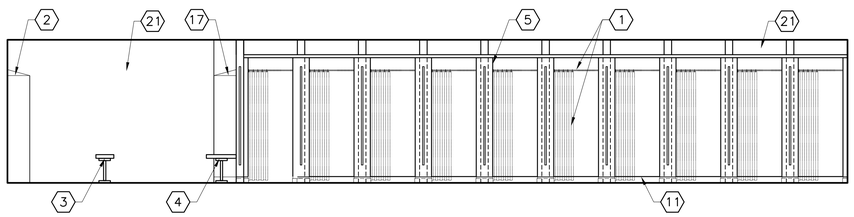
7 – ELEVATION – MEN'S SHOWERS
1/4" = 1'-0"



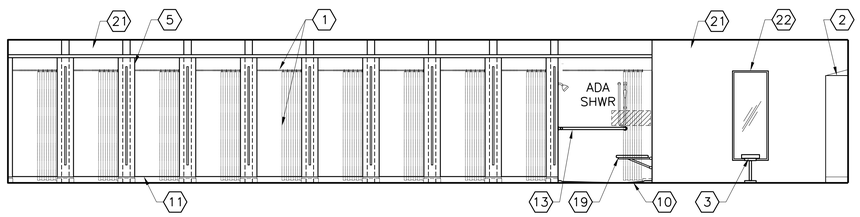
8 – ELEVATION – MEN'S SHOWERS
1/4" = 1'-0"



9 – ELEVATION – MEN'S SHOWERS
1/4" = 1'-0"



10 – ELEVATION – WOMEN'S SHOWERS
1/4" = 1'-0"



11 – ELEVATION – WOMEN'S SHOWERS
1/4" = 1'-0"

NOTES BY SYMBOL "⬡"

1. SHOWER CURTAIN BY OWNER, ROD CONTRACTOR FURNISHED/INSTALLED. MOUNT ROD AT 7'-8" A.F.F. MINIMUM – AT SHOWER AND SHOWER DRESS COMPARMENT.
2. 12"X15"x36" DOUBLE TIER METAL LOCKER WITH SLOPED TOP ON 4" CONCRETE BASE.
3. WOOD BENCHES.
4. ADA BENCH (20"X42"). PROVIDE 2 ROBE HOOKS/TOWEL PINS ABOVE BENCH @ 48" A.F.F.
5. HDPE TOILET PARTITION & SHOWER DRESS COMPARTMENT, TYPICAL.
6. HDPE TOILET PARTITION DOOR (26"X60").
7. SOLID SURFACE COUNTER.
8. HDPE URINAL SCREEN, TYPICAL.
9. ELECTRIC HAND DRYER.
10. ACCESSIBLE TILE SHOWER COMPARTMENT – RE: 2/A-31 FOR ADDITIONAL INFORMATION.
11. STANDARD TILE SHOWER COMPARTMENT – REFER TO SHEET 1/A-31 FOR ADDITIONAL INFORMATION.
12. REMOVABLE PLAM PANEL.
13. GRAB BAR.
14. AMBULATORY STALL.
15. SINK – REFER PLUMBING.
16. FMS – FRAMED MIRROR, TYP.
17. ADA LOCKER: 12"X15"X72" FULL HEIGHT METAL LOCKER W/ SLOPE TOP ON 4" CONC. BASE – REFER 7/A-33.
18. HDPE TOILET PARTITION DOOR AT ADA STALL (36"X60")
19. WOOD BENCH AT SHOWER DRESS COMPARTMENT (10"X24")
20. CERAMIC TILE BASE AS SCHEDULED.
21. CERAMIC TILE – CT-2.
22. FULL LENGTH FRAMED MIRROR (24"X54").

0 1' 2' 4' 8'
1/4"=1'-0"



THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

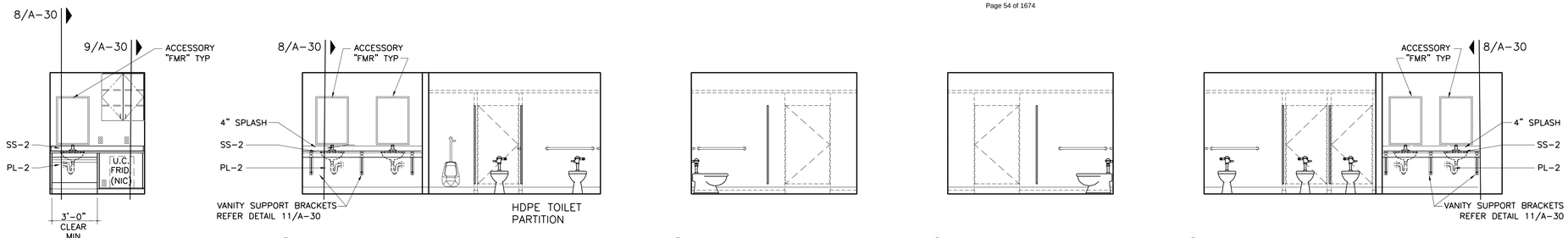
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL INTERIOR ELEVATIONS

A-29

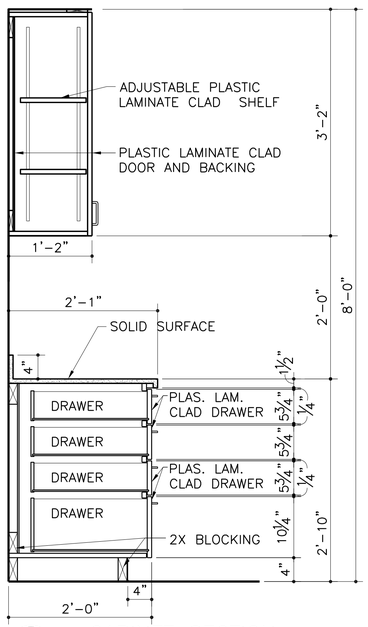
SHT. 37 of 129



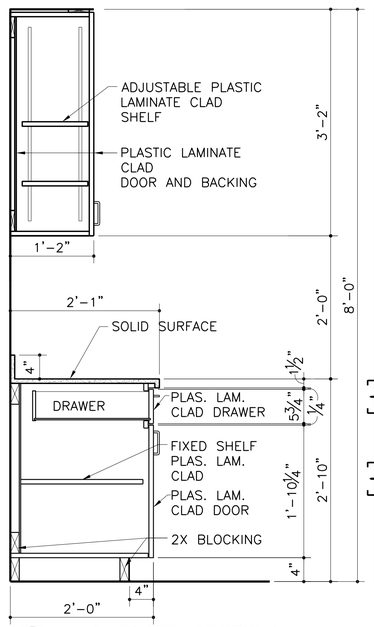
BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING.

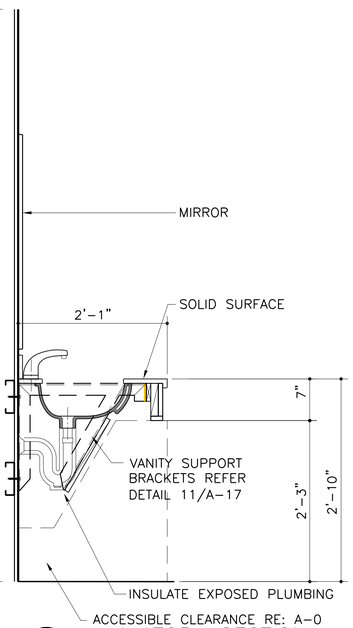
(1/–) LACTATION
1/4" = 1'-0"



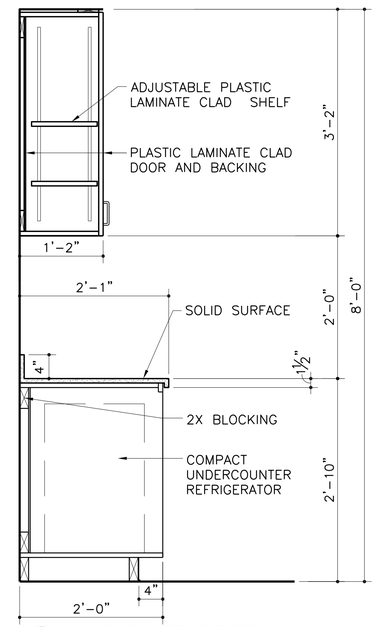
(5/2/–) MENS A135
1/4" = 1'-0"



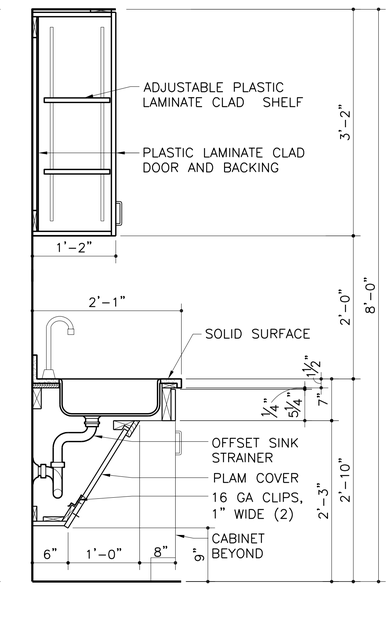
(5/3/–) MENS A135
1/4" = 1'-0"



(5/4/–) WOMENS A137
1/4" = 1'-0"



(5/5/–) WOMENS A137
1/4" = 1'-0"



(6/A-30) CABINET SECTION
1" = 1'-0"

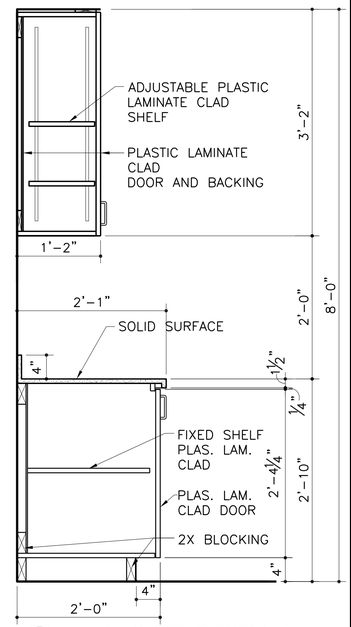
(7/A-30) CABINET SECTION
1" = 1'-0"

BASE CABINET ONLY AT SIM.

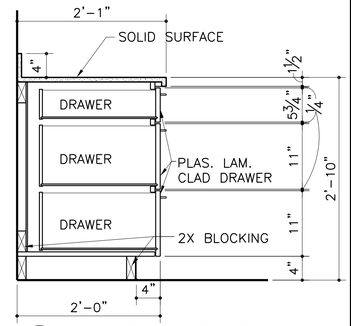
(8/A-30) LAVATORY SECTION
1" = 1'-0"

(9/A-30) CABINET SECTION
1" = 1'-0"

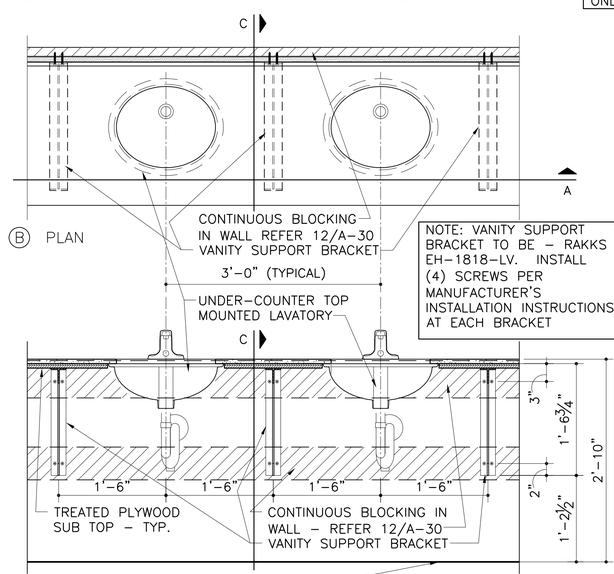
(10/A-30) CABINET SECTION
1" = 1'-0"



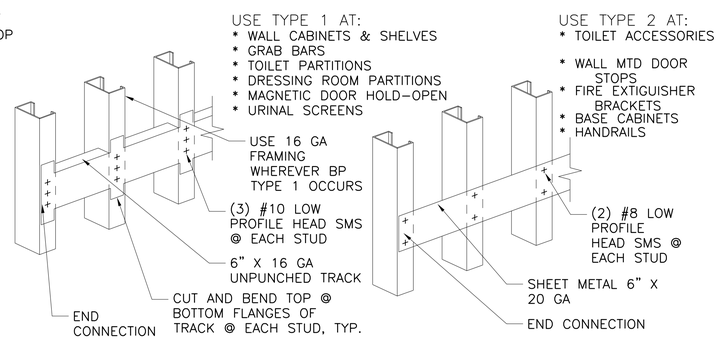
(14/A-30) CABINET SECTION
1" = 1'-0"



(15/A-17) CABINET SECTION
1" = 1'-0"



(11/A-17) LAVATORY SUPPORT BRACKET
N.T.S.



BACKING PLATE NOTES:
1. EXTEND BACKING PLATE TYPE 1 ACROSS (3) STUDS MIN.
2. EXTEND BACKING PLATE TO 1 STUD BEYOND EXTENT OF CABINETRY OR WALL HUNG EQUIPMENT.
3. DO NOT CUT BACKING PLATE FLANGES EXCEPT FOR NOTCHING AT WALL STUDS

(12/A-30) BLOCKING/BACKING PLATE SUPPORT DETAIL
N.T.S.

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481
CAMP MABRY P.O. BOX 5218
(512) 782-6131

STAR CAMPAIGN FY18 - WESLACO RC MAJOR MAINTENANCE

0 1" 2" 4" 8"
3"=1'-0"
0 6" 1' 2'
1"=1'-0"
0 1' 2' 4' 8'
1/4"=1'-0"

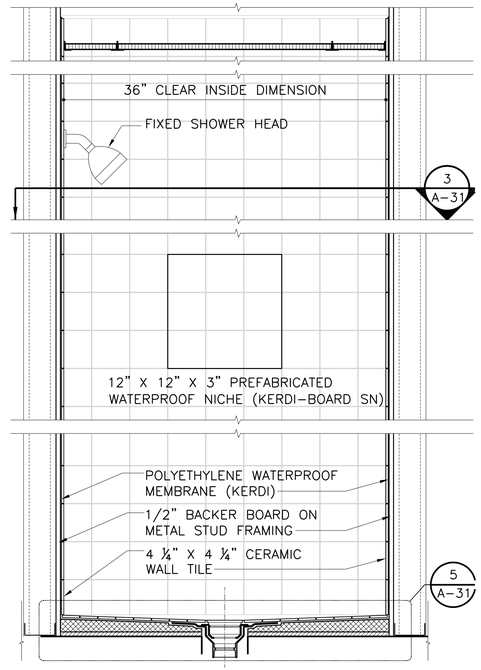
TXARNG CFMO

MILLWORK ELEVATIONS & DETAILS

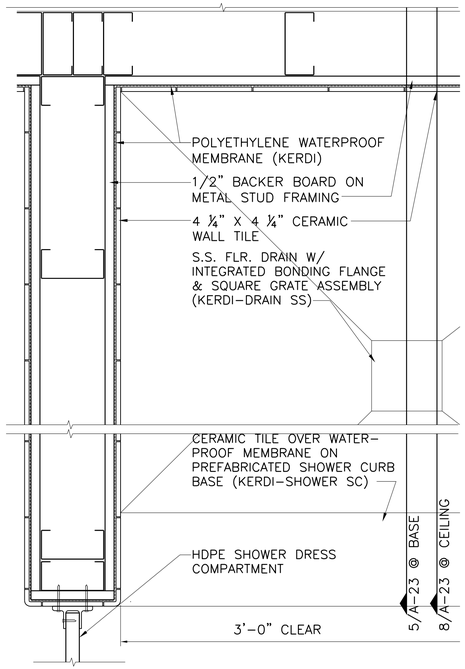
A-30

SHT. 38 of 129

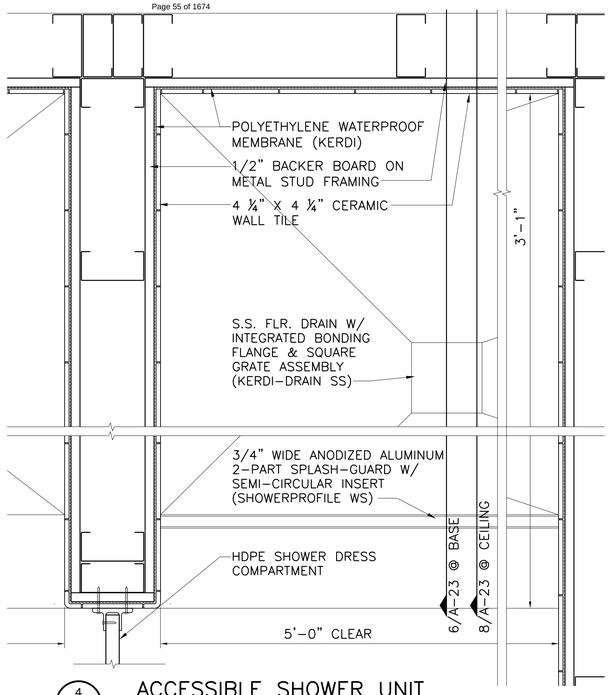
04/20/2018



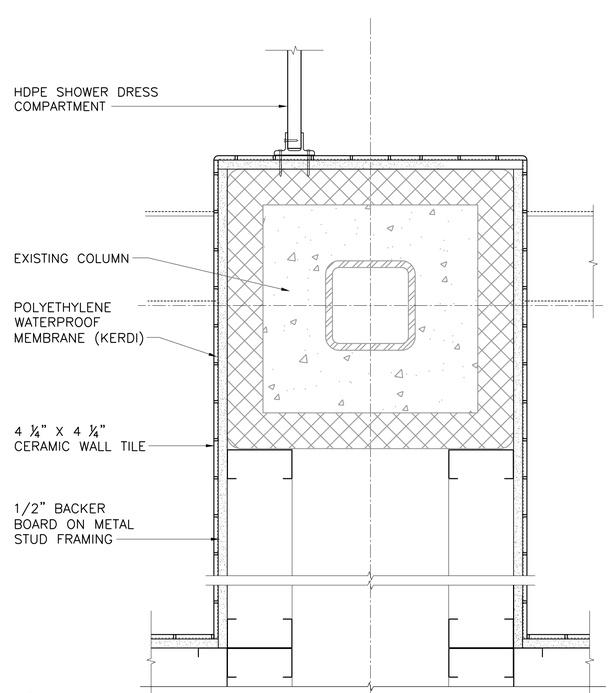
1 STANDARD SHOWER UNIT
1 1/2" = 1'-0"



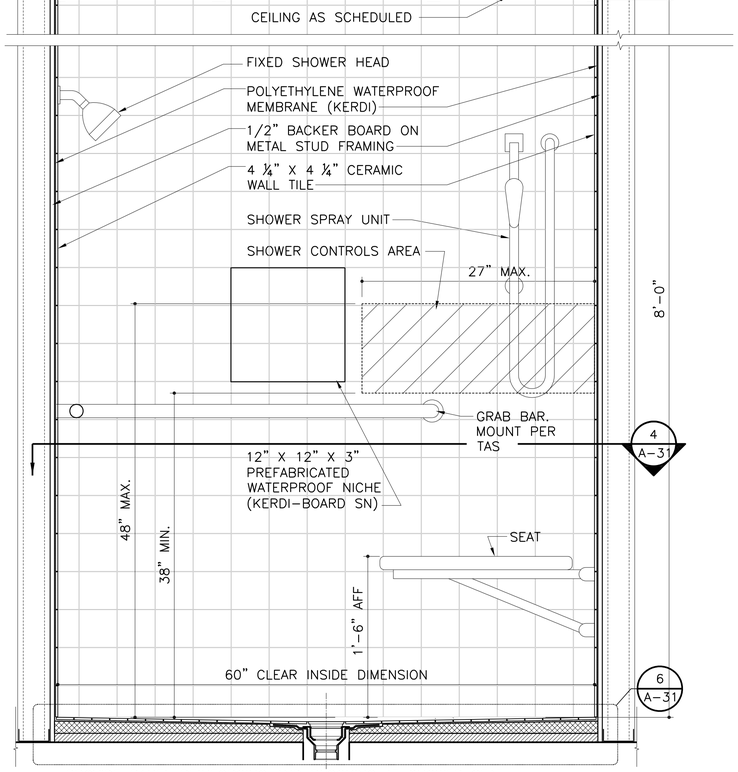
3 STANDARD SHOWER UNIT
3" = 1'-0"



4 ACCESSIBLE SHOWER UNIT
3" = 1'-0"



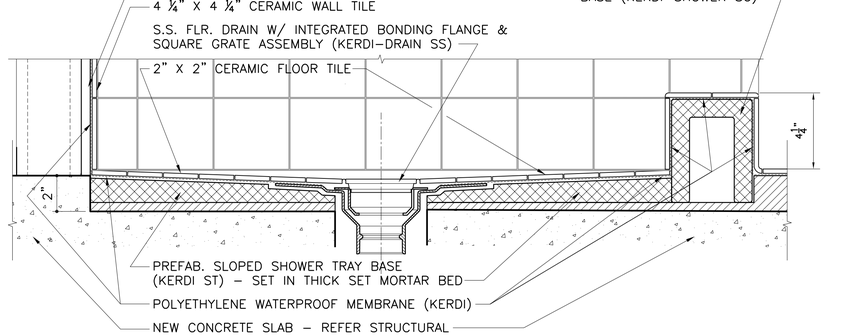
7 PLAN DETAIL @ EXISTING COLUMN
3" = 1'-0"



PROVIDE PANEL REINFORCING AND BLOCKING AT SHOWER SEAT AND GRAB BARS

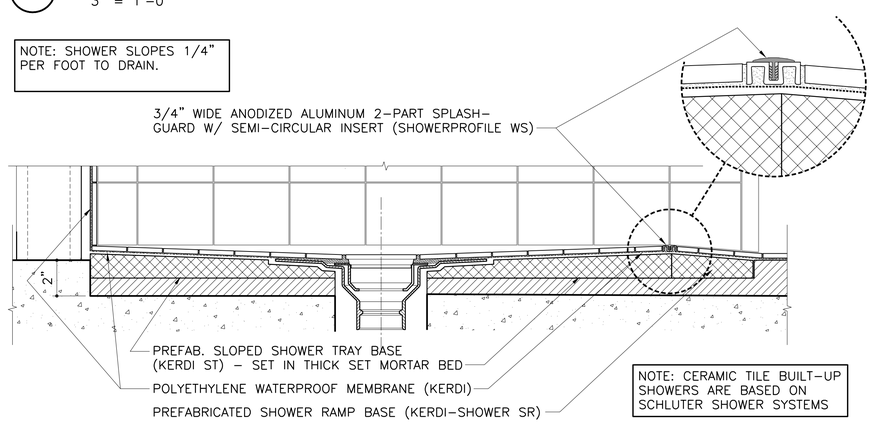
SEAL ALL JOINTS AT BACKER BOARD AND PROVIDE PRIMER PRIOR TO INSTALL.

2 ACCESSIBLE SHOWER UNIT
1 1/2" = 1'-0"



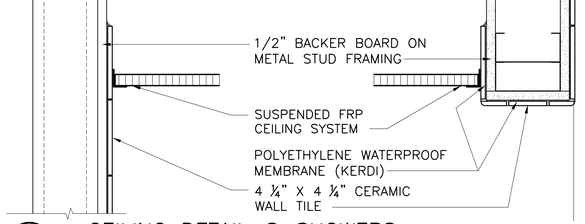
5 STANDARD SHOWER BASE DETAIL
3" = 1'-0"

NOTE: SHOWER SLOPES 1/4" PER FOOT TO DRAIN.



REFER TO 5/A-31 - STANDARD SHOWER FOR BALANCE OF NOTES

6 ACCESSIBLE SHOWER BASE DETAIL
3" = 1'-0"



8 CEILING DETAIL @ SHOWERS
3" = 1'-0"

0 1' 2' 4'
3/8"=1'-0

0 4" 8" 1'
1-1/2"=1'-0"

0 1" 2" 4" 8"
3"=1'-0"

JOSEPH SLEEPER 85067 REGISTERED ARCHITECT STATE OF TEXAS
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	~~ADD1 06/26/2017~~	
2	~~ADD2 07/12/2017~~	
3	~~IFC 08/25/2017~~	
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

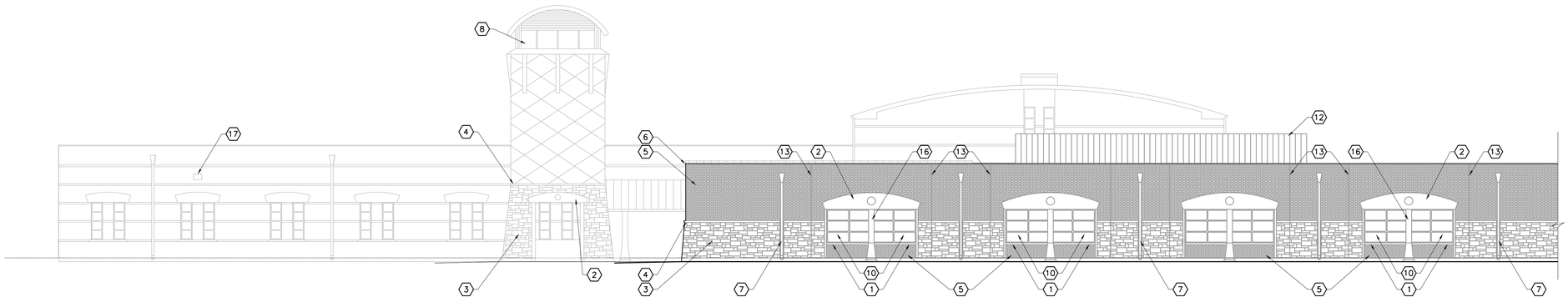
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

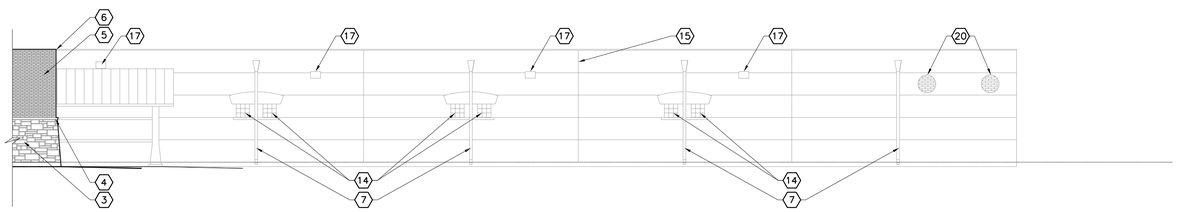
ARCHITECTURAL DETAILS

A-31

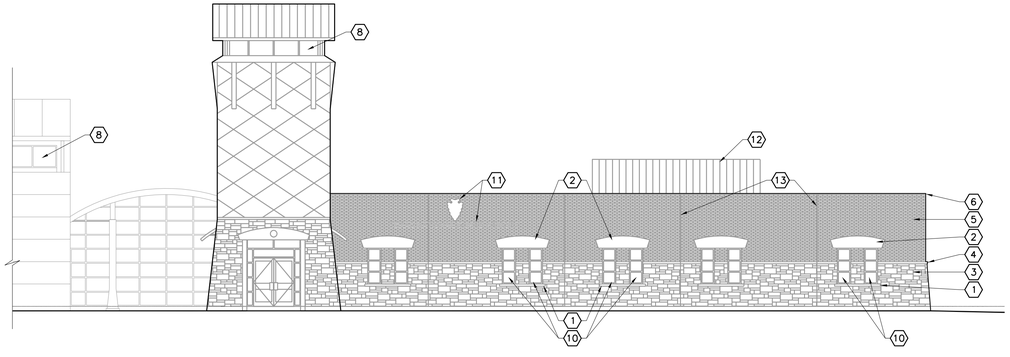
SHT. 39 of 129



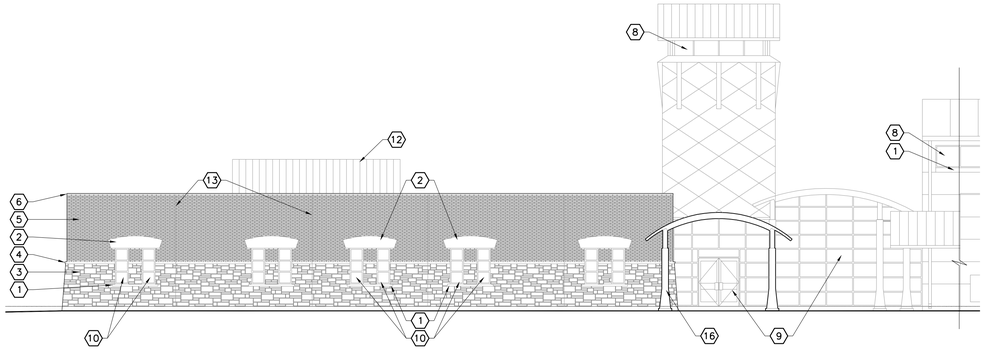
1 PARTIAL SOUTH ELEVATION
3/32" = 1'-0"



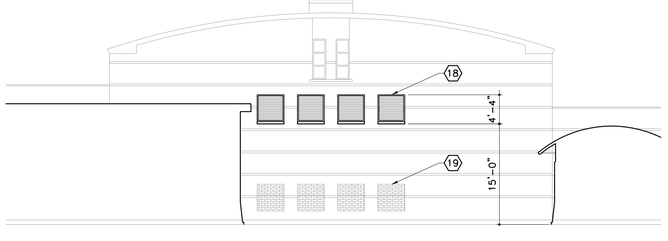
2 PARTIAL SOUTH ELEVATION
3/32" = 1'-0"



3 PARTIAL WEST ELEVATION
3/32" = 1'-0"



4 PARTIAL EAST ELEVATION
3/32" = 1'-0"



5 PARTIAL ELEVATION – DRILL HALL SOUTH WALL
3/32" = 1'-0"

GENERAL NOTES

1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THE COVER SHEET.
2. ELEVATIONS BASED ON PLAN NORTH ORIENTATION.

NOTES BY SYMBOL "⬡"

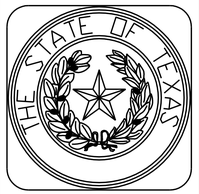
6 1. EXISTING CAST STONE SILL – CLEAN EXISTING STAINS AND SEAL.
6 2. EXISTING CAST STONE HEAD – CLEAN EXISTING STAINS AND SEAL.
6 3. EXSTING LIMESTONE VENEER – CLEAN EXISTING STAINS AND SEAL.
6 4. EXISTING CAST STONE WATERTABLE – CLEAN EXISTING STAINS AND SEAL.
5. EXISTING BRICK VENEER TO REMAIN.
6. EXISTING METAL COPING TO REMAIN.
7. EXISTING DOWNSPOUT.
8. EXISTING CLERESTORY WINDOW.
9. EXISTING STOREFRONT AND DOOR SYSTEM.
6 10. EXISTING WINDOWS TO REMAIN, CAULK AND RESEAL EXTERIOR AND INTERIOR.
11. EXISTING BUILDING SIGNAGE TO REMAIN.
12. EXISTING METAL PANEL – HVAC SCREEN TO REMAIN.
6 13. EXISTING EXPANSION JOINT, REPLACE ELASTOMERIC SEALANT – TYPICAL.
6 14. EXISTING GLASS BLOCK WINDOW TO REMAIN, CAULK AND RESEAL EXTERIOR AND INTERIOR – TYPICAL.
6 15. EXISTING MASONRY CONTROL JOINT, REPLACE ELASTOMERIC SEALANT – TYPICAL.
16. EXISTING COLUMN TO REMAIN.
6 17. NEW LIGHT FIXTURE – RE: ELECTRICAL.
18. NEW ALUMINUM LOUVERS.
19. INFILL EXISTING LOUVER OPENINGS, RE: 1/A-2.
20. INFILL EXISTING EXHAUST FAN OPENINGS, RE: 1/A-2.

BID OPTIONS "◯"

6. EXTERIOR BUILDING IMPROVEMENTS.

0 4' 8' 16'
3/32"=1'-0"





PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: CT
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

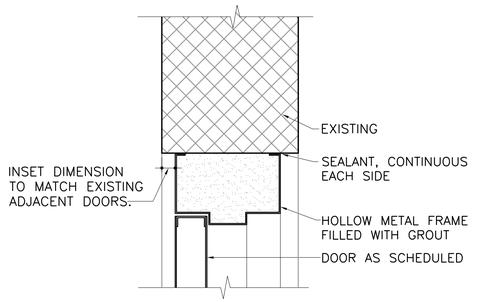
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

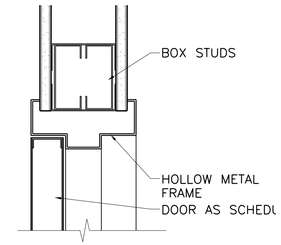
ARCHITECTURAL EXTERIOR ELEVATIONS

A-32

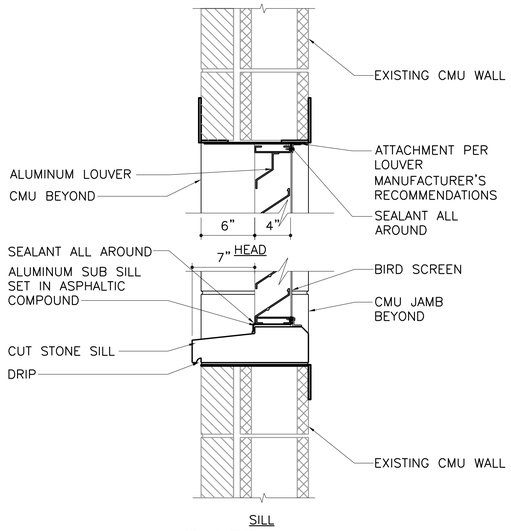
SHT. 40 of 129



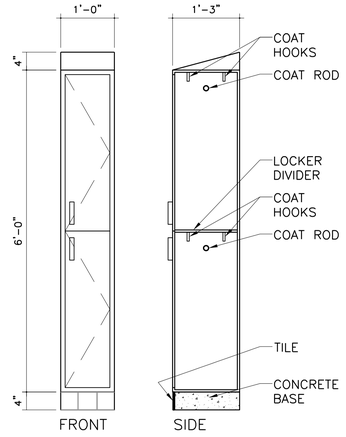
1 HEAD
3"=1'-0"



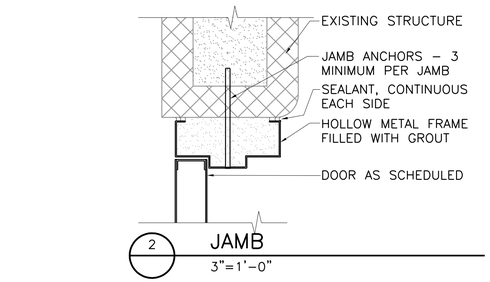
3 HEAD
3"=1'-0"



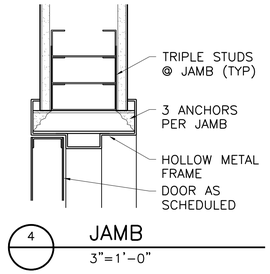
5 LOUVER HEAD AND SILL (JAMB SIM)
3"=1'-0"



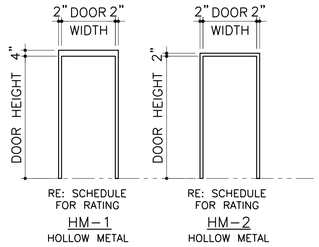
6 STANDARD LOCKER
N.T.S.



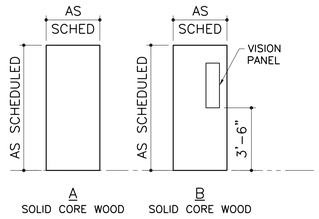
2 JAMB
3"=1'-0"



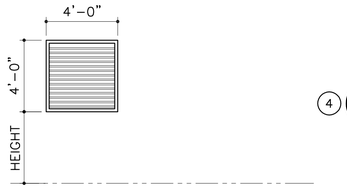
4 JAMB
3"=1'-0"



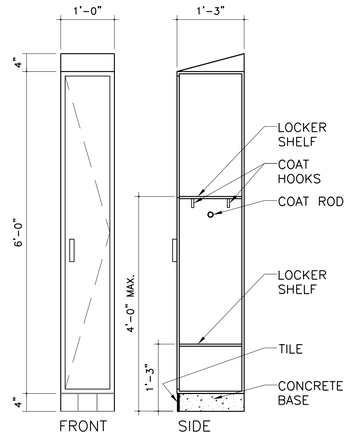
FRAME TYPES
1/4"=1'-0"



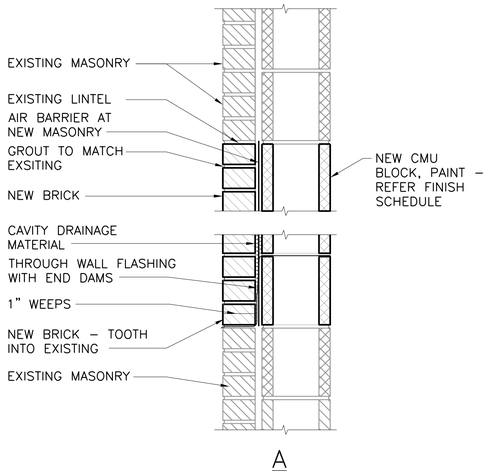
DOOR TYPES
1/4"=1'-0"



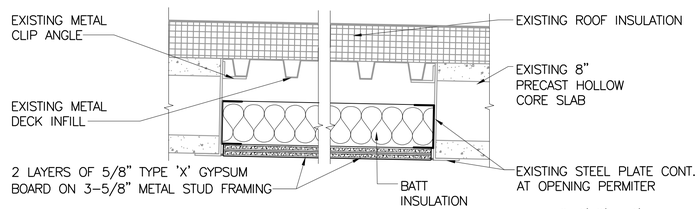
OPENING TYPES
1/4"=1'-0"



7 ACCESSIBLE LOCKER
N.T.S.



9 CMU WALL INFILL DETAILS
1 1/2" = 1'-0"



4 8 INFILL AT EXISTING PRECAST HOLLOW CORE SLAB OPENINGS
N.T.S.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/ REPAIRS/ HVLS FANS.

0 1' 2' 4' 8'
1/4"=1'-0"
0 4" 8" 1'
1-1/2"=1'-0"
0 1" 2" 4" 8"
3"=1'-0"



THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL DOOR TYPES AND DETAILS

A-33

SHT. 41 of 129

GENERAL NOTES

1. CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE 2015 INTERNATIONAL BUILDING CODE, INCLUDING LOCAL SUPPLEMENTS, EXCEPT WHERE APPLICABLE CODES OR THE CONTRACT DOCUMENTS ARE MORE RESTRICTIVE.

2. DEAD LOADS: ACTUAL WEIGHTS OF MATERIALS OF CONSTRUCTION AND FIXED SERVICE EQUIPMENT

3. LIVE LOADS:
   A. MECHANICAL, LIGHT STORAGE: 125 PSF
   B. ASSEMBLY: 100 PSF
   C. CORRIDORS: 80 PSF
   D. ROOMS: 50 PSF
   E. ROOF: 20 PSF

4. SNOW LOAD
   A. GROUND SNOW LOAD: Pg = 5 PSF
   B. SNOW IMPORTANCE FACTOR: I = 1.00

5. LATERAL LOADS:
   A. RISK CATEGORY II
   B. WIND LOAD:
      i. ULTIMATE DESIGN WIND SPEED: V ULT = 135 MPH
      ii. WIND EXPOSURE: C
   C. SEISMIC LOAD:
      i. SEISMIC IMPORTANCE FACTOR: I = 1.00
      ii. MAPPED SPECTRAL ACCELERATIONS: SS = 0.040, S1 = 0.014
      iii. SITE CLASS: C
      iv. SPECTRAL RESPONSE COEFFICIENT: SDS = 0.043, SD1 = 0.023
      v. SEISMIC DESIGN CATEGORY: A

6. VERIFY ALL DIMENSIONS, ELEVATIONS, OPENING SIZES, AND MECHANICAL AND ELECTRICAL EQUIPMENT WEIGHTS PRIOR TO STARTING WORK.

7. REMOVE ALL ABANDONED FOUNDATIONS, UTILITIES, PIPELINES, ETC. THAT INTERFERE WITH NEW CONSTRUCTION.

8. FIELD VERIFY ALL EXISTING CONDITIONS, INCLUDING LOCATION AND DIMENSIONS OF ALL EXISTING CONSTRUCTION AND UTILITIES. NOTIFY ENGINEER IF THERE IS A CONFLICT BETWEEN THE CONTRACT DOCUMENTS AND EXISTING CONDITIONS BEFORE PROCEEDING WITH WORK.

9. PROVIDE EXCAVATION SHORING TO PROTECT AND SUPPORT FOUNDATION SOILS UNDER EXISTING STRUCTURES.

10. THE STRUCTURES ARE DESIGNED FOR STABILITY IN THE FINAL CONDITION ONLY. PROVIDE TEMPORARY BRACING AND SHORING AS REQUIRED FOR STABILITY DURING CONSTRUCTION.

11. SEE OTHER DISCIPLINE DRAWINGS FOR SIZE AND LOCATION OF ALL OPENINGS, DEPRESSIONS, OFFSETS, SLEEVES, CURBS, PADS, INSERTS, ETC. NOT SHOWN ON STRUCTURAL DRAWINGS. BEFORE FABRICATION OF MATERIALS, COORDINATE WITH MECHANICAL AND ELECTRICAL EQUIPMENT REQUIREMENTS.

12. PLANS, SECTIONS, AND DETAILS ARE NOT TO BE SCALED FOR DETERMINATION OF QUANTITIES, LENGTHS, OR FIT OF MATERIALS.

13. THE GENERAL NOTES AND TYPICAL DETAILS ARE GENERAL AND APPLY TO THE ENTIRE PROJECT EXCEPT WHERE THERE ARE SPECIFIC INDICATIONS TO THE CONTRARY.

14. CONTRACTOR SHALL PROVIDE COORDINATION DRAWINGS BEFORE STARTING CONSTRUCTION. COORDINATION DRAWINGS MUST SHALL ALL TRADES.

CONCRETE

1. CONCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI, UNLESS SPECIFIED OTHERWISE.

2. REINFORCING SHALL BE IN ACCORDANCE WITH ASTM A615, GRADE 60, DEFORMED.

3. CONCRETE CLEAR COVER OVER REINFORCING SHALL BE IN ACCORDANCE WITH ACI 318, LISTED BELOW, UNLESS NOTED OTHERWISE.
   A. CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH: 3"
   B. EXPOSED TO EARTH OR WEATHER
      i. #6 BARS AND LARGER: 2"
      ii. #5 BARS AND SMALLER: 1-1/2"
   C. NOT EXPOSED TO EARTH OR WEATHER
      i. SLABS AND WALLS: 1"
      ii. BEAMS AND COLUMNS: 1-1/2"

4. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4" INSIDE FORMS OR TOOLED TO 3/4" RADIUS ON SLABS, UNLESS NOTED OTHERWISE.

5. SLABS ON GRADE SHALL HAVE CONSTRUCTION JOINTS AND/OR CONTROL JOINTS (SAWED OR FORMED JOINTS) LOCATED AS SHOWN ON THE DRAWINGS. CONTRACTOR SHALL LOCATE SLAB JOINTS ON RECORD INFORMATION SHOP DRAWINGS.

6. HOOKS SHOWN ON DRAWINGS SHALL BE ASSUMED TO BE STANDARD HOOKS PER ACI 318, UNLESS NOTED OTHERWISE.

7. ALL REINFORCING SHALL BE CONTINUOUS. CONTINUOUS BARS SHALL LAP 48 BAR DIAMETERS OF SMALLER BAR LAPPED, UNLESS NOTED OTHERWISE. ALL REBAR EMBEDMENT LENGTHS SHALL BE 36 BAR DIAMETERS, UNLESS NOTED OTHERWISE.

8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF ALL FORMING, TEMPORARY BRACING, AND SHORING.

FOUNDATION

1. FOUNDATIONS HAVE BEEN DESIGNED IN ACCORDANCE WITH GEOTECHNICAL REPORT "SUBSURFACE EXPLORATION AND FOUNDATION RECOMMENDATIONS FOR THE PROPOSED ARMORY" WESLACO, TEXAS DATED DECEMEBER 14, 1993, PREPARED BY PROFESSIONAL SERVICE INDUSTRIES, INC. (REPORT NO. 326-35415). A COPY OF THIS REPORT IS AVAILABLE FOR INSPECTION AT THE ENGINEER'S OFFICE.

2. AT THE LOCATIONS WHERE UTILITY TRENCHES CROSS THE BUILDING LINE, 5'-0" OF EACH TRENCH CENTERED ON THE BUILDING LINE SHALL BE BACKFILLED AS FOLLOWS: OUTSIDE THE BUILDING LINE BACKFILL ABOVE THE UTILITY WITH A COMPACTED, LOW-PERMEABILITY CLAY; INSIDE THE BUILDING LINE BACKFILL WITH SPECIFIED SELECT FILL; EMBEDMENT MATERIAL BELOW AND AROUND THE UTILITY SHALL BE FLOWABLE FILL.

3. EXCAVATION, SUBGRADE PREPARATION, AND BACKFILL
   A. EXISTING SUBGRADE MATERIAL MOISTURE CONTENT SHALL BE ADJUSTED AS NECESSARY AND MAINTAIN IT TO BETWEEN 1 PERCENT BELOW OPTIMUM AND 3 PERCENT ABOVE OPTIMUM AND RECOMPACT THE SOIL TO A MINIMUM OF 98 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 (STANDARD PROCTOR). ADD SELECT FILL TO RAISE SUBGRADE AS NECESSARY.
   B. SELECT FILL MATERIAL SHALL CONSIST OF MATERIALS WHICH ARE CLASSIFIED AS SP, SM, SC, CL, OR DUAL CLASSIFICATIONS THEREOF, WHICH HAVE A LIQUID LIMIT LESS THAN OR EQUAL TO 36 AND A PLASTICITY INDEX OF A MINIMUM OF 7 AND A MAXIMUM OF 15 AND CONTAIN AT LEAST 30 PERCENT MATERIAL PASSING THE #200 SIEVE, WHICH ARE FREE OF ORGANIC MATERIALS.
   C. SELECT FILL SHALL BE PLACED IN MAXIMUM 8" LOOSE LIFTS FOR HEAVY EQUIPMENT AND 4" LOOSE LIFTS FOR HAND-DIRECTED EQUIPMENT. COMPACT TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 (STANDARD PROCTOR).
   D. IN-PLACE FIELD DENSITY TESTS SHALL BE CONDUCTED AT A RATE OF ONE TEST PER 2,500 SQUARE FEET FOR EVERY LIFT OR A MINIMUM OF 2 TESTS PER LIFT.
   E. THE SUBGRADE MOISTURE CONTENT AND DENSITY SHALL BE MAINTAINED DURING CONSTRUCTION.

4. EXTERIOR SLABS SHALL SLOPE AWAY FROM THE STRUCTURES A MINIMUM OF 1/4" PER FOOT, UNLESS NOTED OTHERWISE. GRADING AROUND STRUCTURES SHALL BE SLOPED TO DRAIN ALL WATER AWAY FROM STRUCTURES.

5. FOUNDATIONS HAVE BEEN DESIGNED FOR A NET ALLOWABLE BEARING PRESSURE OF 1,800 PSF FOR BEAMS AND 2,300 PSF FOR COLUMN FOOTINGS FOR FOUNDATIONS BEARING ON UNDISTURBED FIRM SOIL OR APPROVED ENGINEERED FILL MATERIAL. SUITABLE BEARING MATERIALS SHALL BE VERIFIED BY A LICENSED PROFESSIONAL GEOTECHNICAL ENGINEER.

STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL SHALL BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE AISC "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS", ANSI/AISC 360-05.

2. STEEL MATERIAL SHALL BE IN ACCORDANCE WITH THE FOLLOWING UNLESS NOTED OTHERWISE:
   A. WIDE FLANGES: ASTM A992
   B. CHANNELS: ASTM A36
   C. PIPES: ASTM A53, TYPE E OR S, GRADE B
   D. HSS: ASTM A500, GRADE B
   E. PLATES: ASTM A36
   F. MISC.: ASTM A36
   G. ANCHOR RODS: ASTM F1554, GRADE 36

3. PROVIDE ALL TEMPORARY SUPPORTS REQUIRED FOR STEEL ERECTION.

4. UNLESS NOTED OTHERWISE, IT IS THE INTENT OF THESE DRAWINGS THAT SHOP CONNECTIONS EITHER BE WELDED OR BOLTED AND THAT FIELD CONNECTIONS BE BOLTED.

5. ALL BOLTED CONNECTIONS SHALL BE MADE WITH 3/4" DIA. ASTM A325 BOLTS OR 7/8" DIA. ASTM A490 BOLTS, UNLESS NOTED OTHERWISE.

6. ALL BOLT HOLES SHALL BE STANDARD HOLES PER AISC 360 TABLE J3.3, UNLESS OTHERWISE NOTED. DO NOT OVERSIZE, SLOT, OR ENLARGE HOLES UNLESS SPECIFICALLY INDICATED.

7. WELDING SHALL BE DONE IN ACCORDANCE WITH "STRUCTURAL WELDING CODE-STEEL", AMERICAN WELDING SOCIETY (AWS D1.1 - 2010).

8. WELDING SHALL BE PERFORMED WITH E70XX LOW-HYDROGEN ELECTRODES.

9. NO HOLES SHALL BE CUT THROUGH STEEL FRAMING IN FIELD UNLESS APPROVED BY THE ENGINEER.

POST-INSTALLED ANCHORS (EXPANSION OR ADHESIVE)

1. INSTALL IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII), BUT NOT LESS THAN THAT INDICATED BELOW.

2. ADHESIVE ANCHORS SHALL ONLY BE INSTALLED BY CONSTRUCTION PERSONNEL CERTIFIED UNDER ACI/CRSI ADHESIVE ANCHOR INSTALLER CERTIFICATION PROGRAM. SUBMIT CERTIFICATIONS AS RECORD DATA.

3. ANCHOR DIAMETER AND EMBEDMENT SHALL BE AS INDICATED. USE STANDARD EMBEDMENT AS RECOMMENDED BY MANUFACTURER IF EMBEDMENT IS NOT INDICATED
.

4. HOLES SHALL BE DRILLED USING ROTARY HAMMER DRILLS WITH ANSI MATCHED TOLERANCE CARBIDE-TIPPED DRILL BITS. DRILL BIT DIAMETER SHALL MATCH DIAMETER RECOMMENDED BY MANUFACTURER.

5. USE CARE AND CAUTION WHEN INSTALLING TO AVOID CUTTING OR DAMAGING EXISTING REINFORCING STEEL.

6. AS INDICATED BLOW HOLES CLEAN WITH COMPRESSED AIR, 80 PSI MINIMUM. START BLOWING WITH NOZZLE AT BACK OF HOLE AND SLOWLY EXTRACT NOZZLE.

7. EXPANSION ANCHORS SHALL BE A STUD BOLT TYPE WITH HEX HEAD NUT AND SHALL BE GALVANIZED, UNLESS NOTED OTHERWISE, AND AS NOTED BELOW:
   A. ANCHORS SHALL BE HILTI KWIK BOLT TZ OR AN APPROVED EQUAL.
   B. BLOW HOLES CLEAN. REPEAT 3 TIMES.
   C. DRIVE ANCHOR INTO HOLE WITH A HAMMER AND THEN TIGHTEN TO SPECIFIED TORQUE.

8. ADHESIVE ANCHORS SHALL BE DEFORMED REINFORCING BARS CONFORMING TO ASTM A615, GR 60 OR GALVANIZED THREADED ROD CONFORMING TO ASTM F1554 GRADE 36, UNLESS NOTED OTHERWISE, AND AS NOTED BELOW:
   A. ADHESIVE SHALL BE HILTI HIT-RE 500-V3 OR AN APPROVED EQUAL. USE HILTI HIT-HY 70 FOR HOLLOW OR GROUTED MASONRY OR AN APPROVED EQUAL.
   B. PRIOR TO INSTALLATION: ALL DEFORMED BARS AND THREADED ROD SHALL BE CLEAN, FREE OF OIL, GREASE, OR OTHER RESIDUE, IN ACCORDANCE WITH MPII.
   C. CLEAN HOLES BEFORE INSTALLING ANCHOR PER MPII, BUT NOT LESS THAN THE FOLLOWING:
      i. BLOW HOLE CLEAN. REPEAT 3 TIMES.
      ii. BRUSH HOLE WITH SPECIFIED BRUSH. REPEAT 3 TIMES.
      iii. BLOW HOLE CLEAN. REPEAT 3 TIMES.
   D. INSTALL EPOXY STARTING AT BACK OF HOLE. AS REQUIRED BY MPII, USE MANUFACTURER SUPPLIED PISTON PLUG INJECTION SYSTEM FOR ALL HORIZONTAL AND VERTICALLY INCLINED HOLES.
   E. INSTALL ANCHOR BY SIMULTANTEOUSLY TWISTING AND INSERTING INTO HOLE.
   F. ALLOW ANCHOR TO SET REQUIRED TIME. DO NOT DISTURB.
   G. TIGHTEN NUT. DO NOT OVER-TORQUE.
   H. MINIMUM CONCRETE AGE AT TIME OF INSTALLATION: 28 DAYS
   I. CONCRETE TEMPERATURE RANGE AT TIME OF INSTALLATION SHALL BE: 41DEG F TO 104DEG F.
   J. CONCRETE MOISTURE CONDITION AT TIME OF INSTALLATION: DRY.

STRUCTURAL MODIFICATIONS

1. REFER TO OTHER DISCIPLINE DRAWINGS FOR RELOCATION AND DEMOLITION OF PIPING, CONDUITS, FIXTURES, INSTRUMENTS, ETC. ASSOCIATED WITH STRUCTURES SHOWN TO BE DEMOLISHED.

2. ALL DEMOLITION, REMOVAL, AND CONSTRUCTION ACTIVITIES SHALL BE CONDUCTED WITH CONSIDERATION FOR EXISTING STRUCTURES, EQUIPMENT, ETC. ANY DAMAGE WHICH MAY OCCUR BEYOND DESCRIBED DEMOLITION AND CONSTRUCTION SHALL BE REMEDIED AT CONTRACTOR'S EXPENSE AND OWNER/ENGINEER NOTIFIED. DO NOT OVER CUT AT OPENINGS AND PROPOSED DEMOLITION AREAS UNLESS SPECIFICALLY NOTED AS ACCEPTABLE IN THE DRAWINGS.

3. CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE OF ALL DEMOLISHED CONCRETE AND OTHER MATERIALS FROM THE EXISTING STRUCTURES OFF SITE PRIOR TO THE NEW CONSTRUCTION.

4. UNLESS NOTED OTHERWISE, CUTTING EMBEDDED REBARS DUE TO PIPING, CONDUITS, OR ANY OTHER PENETRATION THROUGH EXISTING CONCRETE OR MASONRY STRUCTURE IS PROHIBITED. CONTRACTOR SHALL DETECT THE EXISTING REBAR LOCATIONS BY NONDESTRUCTIVE TESTING METHODS AND KEEP PENETRATION AWAY FROM THE EMBEDDED REBARS.

5. WHERE REMOVING EXISTING CONCRETE BUT RETAINING REBARS IS INDICATED ON DRAWINGS, SAWCUT EXISTING CONCRETE TO THE LIMITS SHOWN ON PLANS BUT NOT MORE THAN 3/4" DEEP TO AVOID DAMAGING OR NICKING THE REINFORCING.

6. WHERE DEMOLITION OF EXISTING CONCRETE WILL LEAVE EMBEDDED EXISTING REBARS EXPOSED, AN ADDITIONAL 1-1/2" CONCRETE AND REINFORCEMENT BEYOND LIMITS OF THE DEMOLITION SHALL BE REMOVED. THE 1-1/2" AREAS BEING REMOVED SHALL THEN BE PLACED BACK WITH CONCRETE STRUCTURAL REPAIR MATERIAL AS SPECIFIED TO PROVIDE CORROSION PROTECTION FOR THE EXPOSED EXISTING REBARS, UNLESS NOTED OTHERWISE NOTED.

7. ROUGHEN THE EXISTING CONCRETE SURFACES THAT WILL ENCOUNTER NEW CONCRETE. "ROUGHENED SURFACE" SHALL HAVE A UNIFORMLY ROUGHENED CONCRETE SURFACE TO A FULL AMPLITUDE (DISTANCE BETWEEN HIGH AND LOW POINTS OR SIDE TO SIDE) OF APPROXIMATELY 1/4" WITH SUITABLE TOOLS TO EXPOSE A FRESH FACE. APPLY SPECIFIED BONDING AGENT TO THE EXISTING CONCRETE SURFACES PRIOR TO THE PLACEMENT OF NEW CONCRETE PER MANUFACTURER'S INSTRUCTIONS.

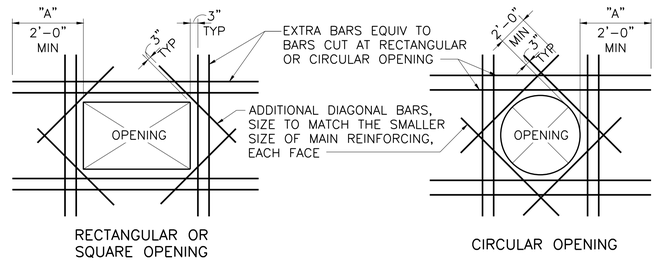
8. ALL EXPOSED EXISTING REBARS SHALL BE CLEANED BY ABRASIVE BLASTING AND COATED WITH AN EPOXY RESIN/PORTLAND CEMENT ADHESIVE BONDING AGENT TO PROVIDE CORROSION PROTECTION.

9. PRIOR TO DEMOLITION, CONTRACTOR SHALL PERFORM GPR SCANNING OF EXISTING CMU WALLS TO DETERMINE LOCATION OF REINFORCING, GROUTED AND/OR UNGROUTED CELLS, BOND BEAMS, LINTELS, ETC. PENETRATIONS SHALL BE LOCATED TO AVOID CUTTING EXISTING REINFORCING AND GROUTED CELLS. ADJUSTED LOCATIONS OF PENETRATIONS SHALL BE INCLUDED IN COORDINATION DRAWINGS.

IBC CHAPTER 17 SPECIAL INSPECTION REQUIREMENTS

1. SPECIAL INSPECTIONS ARE REQUIRED TO BE PERFOMRED IN ACCORDANCE WITH IBC 2015.

2. THE CONTRACTOR IS REQUIRED TO ENABLE THE ABOVE INSPECTIONS TO OCCUR BY PROVIDING ACCESS TO THE ELEMENTS REQUIRING INSPECTION. IN ADDITION, THE CONTRACTOR SHALL PROVIDE 48 HOURS ADVANCED NOTICE TO THE OWNER OR THE OWNER'S REPRESENTATIVE REGARDING ALL CONSTRUCTION ACTIVITIES RELATED TO AND/OR AFFECTING THE REQUIRED SPECIAL INSPECTIONS.



NOTES:
1. DISCONTINUE TYPICAL REINFORCING AT OPENING.
2. PLACE ADDITIONAL BARS IN SAME ORIENTATION AND POSITION AS BARS CUT BY OPENING. PROVIDE ONE SET OF BARS FOR EACH LAYER OF REINFORCING CUT.
3. "A" = TOP BAR EMBEDMENT LENGTH (24" MINIMUM). PROVIDE STANDARD HOOK IF FULL EMBEDMENT LENGTH IS NOT POSSIBLE.
4. REINFORCING STEEL IS TO BE CARRIED ACROSS ALL CONSTRUCTION JOINTS.
5. SEE MECHANICAL AND ARCHITECTURAL DRAWINGS FOR SLAB AND WALL OPENINGS NOT SHOWN ON STRUCTURAL DRAWINGS.
6. ADDITIONAL REINFORCING MAY BE OMITTED ONLY WHERE OPENING IS FRAMED BY BEAMS OR WALLS.
7. ADDITIONAL REINFORCING NOT REQUIRED WHEN SPECIFIED REINFORCING IS NOT CUT.
8. ALL REINFORCING SPACING SHALL BE GREATER THAN 3" CENTER TO CENTER.

1 — TYPICAL WALL OR SLAB OPENING ADDITIONAL REINFORCEMENT
NOT TO SCALE



04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: JLM
REVIEWED BY: PAB

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
AUSTIN, TEXAS 78763-5218
CAMP MABRY P.O. BOX 5218 FAX (512) 782-1481
(512) 782-6131

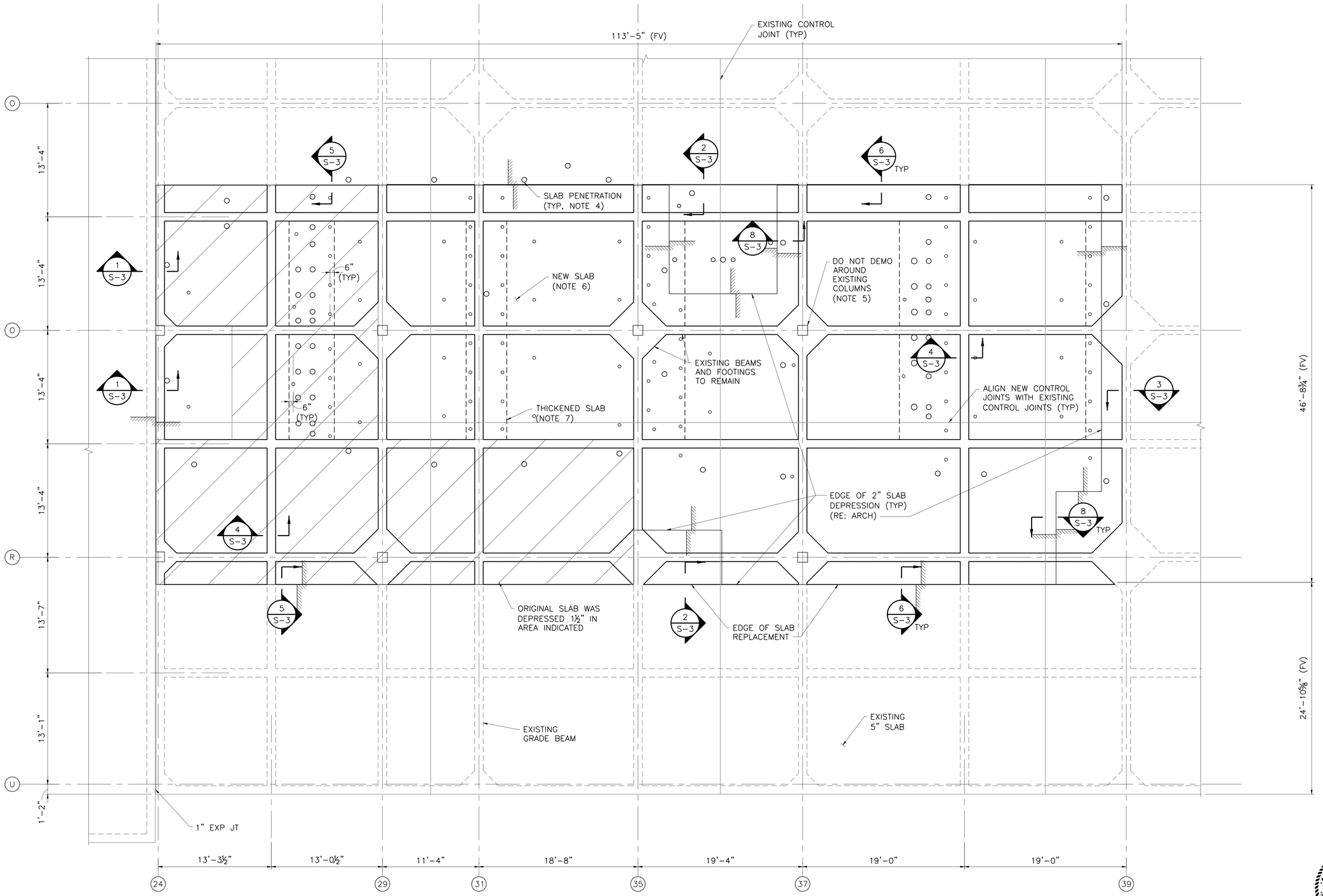
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

STRUCTURAL GENERAL NOTES

S-0

SHT. 42 of 129



NORTH TRUE NORTH PLAN

1 — FOUNDATION PLAN
3/16"=1'-0"

NOTES:
1. FIELD VERIFY EXISTING GRADE BEAM LOCATIONS AND SIZES PRIOR TO DEMOLITION.
2. CARE SHALL BE TAKEN DURING DEMOLITION AND CONSTRUCTION TO NOT DAMAGE EXISTING STRUCTURE SHOWN TO REMAIN.
3. DO NOT OVER CUT SLAB DURING SLAB DEMOLITION. DO NOT CUT THROUGH EXISTING GRADE BEAMS OR FOOTINGS.
4. REFER TO PLUMBING FOR ALL UNDERFLOOR PIPE LOCATIONS AND PENETRATIONS. ALL LOCATIONS MAY NOT BE SHOWN ON STRUCTURAL SHEETS.
5. DO NOT CHIP CONCRETE AT COLUMNS. 14"x14" AREA AROUND EXISTING COLUMNS SHALL NOT BE DEPRESSED.
6. 5" CONCRETE SLAB-ON-GRADE REINFORCED WITH #4 @ 12"C/C, EACH WAY, ON 3" CHAIRS.
7. WHERE MULTIPLE SLAB PENETRATIONS IN CLOSE PROXIMITY EXIST, THICKEN SLAB TO 9". ADD ADDITIONAL REINFORCEMENT AROUND PENETRATIONS PER 1/S-0.

STATE OF TEXAS — MISTY THOMSON — 110346 — LICENSED PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: JLM
REVIEWED BY: PAB

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 (512) 782-6131
AUSTIN, TEXAS 78763-5218 FAX (512) 782-1481

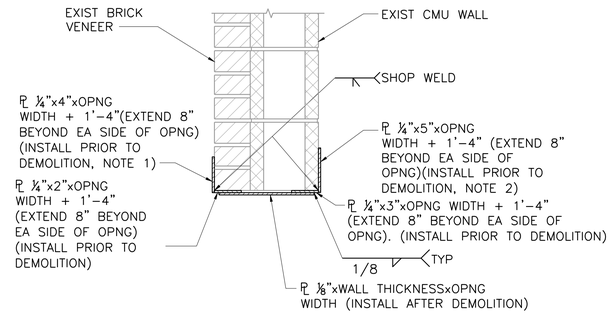
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

STRUCTURAL FOUNDATION PLAN

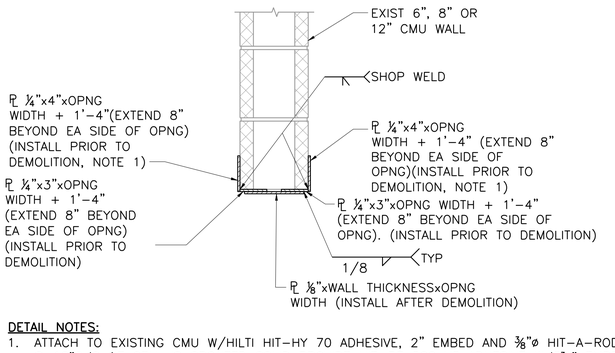
S-1

SHT. 43 of 129



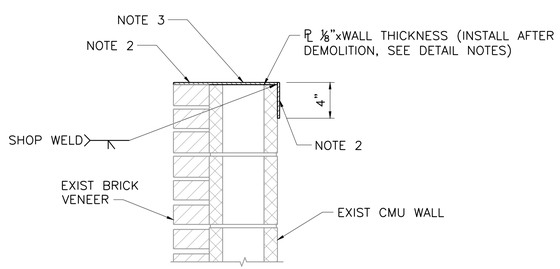
DETAIL NOTES:
1. ATTACH TO EXISTING BRICK AT 16" C/C MAXIMUM WITH ¼"ø HILTI KWIK-CON II AND 1¾" EMBEDMENT. DO NOT LOCATE ANCHORS IN HEAD OR BED JOINTS.
2. ATTACH TO EXISTING CMU W/HILTI HIT-HY 70 ADHESIVE, 2" EMBED AND ⅜"ø HIT-A-ROD @ 16"C/C (IF CELL IS GROUTED SOLID PROVIDE HIT-RE 500 V3 ADHESIVE W/3⅜" EMBED)
3. FIELD VERIFY EXISTING CONDITIONS PRIOR TO DEMOLITION.

1 — HEADER DETAIL AT EXISTING WALL WITH BRICK VENEER
1 1/2"=1'-0"



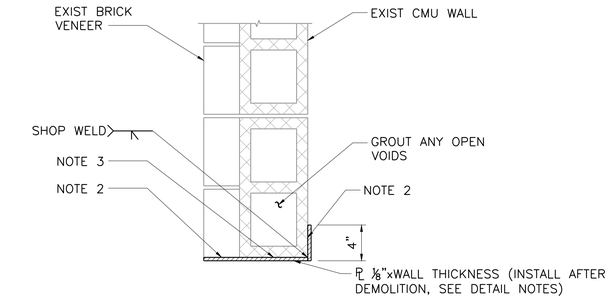
DETAIL NOTES:
1. ATTACH TO EXISTING CMU W/HILTI HIT-HY 70 ADHESIVE, 2" EMBED AND ⅜"ø HIT-A-ROD @ 16"C/C (IF CELL IS GROUTED SOLID PROVIDE HIT-RE 500 V3 ADHESIVE W/3⅜" EMBED)
2. FIELD VERIFY EXISTING CONDITIONS PRIOR TO DEMOLITION.
3. ℄ ¼"x3" HORIZONTAL PLATES MAY BE REDUCED TO ℄ ¼"x2" PLATES AT 6" CMU WALLS.

4 — HEADER DETAIL AT EXISTING CMU WALL
1 1/2"=1'-0"



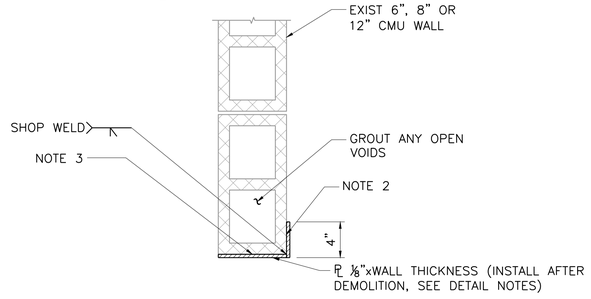
DETAIL NOTES:
1. WELD SILL PLATE TO NEW JAMB PLATE. ANCHOR TO EXISTING CMU WALL AND BRICK VENEER WITH ¼"ø HILTI KWIK-CON II ANCHORS AND 1¾" EMBEDMENT AT THE SPACING INDICATED BELOW. DO NOT LOCATE ANCHORS IN HEAD OR BED JOINTS.
2. ATTACH ⅛" PLATE TO BRICK AND INSIDE FACE OF CMU AT 8" C/C.
3. ATTACH ⅛" PLATE TO HEAD JOINT OF CMU AT 16" C/C.
4. FIELD VERIFY EXISTING CONDITIONS PRIOR TO DEMOLITION.

7 — SILL DETAIL AT EXISTING WALL WITH BRICK VENEER
1 1/2"=1'-0"



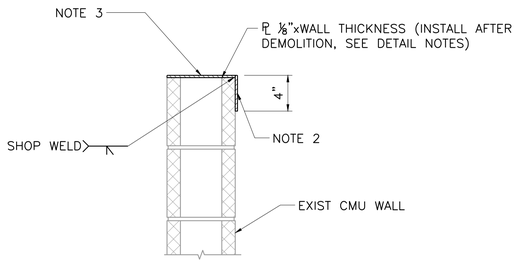
DETAIL NOTES:
1. WELD JAMB PLATE TO NEW HEADER PLATE. ANCHOR TO EXISTING CMU WALL AND BRICK VENEER WITH ¼"ø HILTI KWIK-CON II ANCHORS AND 1¾" EMBEDMENT AT THE SPACING INDICATED BELOW. DO NOT LOCATE ANCHORS IN HEAD OR BED JOINTS.
2. ATTACH ⅛" PLATE TO BRICK AND INSIDE FACE OF CMU AT 8" C/C.
3. ATTACH ⅛" PLATE TO HEAD JOINT OF CMU AT 16" C/C.
4. FIELD VERIFY EXISTING CONDITIONS PRIOR TO DEMOLITION.

2 — JAMB DETAIL AT EXISTING WALL WITH BRICK VENEER
1 1/2"=1'-0"



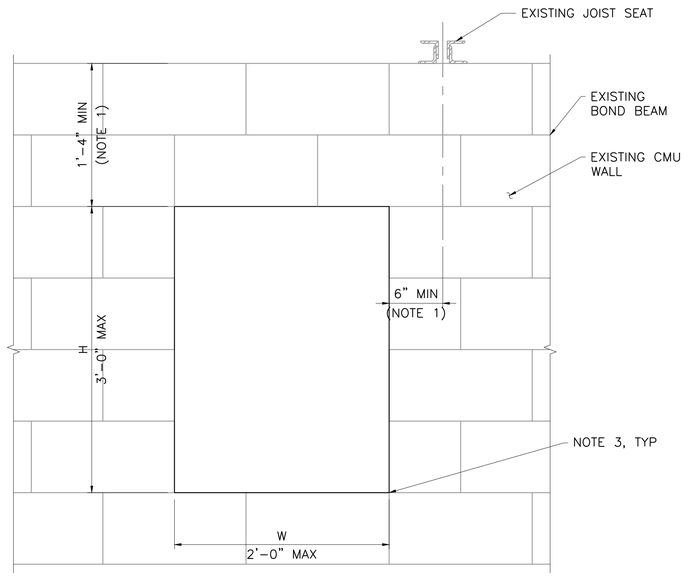
DETAIL NOTES:
1. WELD JAMB PLATE TO NEW HEADER PLATE. ANCHOR TO EXISTING CMU WALL WITH ¼"ø HILTI KWIK-CON II ANCHORS AND 1¾" EMBEDMENT AT THE SPACING INDICATED BELOW. DO NOT LOCATE ANCHORS IN HEAD OR BED JOINTS.
2. ATTACH ⅛" PLATE TO INSIDE FACE OF CMU AT 8" C/C.
3. ATTACH ⅛" PLATE TO HEAD JOINT OF CMU AT 16" C/C.
4. FIELD VERIFY EXISTING CONDITIONS PRIOR TO DEMOLITION.

5 — JAMB DETAIL AT EXISTING CMU WALL
1 1/2"=1'-0"



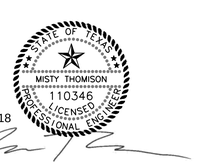
DETAIL NOTES:
1. WELD SILL PLATE TO NEW JAMB PLATE. ANCHOR TO EXISTING CMU WALL AND BRICK VENEER WITH ¼"ø HILTI KWIK-CON II ANCHORS AND 1¾" EMBEDMENT AT THE SPACING INDICATED BELOW. DO NOT LOCATE ANCHORS IN HEAD OR BED JOINTS.
2. ATTACH ⅛" PLATE TO INSIDE FACE OF CMU AT 8" C/C.
3. ATTACH ⅛" PLATE TO HEAD JOINT OF CMU AT 16" C/C.
4. FIELD VERIFY EXISTING CONDITIONS PRIOR TO DEMOLITION.

3 — SILL DETAIL AT EXISTING WALL
1 1/2"=1'-0"



DETAIL NOTES:
1. OPENINGS CUT IN EXISTING CMU WALLS SHALL BE LOCATED NO LESS THAN 6" HORIZONTALLY FROM EXISTING JOIST SEATS OR NO LESS THAN 1'-4" BELOW EXISTING JOIST SEAT ELEVATION.
2. CUTTING EMBEDDED REBARS DUE TO PIPING, CONDUITS, OR ANY OTHER PENETRATION THROUGH EXISTING MASONRY STRUCTURE IS PROHIBITED. OPENINGS SHALL BE LOCATED TO AVOID CUTTING EXISTING REBAR AND BOND BEAMS. CONTRACTOR SHALL DETECT THE EXISTING REBAR LOCATIONS BY NONDESTRUCTIVE TESTING METHODS AND KEEP PENETRATION AWAY FROM THE EMBEDDED REBARS.
3. DO NOT OVER CUT OPENINGS AT CORNERS.
4. DO NOT CUT OPENINGS THROUGH VAULT WALLS.
5. THIS DETAIL SHALL APPLY FOR ALL OPENINGS THROUGH EXISTING CMU WALLS WHERE H IS LESS THAN OR EQUAL TO 3'-0" AND W IS LESS THAN OR EQUAL TO 2'-0". WHERE OPENING DIMENSIONS EXCEED THESE LIMITS, STEEL HEADERS, JAMBS, AND SILLS SHALL BE INSTALLED. COORDINATE SIZE AND LOCATION OF OPENINGS WITH OTHER DISCIPLINE DRAWINGS.

6 — SMALL PENETRATIONS THROUGH EXISTING CMU WALLS
NOT TO SCALE



0 4' 8'
3/16"=1'-0"



PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: JLM
REVIEWED BY: PAB

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

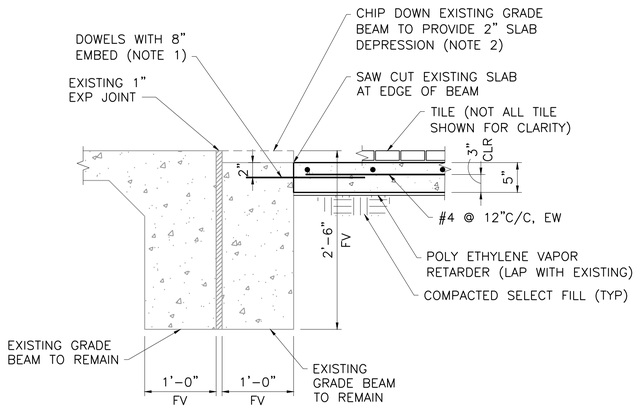
TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

STRUCTURAL TYPICAL DETAILS

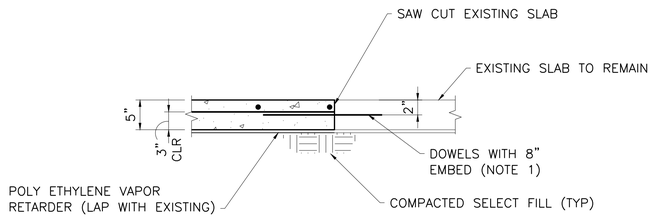
S-2

SHT. 44 of 129



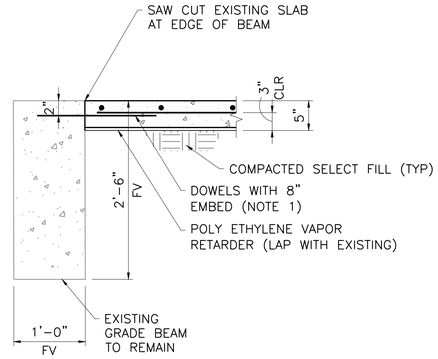
NOTES:
1. DOWELS SHALL BE #4 BARS @ 12"C/C. DRILL AND EPOXY INTO EXISTING SLAB/BEAM USING HILTI HIT-RE 500 V3 OR APPROVED EQUAL. LAP WITH NEW SLAB REINF A MINIMUM OF 12".
2. DEPTH OF DEMOLITION VARIES, MAXIMUM DEMOLITION DEPTH OF 2". DO NOT DAMAGE EXISTING GRADE BEAM REINFORCING. IF REINFORCING IS EXPOSED, NOTIFY ENGINEER.

1 / S-1 TYPICAL SECTION AT EDGE BEAM
1"=1'-0"



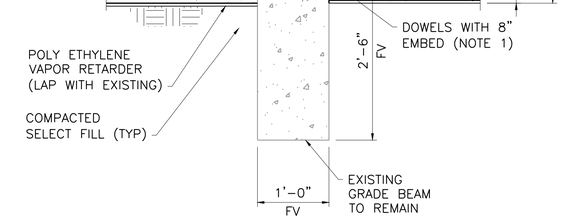
NOTES:
1. DOWELS SHALL BE #4 BARS @ 12"C/C. DRILL AND EPOXY INTO EXISTING SLAB/BEAM USING HILTI HIT-RE 500 V3 OR APPROVED EQUAL. LAP WITH NEW SLAB REINF A MINIMUM OF 12".

2 / S-1 TYPICAL SECTION AT SLAB
1"=1'-0"



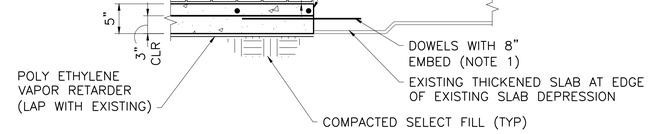
NOTES:
1. DOWELS SHALL BE #4 BARS @ 12"C/C. DRILL AND EPOXY INTO EXISTING SLAB/BEAM USING HILTI HIT-RE 500 V3 OR APPROVED EQUAL. LAP WITH NEW SLAB REINF A MINIMUM OF 12".

3 / S-1 TYPICAL SECTION AT INTERIOR BEAM
1"=1'-0"



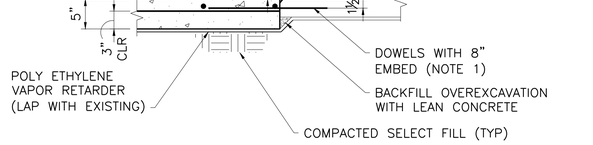
NOTES:
1. DOWELS SHALL BE #4 BARS @ 12"C/C. DRILL AND EPOXY INTO EXISTING SLAB/BEAM USING HILTI HIT-RE 500 V3 OR APPROVED EQUAL. LAP WITH NEW SLAB REINF A MINIMUM OF 12".
2. DEPTH OF DEMOLITION VARIES, MAXIMUM DEMOLITION DEPTH OF 2". DO NOT DAMAGE EXISTING GRADE BEAM REINFORCING. IF REINFORCING IS EXPOSED, NOTIFY ENGINEER.

4 / S-1 SECTION AT DEPRESSED INTERIOR BEAM
1"=1'-0"



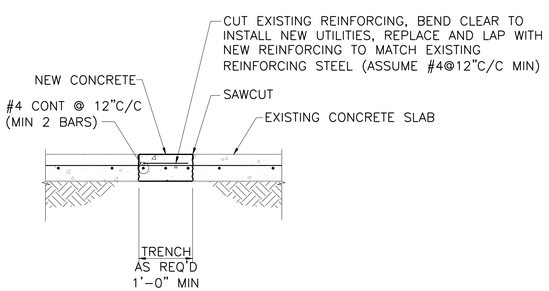
NOTES:
1. DOWELS SHALL BE #4 BARS @ 12"C/C. DRILL AND EPOXY INTO EXISTING SLAB/BEAM USING HILTI HIT-RE 500 V3 OR APPROVED EQUAL. LAP WITH NEW SLAB REINF A MINIMUM OF 12".

5 / S-1 SECTION AT DEPRESSED SLAB
1"=1'-0"

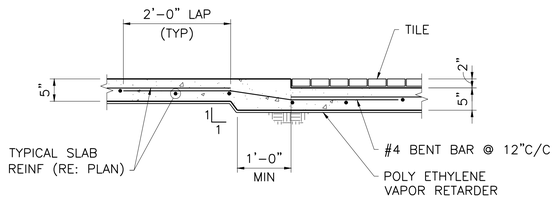


NOTES:
1. DOWELS SHALL BE #4 BARS @ 12"C/C. DRILL AND EPOXY INTO EXISTING SLAB/BEAM USING HILTI HIT-RE 500 V3 OR APPROVED EQUAL. LAP WITH NEW SLAB REINF A MINIMUM OF 12".

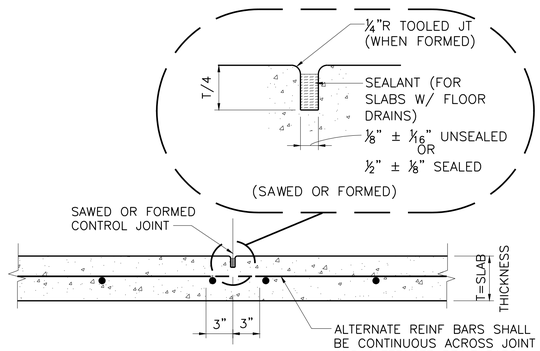
6 / S-1 TYPICAL SECTION AT SLAB
1"=1'-0"



7 / – SLAB TRENCHING DETAIL
NOT TO SCALE



8 / – SECTION AT NEW FLOOR DEPRESSION
3/4"=1'-0"



NOTES:
1. REFER TO PLAN FOR SLAB CONTROL JOINT LOCATIONS.
2. SAW JOINTS WITHIN 1 HOUR OF COMPLETION OF FINISHING OPERATIONS WITH EARLY-ENTRY ROLLER SAW.

9 / – SLAB SAW CUT CONTROL JOINT (SJ)
NOT TO SCALE

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: JLM
REVIEWED BY: PAB

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

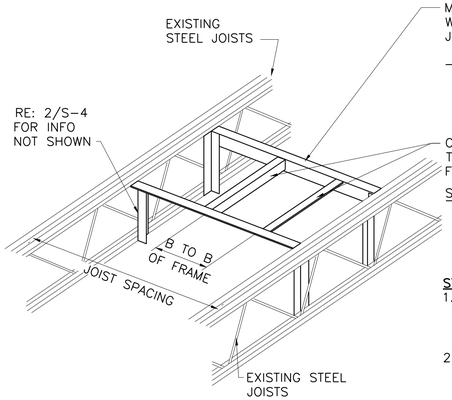
TXARNG CFMO

STRUCTURAL FOUNDATION DETAILS

S-3

SHT. 45 of 129

MISTY THOMISON 110346 LICENSED PROFESSIONAL ENGINEER
04/20/2018



MAIN SUPPORT ANGLES – FIELD WELD BETWEEN ADJACENT ROOF JOISTS. SIZE AS FOLLOWS:

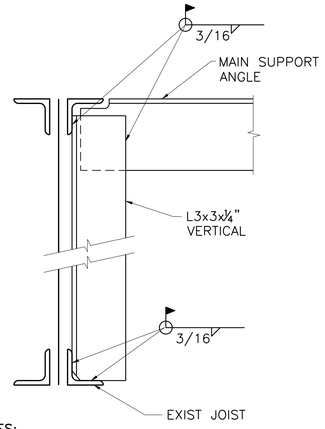
JOIST SPACING	ANGLE SIZE
1'–0" TO 3'–0"	3" x 4" x 5/16" LLV
3'–1" TO 5'–0"	4" x 4" x 3/8"
5'–1" TO 7'–0"	3" x 5" x 3/8" LLV

CROSS FRAMING MEMBERS – SHOP WELD TO MAIN SUPPORT ANGLES. SIZE AS FOLLOWS:

SUPPORT ANGLE SPACING	ANGLE SIZE
6" TO 3'–0"	2" x 2" x 1/4"
3'–1" TO 5'–0"	3" x 4" x 1/4" LLV
5'–1" TO 6'–8"	4" x 4" x 3/8"

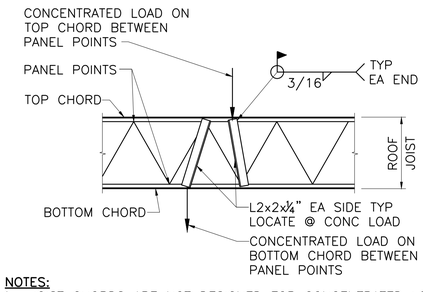
STEEL FRAME NOTES:
1. PROVIDE A ROOF FRAME FOR EACH MECHANICAL EQUIPMENT ROOF PENETRATION. UNLESS NOTED OTHERWISE (UNO) USE THE TYPICAL FRAME DETAIL SHOWN.
2. SIZE OF OPENING (B TO B OF FRAME) TO BE DETERMINED BY THE EQUIPMENT TO BE INSTALLED. VERIFY W/MECH DRAWINGS & SHOP DRAWINGS.

1 / – ROOF FRAMING @ MECHANICAL EQUIPMENT OPENING
NOT TO SCALE



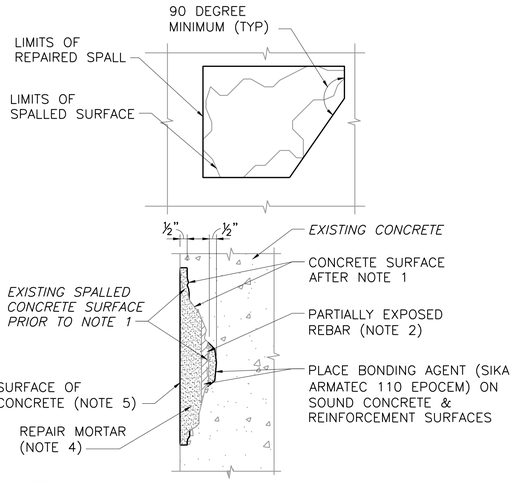
NOTES:
1. WHERE VERTICAL ANGLE DOES NOT ALIGN WITH PANEL JOINT, REINFORCE JOIST PER 3/S-4.

2 / – MECHANICAL OPENING DETAIL
NOT TO SCALE



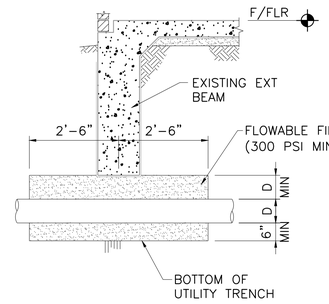
NOTES:
1. JOIST CHORDS ARE NOT DESIGNED FOR CONCENTRATED LOADS. WHEN POSSIBLE PLACE LOADS @ PANEL POINTS. IF LOADS OCCUR BETWEEN PANEL POINTS FIELD WELD ANGLES EACH SIDE FROM POINT OF LOAD TO NEAREST PANEL POINT AS SHOWN ABOVE.
2. REFER TO MECHANICAL PLANS FOR ROOFTOP UNITS.

3 / – TYPICAL JOIST REINFORCING
NOT TO SCALE



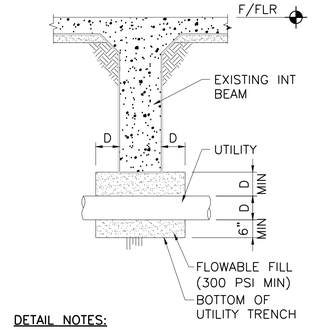
DETAIL NOTE:
1. SAW CUT PERIMETER OF SPALLED AREA. REMOVE CONCRETE WITHIN CUT PERIMETER AS REQUIRED TO PROVIDE A ½" MINIMUM REPAIR DEPTH. REMOVE ALL UNSOUND CONCRETE. CLEAN REBAR OF CORROSION AND CONTAMINATES USING MECHANICAL MEANS.
2. IF ANY REBAR HAS MORE THAN HALF ITS CROSS-SECTION EXPOSED, THEN REMOVE CONCRETE FROM AROUND THE BAR TO A MINIMUM DEPTH OF ½".
3. CRACKS IN SOUND CONCRETE, THAT EXTEND OUT FROM THE SPALLED AREA TO BE REPAIRED, SHALL BE PRESSURE INJECTED WITH HIGH STRENGTH, LOW VISCOSITY EPOXY. USE SIKADUR 35, HI-MOD LV, BY SIKA CORPORATION. PROVIDE SUPPORT PRODUCTS AND CRACK PREPARATION AS RECOMMENDED BY MANUFACTURER.
4. REPAIR MORTAR SHALL BE SIKATOP 122 PLUS (FOR HORIZONTAL SURFACES) OR SIKATOP 123 PLUS (FOR VERTICAL AND OVERHEAD SURFACES), BY SIKA CORPORATION. PREPARE, INSTALL IN MULTIPLE LIFTS AS REQUIRED, FINISH, AND CURE AS RECOMMENDED BY MANUFACTURER.
5. FINISHED SURFACE TEXTURE SHALL MATCH EXISTING FINISH TEXTURE.

4 / – TYPICAL CONCRETE SPALL & CRACK REPAIR
NOT TO SCALE



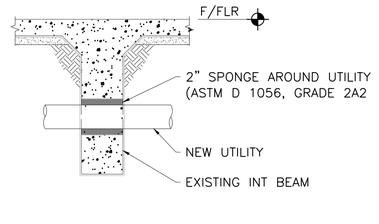
DETAIL NOTES:
1. WIDTH OF FLOWABLE FILL SHALL MATCH WIDTH OF EXCAVATED UTILITY TRENCH, BUT NOT LESS THAN 6" EACH SIDE OF UTILITY.

5 / – UTILITY CROSSING BELOW EXTERIOR BEAM
NOT TO SCALE



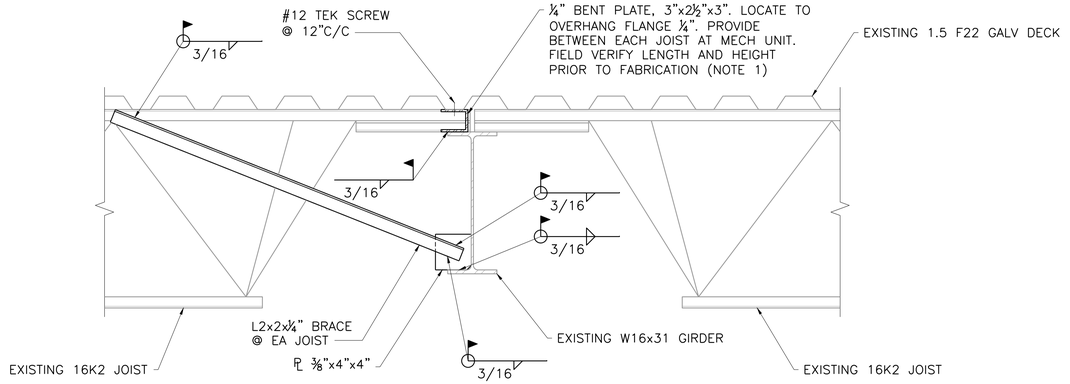
DETAIL NOTES:
1. WIDTH OF FLOWABLE FILL SHALL MATCH WIDTH OF EXCAVATED UTILITY TRENCH, BUT NOT LESS THAN 6" EACH SIDE OF UTILITY.

6 / – UTILITY CROSSING BELOW INTERIOR BEAM
NOT TO SCALE



DETAIL NOTES:
1. LOCATE PENETRATION WITHIN MIDDLE ⅓ OF EXISTING BEAM. PRIOR TO CORING PENETRATION THROUGH BEAM CONTRACTOR SHALL DETECT EXISTING REBAR LOCATIONS BY NON-DESTRUCTIVE TESTING METHODS AND LOCATE PENETRATIONS AWAY FROM THE EMBEDDED REBARS.

8 / – UTILITY CROSSING THROUGH INTERIOR BEAM
NOT TO SCALE



NOTES:
1. INSTALL AND WELD BENT PLATE WHEN SUPPORTED ROOF IS UNLOADED – PRIOR TO INSTALLING NEW EQUIPMENT AND WHEN THERE IS NO LIVE LOAD ON ROOF.

7 / – MECHANICAL EQUIPMENT SUPPORT DETAIL
1 1/2"=1'–0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: JLM
REVIEWED BY: PAB

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

STRUCTURAL FRAMING DETAILS

S-4

SHT. 46 of 129



04/20/2018

HVAC SYMBOLS (ALL SYMBOLS SHOWN ARE NOT NECESSARILY USED ON THE DRAWINGS)

ABBREVIATIONS

A/C	AIR CONDITIONING
AFF	ABOVE FINISHED FLOOR
APPROX	APPROXIMATELY
ARCH	ARCHITECTURE/ARCHITECTURAL
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS
BAS	BUILDING AUTOMATION SYSTEM
BHP	BRAKE HORSEPOWER
BTUH	BRITISH THERMAL UNIT PER HOUR
C	CENTIGRADE
CC	COOLING COIL
CFM	CUBIC FEET PER MINUTE
CD	CONDENSATE DRAIN
CONN	CONNECTION
dB	DECIBELS
DIA	DIAMETER
DB	DRY BULB
DDC	DIRECT DIGITAL CONTROL
DEG	DEGREE
DX	DIRECT EXPANSION
DWGS	DRAWINGS
ELEC	ELECTRIC/ELECTRICAL
EAT	ENTERING AIR TEMPERATURE
EWT	ENTERING WATER TEMPERATURE
EFF	EFFICIENCY
EL	ELEVATION
EMCS	ENERGY MONITORING AND CONTROL SYSTEM
EXH	EXHAUST
F	FAHRENHEIT
FLEX	FLEXIBLE
FPM	FEET PER MINUTE
FT	FEET, FOOT
GPM	GALLONS PER MINUTE
HC	HEATING COIL
HVAC	HEATING, VENTILATION AND AIR CONDITIONING
HZ	HERTZ
HP	HORSEPOWER
HTG	HEATING
IN	INCHES
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LWT	LEAVING WATER TEMPERATURE
MAX	MAXIMUM
MECH	MECHANICAL
MCA	MINIMUM CIRCUIT AMPACITY
MBH	THOUSANDS BTU's PER HOUR
MIN	MINIMUM
NFPA	NATIONAL FIRE PROTECTION ASSOC.
NC	NOISE CRITERIA
NOM	NOMINAL
NTS	NOT TO SCALE
NO	NUMBER
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
OA	OUTSIDE AIR
P/PH	PHASE
PLBG	PLUMBING
PSI	POUNDS PER SQUARE INCH
RE	REFER/REFERENCE
RA	RETURN AIR
RPM	REVOLUTIONS PER MINUTE
SMACNA	SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOC.
SQ FT	SQUARE FEET
SP	STATIC PRESSURE
SA	SUPPLY AIR
TEMP	TEMPERATURE
T-STAT	THERMOSTAT
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VAV	VARIABLE AIR VOLUME
VFD	VARIABLE FREQUENCY DRIVE
VD	VOLUME DAMPER
WT	WATTS
WTR	WATER
WC	WATER COLUMN
WG	WATER GAUGE
WB	WET BULB

PIPING SYMBOLS

- ELBOW UP
- ELBOW DOWN
- PLUG CLEAN-OUT
- CONTROL VALVE
- CLEAN OUT
- PIPE GUIDE
- CAP ON END LINE
- DIRECTION OF FLOW

MISCELLANEOUS

- A200 — DIFFUSER/GRILLE/REGISTER LABEL: "A" – TYPE/DESIGNATION, "200" – AIRFLOW (CFM)
- T — THERMOSTAT
- E — EMERGENCY HVAC SHUTDOWN SWITCH
- H — HUMIDITY SENSOR
- DRAWING NOTE REFERENCE
- ∅ — DIAMETER/PHASE
- DP — DIFFERENTIAL PRESSURE SENSOR
- C — CO2 SENSOR
- SP — DUCT MOUNTED STATIC PRESSURE SENSOR
- S — DUCT SMOKE DETECTOR
- F — FIRESTAT
- POINT OF NEW CONNECTION BETWEEN NEW AND EXISTING WORK
- X — SENSOR WITH LOCKING PROTECTIVE GUARD

PLAN SYMBOLOGY

DEMOLITION PLANS		SINGLE LINE	DOUBLE LINE	NEW PLANS		SINGLE LINE
DUCTWORK	EXISTING TO REMAIN			DUCTWORK	EXISTING TO REMAIN	
DUCTWORK	EXISTING TO BE REMOVED			DUCTWORK	NEW	
PIPING	EXISTING TO REMAIN			PIPING	EXISTING TO REMAIN	
PIPING	EXISTING TO BE REMOVED			PIPING	NEW	
EXISTING EQUIPMENT TO BE RELOCATED.		R		EXISTING EQUIPMENT TO BE RELOCATED.		R

DUCTWORK SYMBOLS

- SUPPLY AIR DIFFUSER – ARROWS INDICATE PATTERN. NO ARROWS SHOWN EQUALS 4-WAY.
- RETURN/TRANSFER/INTAKE AIR GRILLE
- EXHAUST GRILLE
- SUPPLY AIR PLENUM SLOT DIFFUSER
- 12" — ROUND DUCTWORK
- 12/12 — RECTANGULAR DUCTWORK. SIZE INDICATED IN INCHES, FIRST NUMBER IS SIDE SHOWN
- FLEXIBLE DUCT
- SUPPLY OR OUTSIDE AIR DUCT
- RETURN/TRANSFER AIR DUCT
- RELIEF OR EXHAUST AIR DUCT
- RADIUS DUCTWORK ELBOW ROUND OR RECTANGULAR
- RECTANGULAR DUCTWORK BRANCH TAKE-OFF W/DAMPER AND 45 DEGREE BRANCH INLET
- FLARED SPIN-IN TAP WITH DAMPER
- SPIN-IN TAP WITH DAMPER
- ROUND DUCT BRANCH TAKE-OFF FROM RECTANGULAR OR FLAT OVAL MAIN WITH CONICAL TAP. PROVIDE BALANCE DAMPER FOR LOW PRESSURE DUCTWORK ONLY
- DUCTWORK SIZE TRANSITION.
- FLEXIBLE DUCT CONNECTION TO EQUIPMENT
- SUPPLY OR OUTSIDE AIR DUCT UP
- SUPPLY OR OUTSIDE AIR DUCT DOWN
- RETURN AIR DUCT UP
- RETURN AIR DUCT DOWN
- RELIEF OR EXHAUST AIR DUCT UP
- RELIEF OR EXHAUST AIR DUCT DOWN
- IN-LINE 90 DEGREE RISE OR DROP IN DUCT
- UP — INCLINED RISE IN DUCT
- DN — INCLINED DROP IN DUCT
- 90° ELBOW WITH TURNING VANES
- M — MOTORIZED DAMPER
- MANUAL VOLUME (BALANCE) DAMPER
- FD – FIRE DAMPER; SD – SMOKE DAMPER; CD – COMBINATION FIRE/SMOKE DAMPER

PIPING TYPES

- CONDENSATE DRAIN (COLD)

EQUIPMENT DESIGNATIONS

AHU	AIR HANDLING UNIT
ACCU	AIR-COOLED CONDENSING UNIT
CU	DEDICATED CONDENSING UNIT
DH	DEHUMIDIFIER
EF	EXHAUST FAN
FCU	FAN COIL UNIT
HRU	HEAT RECOVERY UNIT
HVLS	HIGH VELOCITY LOW SPEED FAN
MS	MINISPLIT
RH	RELIEF HOOD
RTU	ROOFTOP UNIT
SF	SUPPLY FAN
UH	GAS-FIRED UNIT HEATER

GENERAL NOTES

1. THIS PROJECT IS DESIGNED BASED ON THE FOLLOWING CODES: INTERNATIONAL MECHANICAL CODE 2015, INTERNATIONAL ENERGY CONSERVATION CODE 2015, UFC 3-401-01 MECHANICAL ENGINEERING, UFC 3-410-01 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS, WITH CHANGE 1, UFC-3-420-01 PLUMBING SYSTEMS, UFC 3-600-01 FIRE PROTECTION ENGINEERING FOR FACILITIES, UFC 4-010-01 DOD MINIMUM ANTITERRORISM STANDARDS FOR BUILDINGS, UFC-4-024-01 PROCEDURES FOR DESIGNING AIRBORNE CHEMICAL PROTECTION FOR BUILDINGS.
2. FURNISH AND INSTALL ALL EQUIPMENT AS PER MANUFACTURER'S RECOMMENDATIONS AND INSTRUCTIONS.
3. VERIFY DIMENSIONS, LOCATIONS, ELEVATIONS AND CONFIGURATION OF ALL ITEMS ASSOCIATED WITH INSTALLATION OF THE DUCTWORK AND EQUIPMENT.
4. PROVIDE MODIFICATIONS AND ACCESSORIES AS REQUIRED AND RECOMMENDED BY THE MANUFACTURER TO ENSURE PROPER OPERATION OF EQUIPMENT.
5. PAINT ALL EQUIPMENT VISIBLE THRU AIR DEVICES MATTE BLACK.
6. PROVIDE MANUAL VOLUME DAMPERS IN DUCTWORK AT ALL DUCT SPLITS, BRANCH RUNOUTS AND DUCT COLLARS FOR SUPPLY AIR AND EXHAUST AIR DIFFUSERS, REGISTERS AND GRILLES.
7. ALL DUCT SIZES SHOWN ON THE DRAWINGS ARE NET INSIDE CLEAR DIMENSIONS.
8. UTILIZE LONG RADIUS ELBOWS WHERE SPACE PERMITS UNLESS OTHERWISE NOTED. ALL RECTANGULAR ELBOWS SHALL CONTAIN TURNING VANES.
9. COORDINATE WITH OTHER UTILITIES TO AVOID INTERFERENCES WHEN INSTALLING DUCTWORK, PIPING AND EQUIPMENT.
10. ALL DUCTWORK SHALL BE CONSTRUCTED, SEALED AND INSTALLED IN CONFORMANCE TO SMACNA DUCT CONSTRUCTION STANDARDS.
11. DUCT RUNOUTS TO LINEAR/RECTANGULAR SUPPLY DIFFUSERS SHALL BE THE SAME SIZE AS THE INLET DIAMETER OF THE DIFFUSER. THE LENGTH OF FLEXIBLE DUCTS TO THE DIFFUSERS SHALL NOT EXCEED 5'-0".
12. PROVIDE FIRE DAMPERS IN DUCTWORK AT ALL FIRE BARRIER PENETRATIONS.
13. PROVIDE FIRE RESISTANT FLEXIBLE CONNECTION WHENEVER DUCTWORK IS CONNECTED TO MOTORIZED EQUIPMENT.
14. DUCT MATERIAL SHALL BE ZINC-COATED STEEL WITH METAL AND GALVANIZING THICKNESS AS PER SMACNA CONSTRUCTION STANDARDS.
15. PROVIDE OSHA-REQUIRED CLEARANCES AROUND ALL HVAC EQUIPMENT AND COMPONENTS FOR PERSONNEL ACCESS AND MAINTENANCE.
16. PIPING HANGERS AND SUPPORTS – ALL HANGERS AND SUPPORTS SHALL COMPLY WITH MANUFACTURER'S STANDARDIZATION SOCIETY (MSS) STANDARDS. VERTICAL PIPES MUST BE SUPPORTED AT EACH FLOOR WITH PIPE CLAMPS.
17. INSULATE BACKS AND PLENUMS OF SUPPLY AIR DEVICES WITH MINIMUM 1" MINERAL FIBER.
18. FOR ALL MECHANICAL EQUIPMENT PROVIDE LOCAL DISCONNECT MOUNTED ON UNIT OR INTEGRAL TO UNIT CONTROL PANEL.
19. ALL AIR MOVING EQUIPMENT CONTAINING PARTICULATE FILTERS SHALL NOT BE OPERATED WITHOUT PARTICULATE FILTERS IN PLACE.
20. DRAWINGS SHOWING ALL DUCT AND PIPE SIZES, EQUIPMENT LOCATIONS AND ELEVATIONS HAVE BEEN RECREATED USING EXISTING OWNER-FURNISHED DRAWINGS AND SITE SURVEYS. CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL SITE CONDITIONS IN ORDER TO MAKE ANY NECESSARY ADJUSTMENTS PRIOR TO ORDERING MATERIALS OR COMMENCING INSTALLATION. CHANGE ORDERS WILL NOT BE APPROVED FOR DIMENSIONAL VERIFICATIONS REQUIRING MINOR ADJUSTMENTS NEEDED TO COMPLETE INSTALLATION.
21. CONTRACTOR IS NOT TO PROCEED WITH ANY WORK INVOLVING A CHANGE IN PROJECT SCOPE OR COST WITHOUT HAVING OBTAINED OWNER'S APPROVAL IN WRITING. CONTRACTOR WILL NOT BE REIMBURSED ANY ADDITIONAL CHANGES SHOULD THEY PERFORM WORK WITHOUT THE OWNER'S WRITTEN APPROVAL.
22. CONTRACTOR SHALL PROVIDE A 20 AMP GFCI SERVICE RECEPTACLE WITHIN 25 FEET OF ALL ROOFTOP MOUNTED HVAC EQUIPMENT. COORDINATE WITH ELECTRICAL FOR POWER REQUIREMENTS.
23. INSTALL ALL PIPING PENETRATING WALLS PERPENDICULAR TO WALL. DRAWINGS IN MANY AREAS MAY INDICATE GENERAL ROUTING ONLY. REFRIGERANT PIPE ROUTING NOT SHOWN ON PLANS, CONTRACTOR SHALL ROUTE PIPING TO MINIMIZE PIPE LENGTH AND AVOID CONFLICT WITH EXISTING UTILITIES.
24. ROUTE INSULATED PIPING TIGHT AGAINST STRUCTURE ABOVE SUSPENDED CEILING AND WRAP PIPING BELOW BEAMS. CONCEAL PIPING ABOVE SUSPENDED CEILINGS TO EXTENT POSSIBLE. DO NOT ROUTE PIPING ABOVE ELECTRICAL OR TELECOMMUNICATIONS ROOMS UNLESS IT IS SLEEVED. COORDINATE PIPING LAYOUT WITH OTHER TRADES SUCH AS DUCTWORK, LIGHTING, ELECTRICAL, FIRE ALARM AND BUILDING CONTROLS. PROVIDE SHOP DRAWINGS TO CLEARLY SHOW PIPING ROUTING AND COORDINATION WITH OTHER ELEMENTS. IN CASE OF CONFLICT, COORDINATE REROUTING OF UTILITIES WITH ENGINEER AND ARCHITECT.
25. CONTRACTOR SHALL SUBMIT A COORDINATION SHOP DRAWINGS SHOWING HVAC EQUIPMENT, DUCTWORK, AND PIPING OVERLAID ON OTHER TRADES AND IDENTIFYING CONFLICTS TO THE OWNER AND ENGINEER FOR REVIEW. CONTRACTOR SHALL NOT PROCEED TO INSTALLATION UNTIL COORDINATION DRAWING HAS BEEN APPROVED BY THE OWNER AND ENGINEER.
26. PROVIDE DIELECTRIC UNIONS AT ALL CONNECTIONS OF DISSIMILAR METALS (SUCH AS COPPER TO GALVANIZED STEEL).
27. PROVIDE INSULATED AND TRAPPED CONDENSATE DRAIN LINES FROM ALL AIR CONDITIONING EQUIPMENT INCLUDING BRACH CONNECTOR BOXES AND TERMINATE TO NEAREST FLOOR SINK OR OTHER APPROVED RECEPTACLES. CONDENSATE PIPING SHALL MAINTAIN A MINIMUM HORIZONTAL SLOPE IN THE DIRECTION OF DISCHARGE OF NOT LESS THAN ONE-EIGHTH UNIT VERTICAL IN 12 UNIT HORIZONTAL (1-PERCENT SLOPE). CONDENSATE SHALL NOT DISCHARGE IN STREET, ALLEY, OR OTHER AREAS THAT SHALL CAUSE NUISANCE. AT ALL INDOOR UNITS, PROVIDE SECONDARY DRAIN PAN WITH TRAPPED SECONDARY LINES. IN ADDITION, PROVIDE FLOAT SWITCH IN SECONDARY DRAIN PAN AND HARD WIRE FLOAT SWITCH TO DISABLE UNIT IN AN EVENT OF FLOAT TRIP. DO NOT PROVIDE TRAPS AT PUMPED CONDENSATE LOCATIONS, AND DO NOT COMBINE PUMPED AND GRAVITY CONDENSATE SYSTEMS.
28. DRAWINGS SHOWS GENERAL LOCATIONS OF THERMOSTATS/TEMPERATURE SENSORS. UNLESS NOTED OTHERWISE, INSTALL THERMOSTATS/TEMPERATURE SENSORS AT 48" ABOVE FINISHED FLOOR. WIRING SHALL BE CONCEALED IN WALLS. IN CASE OF CONFLICT WITH FURNITURE, WINDOWS, OR ELECTRICAL SWITCHES, COORDINATE EXACT LOCATION WITH OWNER'S REPRESENTATIVE.
29. PROVIDE A MINIMUM OF 10' BETWEEN EXHAUST FANS, PLUMBING VENTS THRU ROOF AND AIR INTAKES. COORDINATE LOCATIONS WITH EXISTING VENT AND EQUIPMENT LOCATIONS AND OFFSET AS NECESSARY TO COMPLY THEREIN.
30. FOR AIR HANDLING UNITS OVER 2000 CFM, PROVIDE SMOKE DETECTORS IN THE SUPPLY AIR DUCT UPSTREAM OF ANY BRANCH CONNECTIONS AND IN THE RETURN AIR DUCT UPSTREAM OF FILTERS AND OUTSIDE AIR CONNECTION. DUCT SMOKE DETECTORS SHALL SHUT DOWN UNIT UPON ACTIVATION AND SIGNAL ALARM TO FIRE ALARM PANEL. CONTRACTOR TO COORDINATE WITH OWNER'S REPRESENTATIVE FOR FIRE ALARM SYSTEM INFORMATION. FOR DUCTLESS SYSTEMS SUPPLYING OVER 2000 CFM, THE UNIT SHALL SHUT DOWN UPON ACTIVATION OF THE ROOM SMOKE DETECTOR. SMOKE DETECTORS SHALL BE FURNISHED, INSTALLED AND WIRED BY THE FIRE ALARM CONTRACTOR. THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR MOUNTING THE SMOKE DETECTOR IN DUCTWORK IN ACCORDANCE WITH THE MANUFACTURER'S PRINTED INSTRUCTIONS. REFER TO FIRE ALARM SHEETS FOR FIRE ALARM CONTROL PANEL LOCATION. COMPLY WITH NFPA 72.
31. TELECOMMUNICATION EQUIPMENT ROOM (IT) SHALL HAVE DEDICATED HVAC EQUIPMENT.
32. PROVIDE TEMPORARY CONSTRUCTION FILTERS TO BE REMOVED AND REPLACED WITH NEW FILTERS AT SUBSTANTIAL COMPLETION. NEW FILTERS SHALL BE 2", MERV 8, PLEATED FILTERS.
33. ALL THERMOSTATS INSTALLED IN THE DRILL HALL AND STORAGE AREAS SHALL BE PROVIDED WITH A CLEAR, NON-LOCKABLE PLASTIC COVER.
34. ALL EMERGENCY SHUTDOWN BUTTONS THROUGHOUT THE BUILDING SHALL BE PROVIDED WITH A CLEAR, NON-LOCKABLE PLASTIC COVER.
35. ALL REFRIGERANT AND CONDENSATE PIPING INSULATION SHALL ADHERE TO THE 2015 INTERNATIONAL ENERGY CONSERVATION CODE UNLESS OTHERWISE SPECIFIED.
36. CONTRACTOR SHALL PROVIDE COORDINATION DRAWINGS BEFORE STARTING CONSTRUCTION. COORDINATION DRAWINGS MUST SHOW ALL TRADES.

STATE OF TEXAS — VAN CASHEN — 118595 — LICENSED PROFESSIONAL ENGINEER

04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

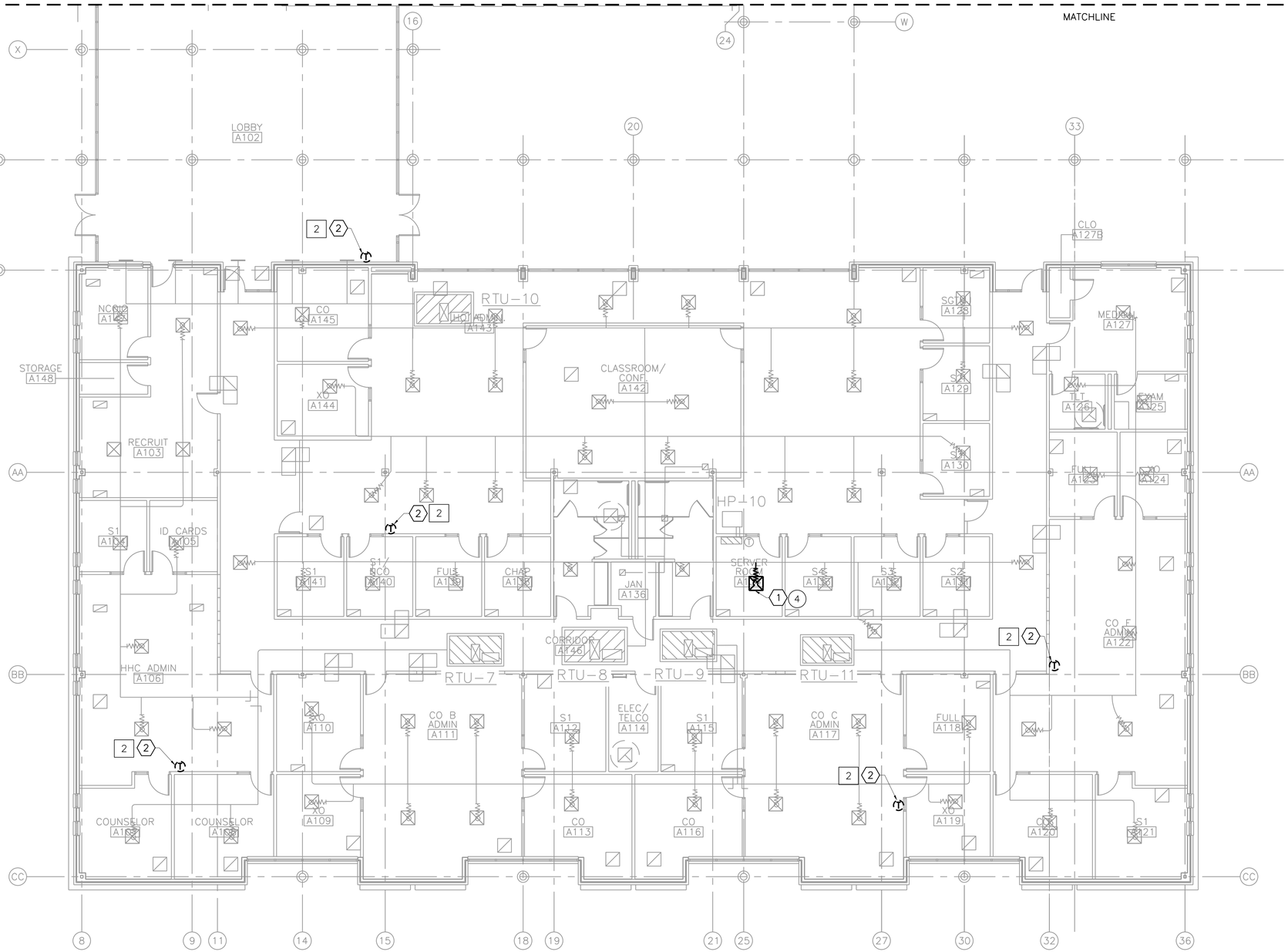
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL LEGEND, GEN, NOTES & ABBREVIATIONS

M-0

SHT. 47 of 129



GENERAL NOTES:

1. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.
2. REFER TO ELECTRICAL DRAWINGS FOR ADDITIONAL WORK RELATED TO HVAC EQUIPMENT.
3. REFER TO SHEET M-0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
4. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.

NOTES BY SYMBOL "⬡"

(4) 1. IF BID OPTION #4 IS SELECTED, DEMOLISH DIFFUSER, CONTROL DAMPER, AND DUCTWORK BACK TO DUCT BRANCH OFF. CAP OPENING PER SMACNA STANDARDS.

[2] 2. IF SECO OPTION #2 IS SELECTED, DEMOLISH EXITING THERMOSTATS. RETAIN WIRING AND CONDUIT FOR REUSE TO EXTENT POSSIBLE.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

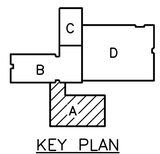
SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.

NORTH TRUE / NORTH PLAN — 1 / M-1

DEMOLITION FLOOR PLAN – A

1/8"=1'-0"



KEY PLAN

STATE OF TEXAS
VAN CASHEN
118595
LICENSED
PROFESSIONAL ENGINEER
04/20/2018

0 4' 8' 16'
1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

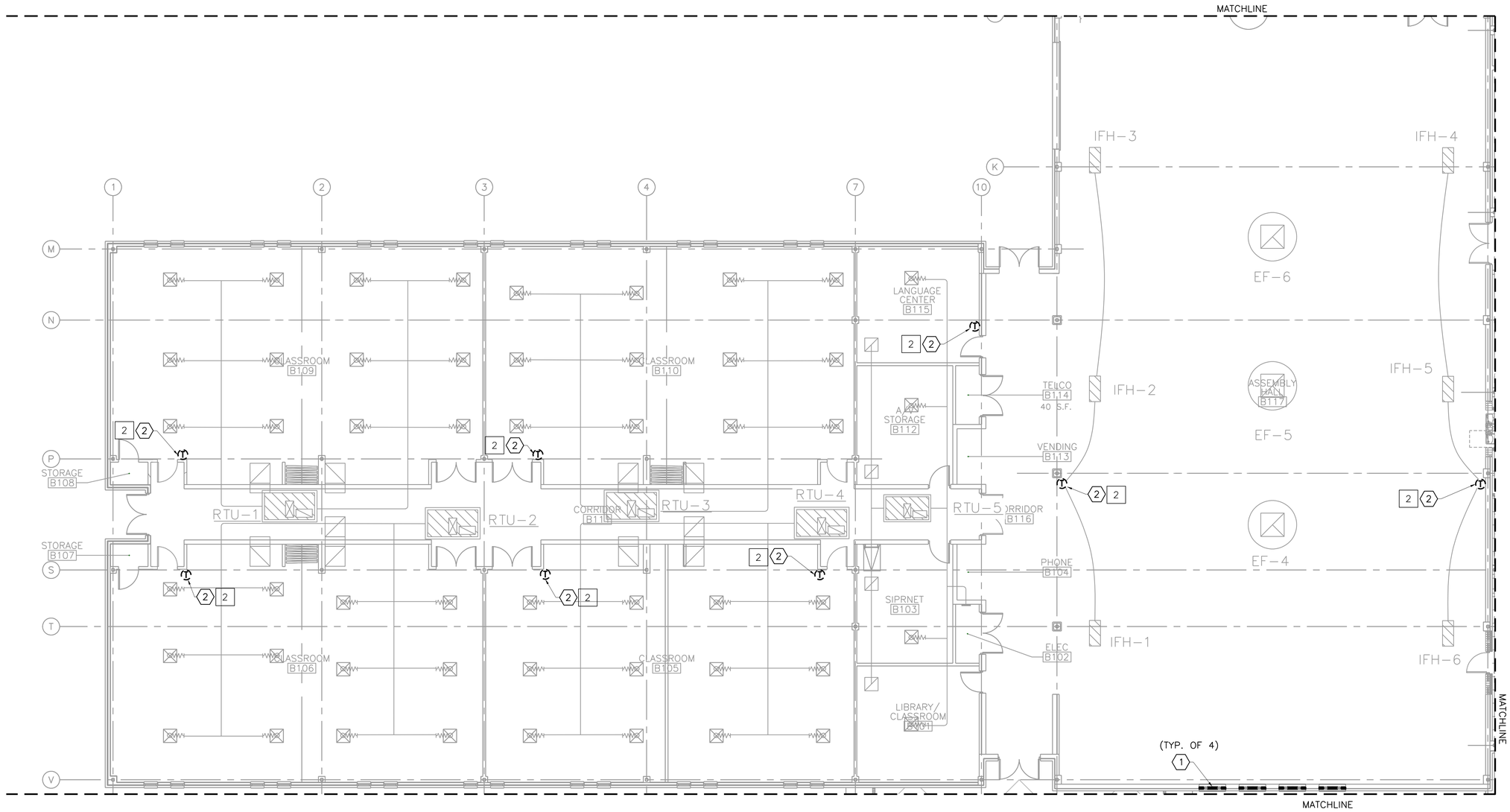
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
DEMOLITION PLAN - A

M-1 (4) [2]

SHT. 48 of 129



NORTH TRUE / NORTH PLAN — 1 M-2

DEMOLITION FLOOR PLAN – B

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.
2. REFER TO ELECTRICAL DRAWINGS FOR ADDITIONAL WORK RELATED TO HVAC EQUIPMENT.
3. REFER TO SHEET M-0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
4. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
5. PATCH OPENINGS IN WALL THAT RESULT FROM DUCT DEMOLITION TO MATCH ADJOINING WALL IN CONSTRUCTION AND FINISH.

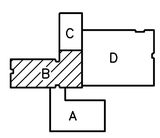
NOTES BY SYMBOL "⬡"

1. DEMOLISH EXISTING LOUVERS. PATCH BRICK WALL TO MEET SECURITY REQUIREMENTS.

[2] 2. IF SECO OPTION #2 IS ACCEPTED, DEMOLISH EXITING THERMOSTATS. RETAIN WIRING AND CONDUIT FOR REUSE TO EXTENT POSSIBLE.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.



KEY PLAN



0 4' 8' 16'
1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		
9		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

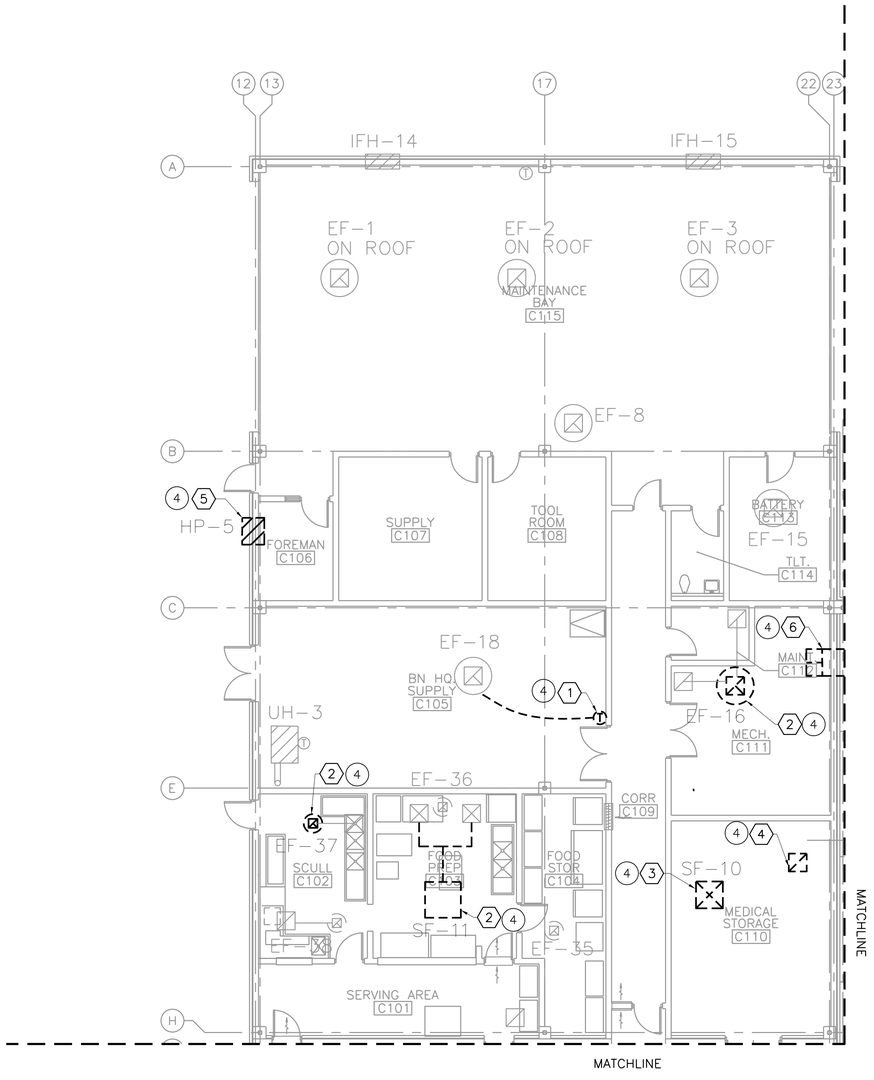
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
DEMOLITION PLAN - B

M-2 [2]

SHT. 49 of 129



DEMOLITION FLOOR PLAN – C

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.
2. REFER TO ELECTRICAL DRAWINGS FOR ADDITIONAL WORK RELATED TO HVAC EQUIPMENT.
3. REFER TO SHEET M–0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
4. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
5. PATCH OPENINGS IN WALL THAT RESULT FROM DUCT DEMOLITION TO MATCH ADJOINING WALL IN CONSTRUCTION AND FINISH.

NOTES BY SYMBOL "⬡"

(4) 1. IF BID OPTION #4 IS SELECTED, DEMOLISH EXISTING THERMOSTATS. RETAIN CONDUIT FOR REUSE TO EXTENT POSSIBLE.

(4) 2. IF BID OPTION #4 IS SELECTED, DEMOLISH EXISTING ROOF–MOUNTED FAN. RETAIN ROOF CURB, DUCTWORK, HOOD, WIRING, CONDUIT AND CONTROLS FOR REUSE TO EXTENT POSSIBLE.

(4) 3. IF BID OPTION #4 IS SELECTED, DEMOLISH ROOF–MOUNTED FAN AND ASSOCIATED DUCTWORK, DIFFUSERS, AND CONTROLS. CAP ROOF OPENING IN ACCORDANCE WITH ROOF WARRANTY.

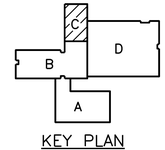
(4) 4. IF BID OPTION #4 IS SELECTED, DEMOLISH ROOF–MOUNTED INTAKE HOOD. CAP ROOF OPENING IN ACCORDANCE WITH ROOF WARRANTY.

(4) 5. IF BID OPTION #4 IS SELECTED, DEMOLISH EXISTING PACKAGED IN–WALL AC UNIT AND ASSOCIATED WIRING AND CONTROLS. RETAIN WALL OPENING.

(4) 6. IF BID OPTION #4 IS SELECTED, DEMOLISH DUCTWORK IN ENTIRETY AND PATCH WALLS PER ARCHITECTURE DETAILS. DUCTWORK CONTINUED ON M–4.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.



KEY PLAN



0 4' 8' 16'

1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763–5218
(512) 782–6131 FAX (512) 782–1481

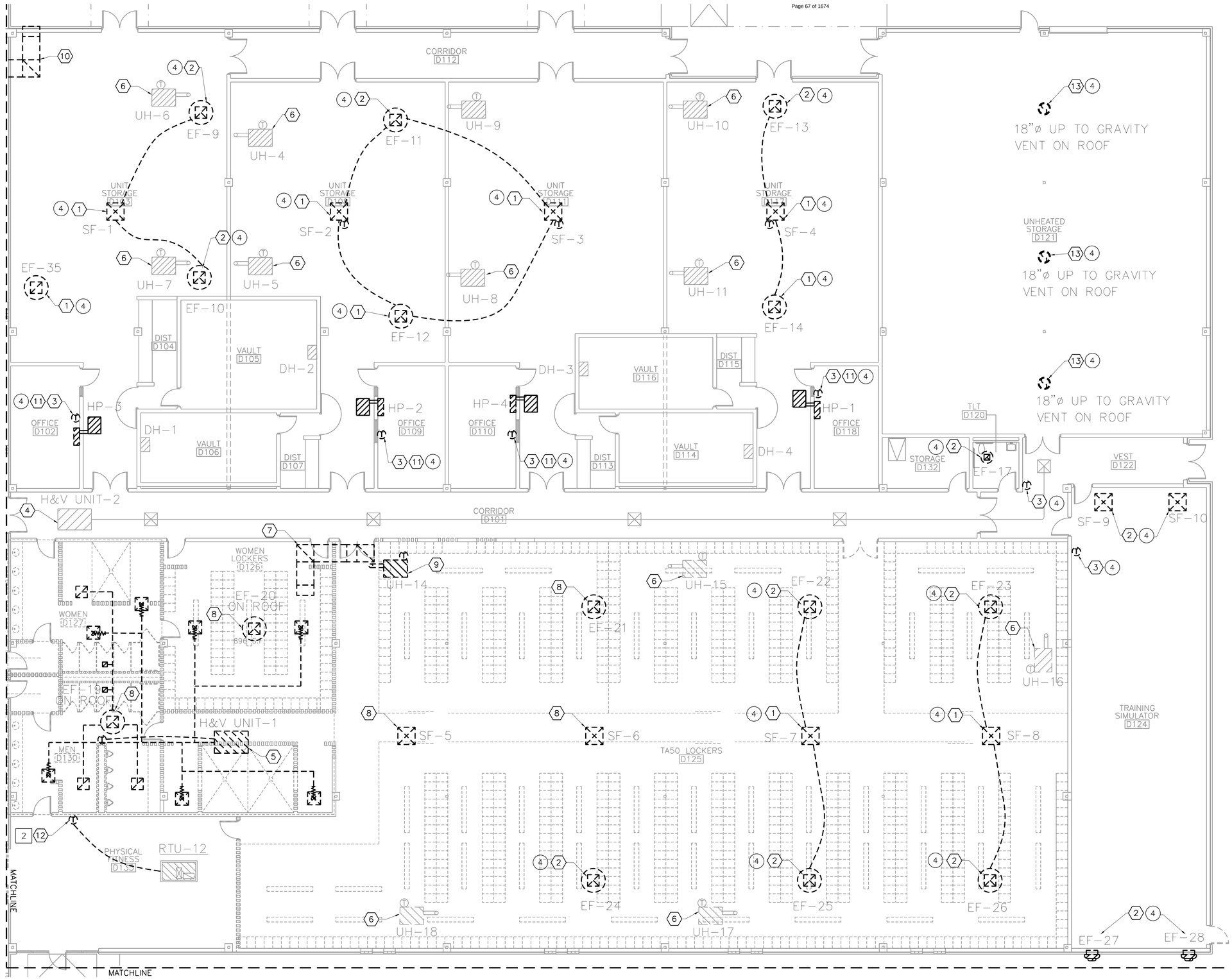
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
DEMOLITION PLAN - C

M-3 (4)

SHT. 50 of 129



NORTH TRUE / NORTH PLAN — 1 / M-4

DEMOLITION FLOOR PLAN – D

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.
2. REFER TO ELECTRICAL DRAWINGS FOR ADDITOINAL WORK RELATED TO HVAC EQUIPMENT.
3. REFER TO SHEET M-0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
4. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
5. PATCH OPENINGS IN WALL THAT RESULT FROM DUCT AND PIPING DEMOLITION TO MATCH ADJOINING WALL IN CONSTRUCTION AND FINISH.
6. CAP ALL ROOF PENETRATIONS RESULTING FROM HVAC DEMOLITION THAT ARE NOT BEING REUSED.

NOTES BY SYMBOL "◇"

(4) 1. IF BID OPTION #4 IS SELECTED, DEMOLISH ROOF-MOUNTED FAN AND ASSOCIATED DUCTWORK, DIFFUSERS, WIRING AND CONTROLS. RETAIN CURB FOR REUSE.

(4) 2. IF BID OPTION #4 IS SELECTED, DEMOLISH ROOF-MOUNTED FANS ND ASSOCIATED DUCTWORK, DIFFUSERS WIRING, AND CONTROLS. PATCH ROOF OPENING PER ROOF MANUFACTURER'S WARRANTY AND ARCHITECTURAL DETAILS.

(4) 3. IF BID OPTION #4 IS SELECTED, DEMOLISH EXITING THERMOSTATS. RETAIN CONDUIT FOR REUSE TO EXTENT POSSIBLE.

4. EXISTING HEATING VENTILATOR UNIT TO REMAIN.
5. DEMOLISH EXISTING HEATING VENTILATOR UNIT AND ASSOCIATED DUCTWORK, DIFFUSERS, WIRING AND CONTROLS.CAP CURB PER MANUFACTURER'S WARRANTY.
6. EXISTING UNIT HEATER TO REMAIN.
7. DEMOLISH EXISTING TRANSFER DUCT AND CAP WALL PENETRATIONS IN WALLS TO REMAIN PER ARCH SHEETS.
8. DEMOLISH ROOF-MOUNTED FAN AND ASSOCIATED DUCTWORK, DIFFUSERS WIRING, AND CONTROLS. CAP CURB PER MANUFACTURER'S WARRANTY.
9. DEMOLISH EXISTING UNIT HEATER AND ASSOCIATED CONTROLS, WIRING, AND FLUE.
10. DEMOLISH DUCTWORK IN ENTIRETY AND PATCH WALLS PER ARCHITECTURE DETAILS.

(4) 11. IF BID OPTION #4 IS SELECTED, DEMOLISH EXISTING MINI SPLIT HEAT PUMP AIR HANDLER, CONTROLS, REFRIGERANT PIPING, CONDENSER UNIT, AND ACCESSORIES. RETAIN AND REUSE ROOF PENETRATIONS FOR NEW EQUIPMENT.

[2] 12. IF SECO OPTION #2 IS SELECTED, DEMOLISH EXITING THERMOSTATS. RETAIN WIRING AND CONDUIT FOR REUSE TO EXTENT POSSIBLE.

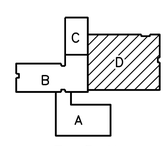
(4) 13. IF BID OPTION #4 IS SELECTED, DEMOLISH 18"ø ROOF VENT; PATCH ROOF PENETRATION PER ROOF MANUFACTURER'S WARRANTY AND ARCHITECTURAL DETAILS.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.



KEY PLAN



0 4' 8' 16'

1/8"=1'-0"

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		
9		

PROJECT ARCHITECT: HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

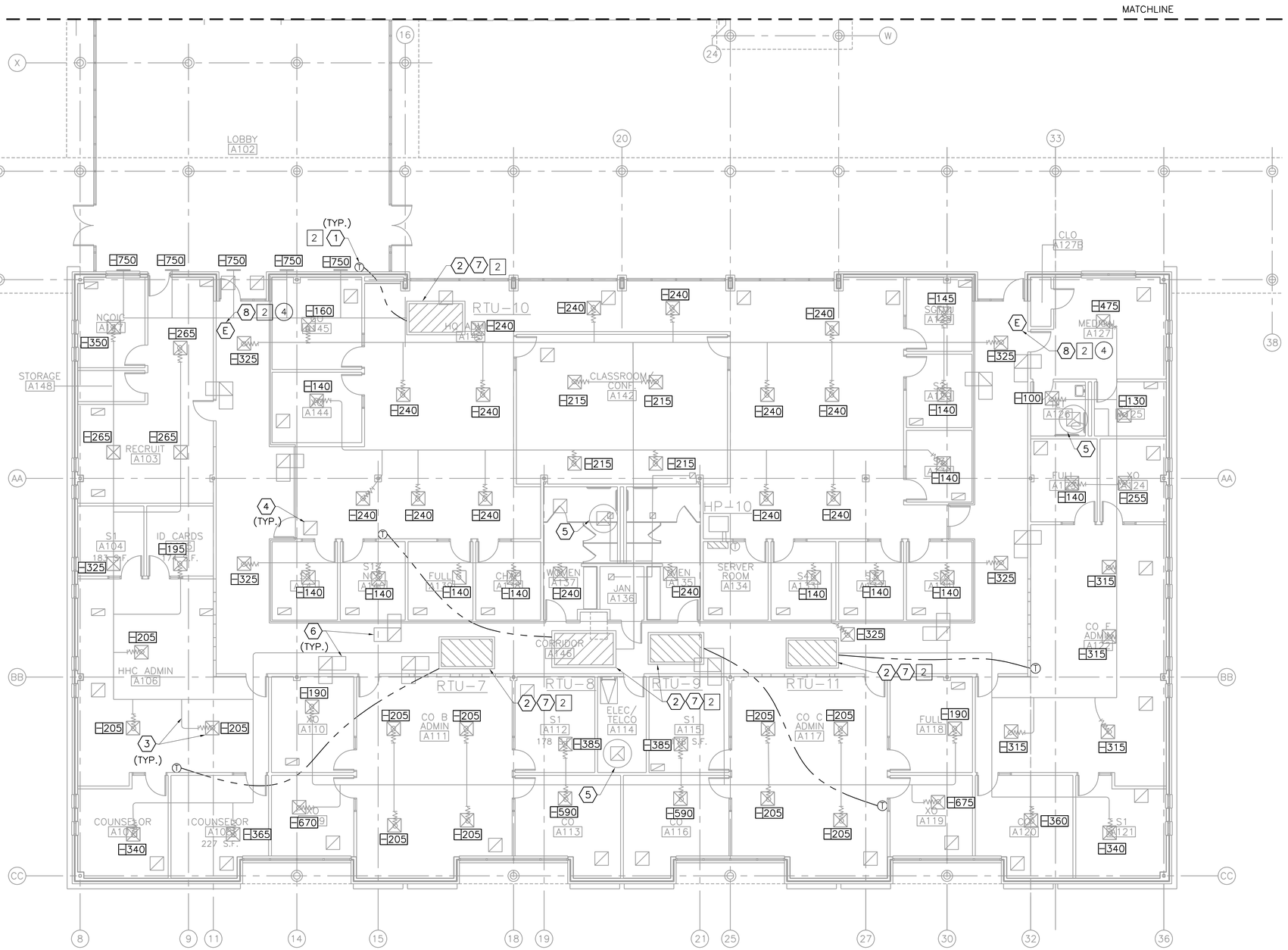
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
DEMOLITION PLAN - D

M-4 (4) [2]

SHT. 51 of 129



FLOOR PLAN – A

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.
2. REFER TO ELECTRICAL DRAWINGS FOR ADDITOINAL WORK RELATED TO HVAC EQUIPMENT.
3. REFER TO SHEET M–0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
4. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
(4) 5. IF BID OPTION #4 IS ACCEPTED, MODIFY EXISTING DUCT ROUTING AS NECESSARY TO ACCOMMODATE FLOWS INDICATED.
6. PROVIDE MANUAL BALANCING DAMPERS AS REQUIRED TO FACILITATE PROPER SYSTEM BALANCING.
7. REUSE EXISTING WALL PENETRATIONS FOR DUCT ROUTING WHERE POSSIBLE.

NOTES BY SYMBOL "⬡"

[2] 1. IF SECO OPTION #2 IS ACCEPTED, PROVIDE BAS–INTEGRATED ZONE TEMPERATURE SENSOR WITH ADJUSTABLE SETPOINT CONTROL.
2. EXISTING ROOF TOP UNITS TO REMAIN.
3. EXISTING DUCTWORK, DIFFUSERS, AND SUPPORTS TO REMAIN. CONTRACTOR TO FIELD VERIFY LOCATION OF BALANCING DAMPERS FOR EACH DIFFUSER AND RE–BALANCE FLOW RATES AS SPECIFIED ON THIS SHEET. IF EXISTING DUCTWORK IS INSUFFICIENT TO MEET DESIGN FLOWS, COORDINATE WITH ENGINEER FOR DIRECTION.
4. EXISTING RETURN AIR GRILLES TO REMAIN.
5. EXISTING EXHAUST FAN AND ASSOCIATED DUCTWORK TO REMAIN.
6. EXISTING TRANSFER DUCT TO REMAIN.
[2] 7. IF SECO OPTION #2 IS SELECTED, PROVIDE NEW BACNET CONTROLLER INTERFACED TO EXISTING RTU CONTROLLER PER 4/M–11.
(4) [2] 8. IF BID OPTION #4 AND SECO OPTION #2 ARE ACCEPTED, PROVIDE EMERGENCY SHUTDOWN SWITCH WITH NON–LOCKING CLEAR PLASTIC COVER TO SHUT DOWN ALL EQUIPMENT CONNECTED TO BAS.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.

KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER 04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763–5218
(512) 782–6131 FAX (512) 782–1481

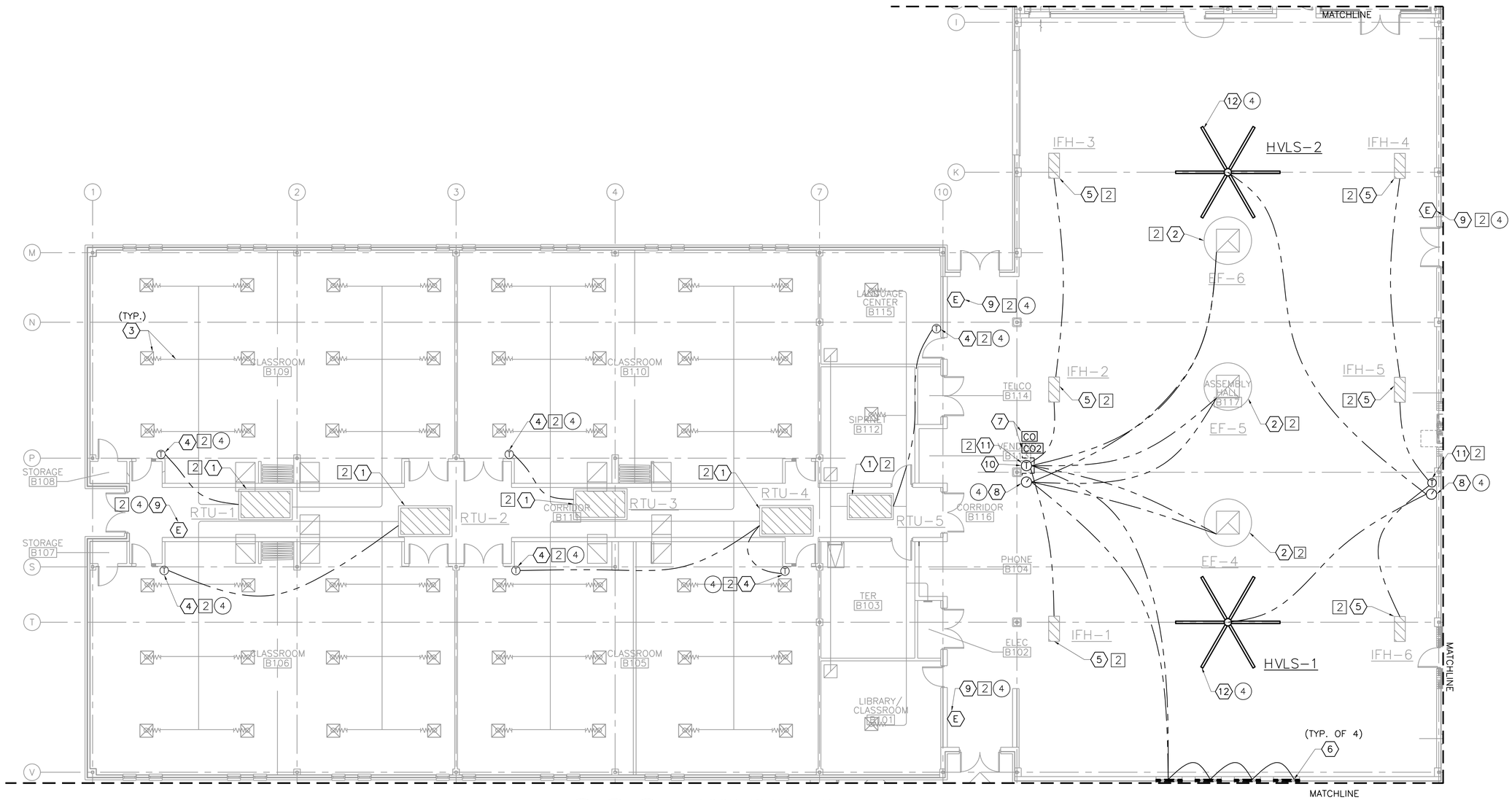
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
FLOOR PLAN - A

M-5 (4) [2]

SHT. 52 of 129



FLOOR PLAN – B

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO SHEET M–0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
2. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
3. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.

NOTES BY SYMBOL "⬡"

[2] 1. EXISTING ROOF TOP UNITS TO REMAIN. IF SECO OPTION #2 IS ACCEPTED, CONNECT TO BAS PER DETAILS ON 1/M–10.

[2] 2. EXISTING ROOF MOUNTED EXHAUST FANS TO REMAIN. IF BID OPTION #2 IS ACCEPTED, CONNECT TO BAS AND CONTROL PER 1/M–10.

3. EXISTING DUCTWORK, DIFFUSERS, SUPPORTS, AND CONTROLS TO REMAIN.

[2] (4) 4. IF SECO OPTION #2 IS ACCEPTED, PROVIDE BAS–INTEGRATED ZONE TEMPERATURE SENSOR WITH ADJUSTABLE SETPOINT CONTROL.

[2] 5. EXISTING RADIANT GAS–FIRED HEATERS TO REMAIN. IF SECO OPTION #2 IS ACCEPTED, CONNECT TO BAS AND CONTROL PER 3/M–11.

6. PROVIDE NEW COMBINATION LOUVER/DAMPERS WITH MOTORIZED ACTUATORS INTERLOCKED WITH EXHAUST FANS; CONTROL PER 1/M–10.

7. PROVIDE CARBON MONOXIDE (CO) AND CARBON DIOXIDE (CO2) SENSORS IN 3 GAUGE WIRE CAGES. REFER TO 2/M–10 FOR INTEGRATION INTO EXHAUST FAN CONTROLLER (OR BAS IF SECO OPTION #2 IS ACCEPTED) AND INFORMATION ON MOUNTING HEIGHTS. REFER TO FIRE ALARM DRAWINGS FOR FIRE ALARM SYSTEM INTEGRATION.

(4) 8. IF BID OPTION #4 IS ACCEPTED, PROVIDE 2 HOUR (ADJ.) TIMER TO CONTROL HVLS FANS.

(4) [2] 9. IF BID OPTION #4 AND SECO OPTION #2 ARE ACCEPTED, PROVIDE EMERGENCY SHUTDOWN SWITCH WITH NON–LOCKING CLEAR PLASTIC COVER TO SHUT DOWN ALL EQUIPMENT CONNECTED TO BAS.

10. PROVIDE TIMER AND THERMOSTAT TO CONTROL EXHAUST FANS. RE: 2/M–10 FOR MORE DETAILS AND CONTROL INFORMATION.

[2] 11. PROVIDE NEW THERMOSTAT TO CONTROL EXISTING INFRARED HEATERS TO MAINTAIN A ROOM TEMPERATURE AT 45°F (ADJ.) IF SECO OPTION #2 IS SELECTED, PROVIDE BAS–COMPATABLE TEMPERATURE SENSOR AND CONTROL PER 3/M–11.

(4) 12. IF BID OPTION #4 IS SELECTED, PROVIDE NEW HIGH VOLUME LOW SPEED CIRCULATION FAN. MOUNT AT THE SAME LEVEL AS LIGHTS IN THIS ROOM.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.

KEY PLAN

VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER 04/20/2018

0 4' 8' 16'

1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763–5218
(512) 782–6131 FAX (512) 782–1481

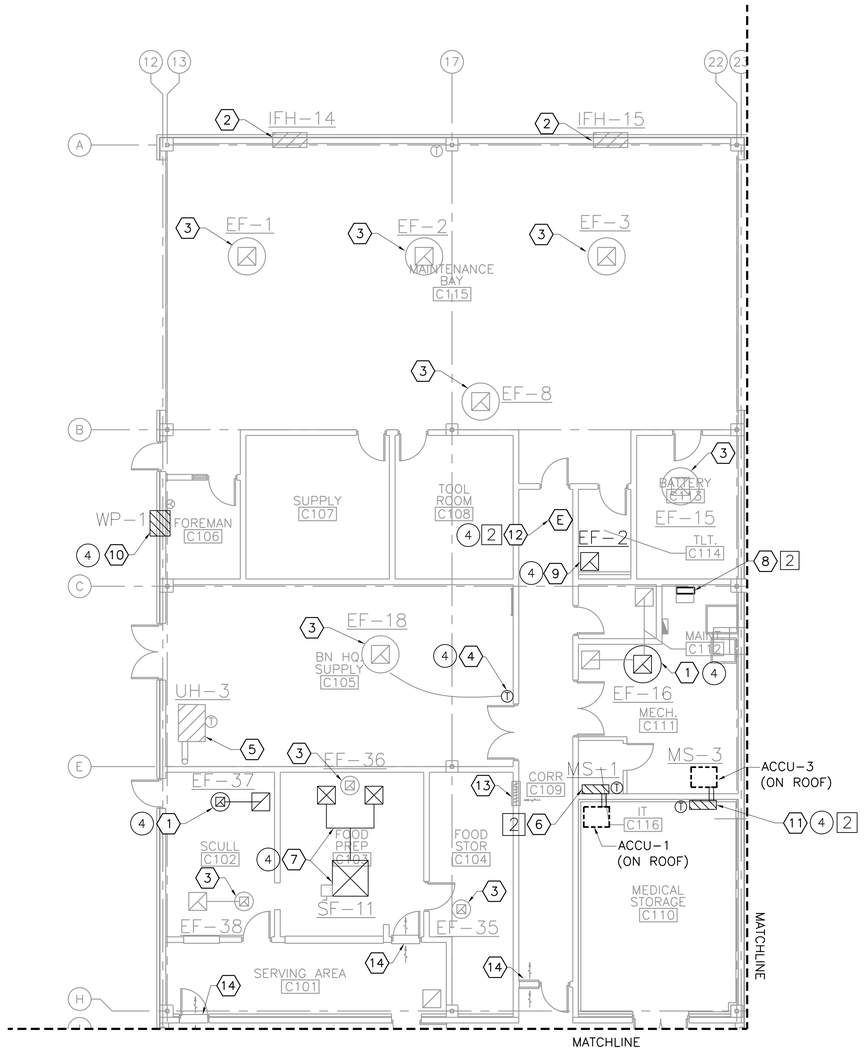
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
FLOOR PLAN - B

M-6 [2] (4)

SHT. 53 of 129



NORTH TRUE / NORTH PLAN — 1 / M-7

FLOOR PLAN – C

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO SHEET M-0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
2. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
3. PATCH OPENINGS IN WALL THAT RESULT FROM DUCT DEMOLITION TO MATCH ADJOINING WALL IN CONSTRUCTION AND FINISH.
4. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.

NOTES BY SYMBOL "⬡"

(4) 1. IF BID OPTION #4 IS ACCEPTED, PROVIDE NEW FAN AS SCHEDULED ON EXISTING CURB. PROVIDE CURB ADAPTOR AS NECESSARY.

2. EXISTING INFRARED UNIT HEATERS TO REMAIN.

3. EXISTING ROOF MOUNTED EXHAUST FANS TO REMAIN.

(4) 4. IF BID OPTION #4 IS ACCEPTED, PROVIDE THERMOSTAT TO ENABLE EXHAUST FANS WHEN TEMPERATURE RISES ABOVE 85°F (ADJ.).

5. EXISTING UNIT HEATER TO REMAIN.

[2] 6. PROVIDE NEW MINI SPLIT AC UNIT. REFRIGERANT LINE TO BE ROUTED PER MANUFACTURER'S RECOMMENDATIONS. AIR-COOLED CONDENSING UNIT TO BE LOCATED ON ROOF. IF SECO OPTION #2 IS ACCEPTED, CONNECT TO BAS AND CONTROL PER 2/M-12.

(4) 7. IF BID OPTION #4 IS ACCEPTED, PROVIDE NEW MAKEUP AIR UNIT ON ROOF AS SCHEDULED. INTERCONNECT TO EF-36 SUCH THAT BOTH FANS OPERATE SIMULTANEOUSLY. BALANCE AS INDICATED ON MECHANICAL SCHEDULES ON M-9.

[2] 8. IF SECO OPTION #2 IS ACCEPTED, PROVIDE BAS PANEL. RE: 1/M-10 FOR MORE DETAILS.

(4) 9. IF BID OPTION #4 IS ACCEPTED, PROVIDE CEILING MOUNTED EXHAUST FAN AS SCHEDULED; WIRE TO OPERATE IN CONJUNCTION WITH LIGHT SWITCH.

(4) 10. IF BID OPTION #4 IS ACCEPTED, PROVIDE PACKAGED WALL UNIT AS SCHEDULED. MODIFY EXISTING OPENING TO ACCOMMODATE NEW UNIT SIZE.

[2] (4) 11. IF BID OPTION #4 IS ACCEPTED, PROVIDE NEW MINI SPLIT HEAT PUMP. REFRIGERANT LINE TO BE ROUTED PER MANUFACTURER'S RECOMMENDATIONS. AIR-COOLED CONDENSING UNIT TO BE LOCATED ON ROOF. IF SECO OPTION #2 IS ACCEPTED, CONNECT TO BAS AND CONTROL PER 1/M-12.

[2] (4) 12. IF BID OPTION #4 AND SECO OPTION #2 ARE ACCEPTED, PROVIDE EMERGENCY SHUTDOWN SWITCH WITH NON-LOCKING CLEAR PLASTIC COVER TO SHUT DOWN ALL EQUIPMENT CONNECTED TO BAS.

13. EXISTING MOTORIZED DAMPER TO REMAIN.

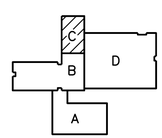
14. EXISTING AIR TRANSFER DUCT TO REMAIN.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.



KEY PLAN

VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER 04/20/2018

0 4' 8' 16'

1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		
9		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

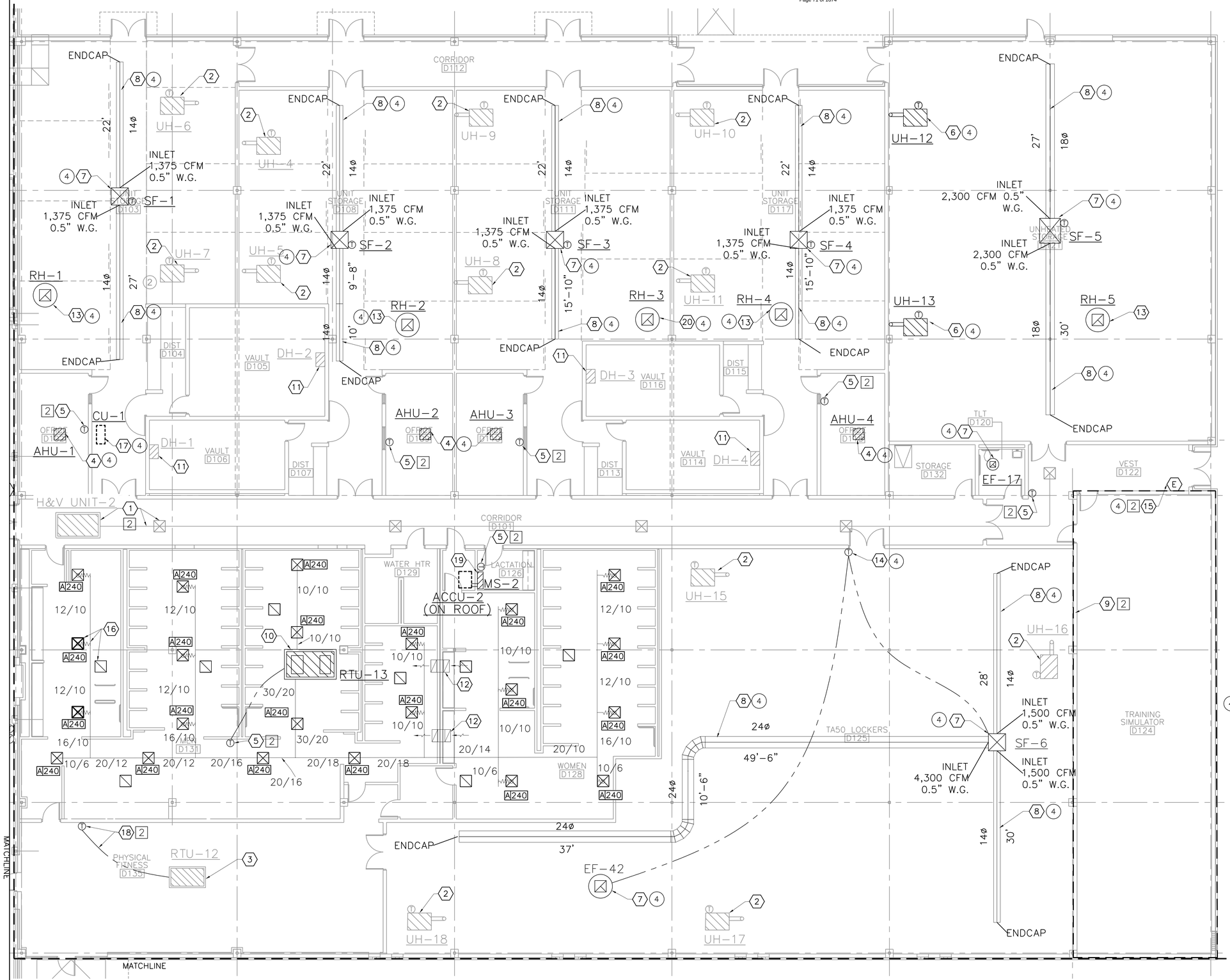
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
FLOOR PLAN - C

M-7 [2] (4)

SHT. 54 of 129



FLOOR PLAN – D

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO SHEET M-0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
2. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
3. PATCH OPENINGS IN WALL THAT RESULT FROM DUCT DEMOLITION TO MATCH ADJOINING WALL IN CONSTRUCTION AND FINISH.
4. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.

NOTES BY SYMBOL "⬡"

[2] 1. EXISTING H&V UNIT AND RELATED DUCTWORK AND DIFFUSERS TO REMAIN. IF SECO OPTION #2 IS ACCEPTED, CONNECT TO BAS AS INDICATED ON 1/M-11.

2. EXISTING UNIT HEATERS TO REMAIN.

[2] 3. EXISTING RTU TO REMAIN; IF SECO OPTION #2 IS SELECTED, PROVIDE NEW BACNET CONTROLLER INTERFACED TO EXISTING RTU CONTROLLER PER 4/M-11.

(4) 4. IF BID OPTION #4 IS SELECTED, PROVIDE NEW CEILING MOUNTED AIR HANDLER UNIT; PROVIDE OUTDOOR AIR DUCT, ROOF PENETRATION, AND INTAKE COVER AS SCHEDULED ON M-9.

[2] 5. PROVIDE 7-DAY PROGRAMMABLE THERMOSTAT. IF SECO OPTION #2 IS ACCEPTED, PROVIDE BAS-INTEGRATED ZONE TEMPERATURE SENSOR WITH ADJUSTABLE SETPOINT CONTROL.

(4) 6. IF BID OPTION #4 IS SELECTED, PROVIDE NEW UNIT HEATER AS SCHEDULED. MOUNT AT BOTTOM OF UNIT AT MIN. 10' AFF.

(4) 7. IF BID OPTION #4 IS SELECTED, PROVIDE NEW FAN AT EXISTING ROOF PENETRATION AS SCHEDULED. MODIFY ROOF OPENING TO ACCOMMODATE NEW UNIT. CONNECT SUPPLY FANS 1-6 TO FABRIC DUCT PER MANUFACTURER'S RECOMMENDATIONS.

(4) 8. IF BID OPTION #4 IS ACCEPTED, PROVIDE FABRIC DUCT; CONNECT TO SUPPLY FAN OPENING PER MANUFACTURER'S RECOMMENDATIONS.

[2] 9. TRAINING SIMULATOR AC TO BE PROVIDED UNDER SEPARATE CONTRACT. UNITS TO BE CONNECTED TO BAS IF SECO OPTION #2 IS ACCEPTED. RE: 1/M-10 AND 4/M-11 FOR INTEGRATION AND CONTROL DETAILS.

10. PROVIDE NEW RTU WITH ENERGY RECOVERY. REFER TO SCHEDULE FOR MORE DETAILS. PROVIDE WITH FULL SIZED CONDENSATE DRAIN; REUSE EXISTING PENETRATION AND DRAIN TERMINATION. REFER TO 1/S-4 FOR STRUCTURAL SUPPORT AT NEW UNIT; REFER TO 7/S-4 FOR SUPPORT AT EXISTING GIRDER BEAM.

11. EXISTING DEHUMIDIFIERS TO REMAIN.

12. PROVIDE NEW 12"x26" TRANSFER DUCT ABOVE CEILING. REFER TO 7/M-13 FOR MORE DETAILS.

(4) 13. IF BID OPTION #4 IS SELECTED, PROVIDE RELIEF HOOD AT EXISTING ROOF PENETRATION. MODIFY ROOF OPENING AS NECESSARY TO ACCOMMODATE SPECIFIED RELIEF HOOD.

(4) 14. IF BID OPTION #4 IS ACCEPTED, PROVIDE NEW THERMOSTAT TO CONTROL SF-6 AND EF-42 PER 3/M-12.

(4)[2] 15. IF BID OPTION #4 AND SECO OPTION #2 ARE ACCEPTED, PROVIDE EMERGENCY SHUTDOWN SWITCH TO SHUT DOWN ALL EQUIPMENT CONNECTED TO BAS.

16. PROVIDE NEW SUPPLY DIFFUSERS, RETURN GRILLES, AND DUCT AS SCHEDULED.

(4) 17. IF BID OPTION #4 IS SELECTED, PROVIDE NEW AIR-COOLED CONDENSING UNIT LOCATED ON ROOF, ROUTE REFRIGERANT LINES TO ASSOCIATED AHUS PER MANUFACTURER'S RECOMMENDATIONS. PENETRATE ROOF PER DETAIL 3/M-13. USE EXISTING PENETRATION.

[2] 18. EXISTING THERMOSTAT TO REMAIN. IF SECO OPTION #2 IS SELECTED, PROVIDE BAS-INTEGRATED ZONE TEMPERATURE SENSOR WITH ADJUSTABLE SETPOINT CONTROL

19. PROVIDE NEW WALL-MOUNTED AIR HANDLER UNIT; PROVIDE OUTDOOR AIR DUCT, ROOF PENETRATION, AND INTAKE COVER AS SCHEDULED ON M-9.

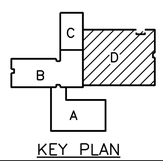
(4) 20. IF BID OPTION #4 IS SELECTED, PROVIDE RELIEF HOOD AT NEW ROOF PENETRATION. PENETRATE ROOF PER MANUFACTURER'S RECOMMENDATIONS AND ARCHITECTURAL DETAILS.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.



KEY PLAN

VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER
04/20/2018
0 4' 8' 16'
1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		
9		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
FLOOR PLAN - D

M-8 [2] (4)

SHT. 55 of 129

FAN SCHEDULE (4)

MARK	SERVES	CFM	EXT SP IN. WG	MOTOR DATA HP	RPM	VOLT/PH/HZ	MAX. SONES	MANUFACTURER/MODEL	NOTES
EF-16	C111	250	0.5	1/10	1750	115/1	7.1	GREENHECK/G-085-VG	1,2,3,4,5,8
EF-2	C114	70	0.10	6W	935	115/1	0.4	GREENHECK/SP-80-VG	7
EF-17	D120	70	0.10	6W	935	115/1	0.4	GREENHECK/SP-80-VG	7
EF-37	C102	700	0.38	1/4	1750	115/1	6	GREENHECK/CUE-121-VG	1,2,3,4,5,8
EF-42	D125	8,100	0.2	3/4	1750	460/3	309	GREENHECK/RPDR-36-611-C7	1,2,3,4,5,8
SF-11	RANGE HOOD	4,100	0.5	1	1750	460/3	15.8	GREENHECK/RSF-150-15	1,2,3,4,6,8
SF-1 THRU 4	D104, D108, D111, D117	2,750	0.523	1/2	1750	230/1	21	GREENHECK/AS-24-418-B5	1,2,3,4,5,8
SF-5	D121	4,600	0.5	1 1/2	1750	230/1	34	GREENHECK/AS-20-428-A15	1,2,3,4,5,8
SF-6	D125	7,300	0.549	1 1/2	1750	460/3	61	GREENHECK/RPDR-30-410-A15	1,2,3,4,5,8

NOTES:
1) PROVIDE WITH ROOF CURB ADAPTER, DAMPER TRAY CURB CAP SEAL, AND ACCESSORIES FOR HIGH WIND LOADS FROM FACTORY.
2) PROVIDE WITH NEMA-1, TOGGLE STYLE DISCONNECT SWITCH SHIPPED WITH UNIT.
3) PROVIDE WITH WD-100 GRAVITY DAMPER SIZED FOR DAMPER TRAY FROM FACTORY.
4) PROVIDE WITH ALUMINUM BIRDSCREEN.
5) DIRECT DRIVE, ROOF MOUNTED CENTRIFGUAL FAN. PROVIDE WITH MOTOR SPEED DIAL MOUNTED TO FAN MOTOR FOR BALANCING.
6) BELT DRIVE, ROOF MOUNTED CENTRIFGUAL FAN. PROVIDE WITH TWO ADDITIONAL BELTS FROM FACTORY.
7) CEILING MOUTNED FAN. PROVIDE WITH ALUMINUM GRILLE AND ROOF JACK FROM FACTORY.
8) PROVIDE WITH NEW ROOF CURB, DAMPER TRAY CURB CAP SEAL, AND ACCESSORIES FOR HIGH WIND LOADS FROM FACTORY.

VENTILATOR HOOD SCHEDULE (4)

MARK	THROAT DIAMETER (IN.)	HOOD DIAMETER (IN.)	CURB DIMENSIONS (L/W/H)	CFM	ESP (IN. WG)	THROAT VELOCITY	TYPE	MANUFACTURER/MODEL	NOTES
RH-1 THRU 4	20	35.5	32.5/32.5/12	2,750	0.184	1222	GRAVITY	GREENHECK/GRSR-20	1,2,3
RH-5	30	48	42.5/42.5/12	4,600	0.163	915	GRAVITY	GREENHECK/GRSR-30	1,2,3

NOTES:
1) PROVIDE 0.5 IN. MESH BIRDSCREEN.
2) ALUMINUM HOUSING.
3) PROVIDE WITH WD-100 GRAVITY DAMPERS.

PACKAGED WALL UNIT SCHEDULE

TAG	SERVES	MANUFACTURER/MODEL	TYPE	NOMINAL COOLING CAPACITY (BTU/H)	COOLING EER	NOMINAL HEATING CAPACITY (BTU/H)	HEATING COP	COOLING DESIGN ENTERING TEMP DB/WB (°F)	HEATING DESIGN ENTERING TEMP DB (°F)	VOLTAGE / PHASE	MCA (COOLING/HEATING)
WP-1	C106	CARRIER/26TTW12HC230V1A	THRU WALL	12,000	9.8	10,600	ELECTRIC	80.0/67.0	37	208/230V/1-PHASE	6.1/15.2

NOTES:
1. PROVIDE WITH FACTORY FURNISHED DISCONNECT SWITCH.

CIRCULATION FAN SCHEDULE (4)

MARK	WEIGHT (LBS)	MOTOR DATA HP	RPM	VOLT/PH	MOCP	MCA	MAX. SONES	NO. BLADES	FAN DIAMETER (FT.)	MANUFACTURER/MODEL	NOTES
HVLS-1 & 2	284	2	87	208/3	15	4.9	3	4	16	JOHNSON/REVOLUTION	1,2,3

NOTES:
1. PROVIDE WITH FACTORY MOUNTING HARDWARE TO MOUNT FAN TO STRUCTURE.
2. PROVIDE WITH FACTORY WALL-MOUNTED CONTROLLER.
3. PROVIDE DIRECT DRIVE MOTOR.

GAS-FIRED UNIT HEATER SCHEDULE (4)

MARK	SERVES	CFM	CAP. (MBH)	TEMP. RISE (°F)	MOUNTING HIEGHT	HP	VOLT/PH	MANUFACTURER/MODEL	NOTES
UH 12 & 13	D121	1160	60	48	10'-0"	1\12	115/1	MODINE / HD-75	1,2

NOTES:
1) PROVIDE SUPPORT FROM STRUCTURE ABOVE.
2) PROVIDE WITH FACTORY MOUNTED INTEGRAL THERMOSTAT AND SET TO TURN ON AT 45 °F (ADJ.)

ROOFTOP UNIT WITH ENERGY RECOVERY SCHEDULE

MARK	SUPPLY FAN CFM	FAN HP/QTY	E.S.P. (IN. W.G.)	T.S.P. (IN. W.G.)	EXHAUST FAN CFM	FAN HP/QTY	E.S.P. (IN. W.G.)	T.S.P. (IN. W.G.)	EER	AMBIENT COOL/ HEAT (°F) DB	ENERGY RECOVERY WHEEL PERFORMANCE: COOLING OA (°F) DB/WB	COOLING PRE-TREATED OA (°F) DB/WB	COOLING RA (°F) DB/WB	COOLING EA (°F) DB/WB	COOLING TOTAL CAPACITY (MBH)	HEATING OA (°F) DB/WB	HEATING PRE-TREATED OA (°F) DB/WB	HEATING RA (°F) DB/WB	HEATING EA (°F) DB/WB	HEATING TOTAL CAPACITY (MBH)	COOLING COIL EAT (°F) DB/WB	COOLING COIL LAT (°F) DB/WB	COOLING COIL TOTAL CAP (MBH)	COOLING COIL SENSIBLE CAP (MBH)	COOLING COIL FACE VELOCITY (FPM)	NAT. GAS HEATING COIL EAT (°F) DB	NAT. GAS HEATING COIL LAT (°F) DB	NAT. GAS HEATING COIL HEAT INPUT (MBH)	NAT. GAS HEATING COIL HEAT OUTPUT (MBH)	CONDENSER ROWS/FPI	CONDENSER COMPRESSOR QTY/RLA	CONDENSER FAN QTY/HP/FLA	ELECTRICAL VOLT /PH	ELECTRICAL MCA (AMPS)	ELECTRICAL MFS (AMPS)	WEIGHT (LBS)	MANUFACTURER/MODEL
RTU-13	5,300	5/1	0.50	1.83	1,870	5/1	0.50	0.92	11.4	98/37	98/80	78/64	75/63	91/78	117.0	37/31	66/55	70/58	41/36	58.4	76/64	48/48	234.0	160.0	262	68	110	300.0	240.0	6/12	2/14.7	3/1.34/1.55	460/3	53.6	60	4,650	GREENHECK/RVE-85-52P-30L-20

REMARKS:
1) PROVIDE WITH 14" TALL ROOF CURB SHIPPED FROM FACTORY AND ALL ACCESSORIES FOR ROOF MOUNTING WITH BOTTOM SUPPLY AND BOTTOM RETURN.
2) PROVIDE WITH SINGLE POINT ELECTRICAL CONNECTION FROM FACTORY.
3) PROVIDE WITH CONTROLLER COMPATIBLE WITH BACNET BAS.
4) PROVIDE WITH MERV 8 PLEATED FILTERS.
5) PROVIDE WITH 115V CONVENIENCE OUTLET.
6) PROVIDE ELECTRICAL CONNECTIONS THROUGH ROOF CURB.

DIFFUSER AND GRILLE SCHEDULE

MARK	TYPE	FACE SIZE (IN.)	NECK SIZE (IN.)	MANUFACTURER/MODEL	NOTES
A	LAY-IN SUPPLY DIFFUSER	24x24	8"Ø	TITUS/TDC	1,2,3,4
B	LAY-IN EGGCRATE RETURN GRILLE	24x24	N/A	TITUS/50F	1,2,3,4

NOTES:
1) UNITS SHALL BE FURNISHED WITH APPROPRIATE FRAMES FOR DUCT, CEILING OR WALL MOUNTING.
2) FINISH/PAINT COLOR SHALL BE WHITE UNLESS OTHERWISE NOTED.
3) PROVIDE FRAMES/ACCESSORIES FOR MOUNTING IN RESPECTIVE CEILING/WALL/DUCT.
4) ALL DEVICES SHALL BE WHITE.

AIR COOLED CONDENSING UNIT SCHEDULE

SYSTEM TAG	TAG REFERENCE	SERVES	MANUFACTURER/ MODEL	COOLING INDOOR CONDITIONS (DB/WB)	HEATING INDOOR CONDITIONS (DB)	NOMINAL COOLING CAPACITY (MBH)	NOMINAL HEATING CAPACITY (MBH)	COOLING EFFICIENCY IEER/EER [SEER]	HEATING COP @ 47°F [HSPF]	DESIGN COOLING OUTDOOR TEMP DB (°F)	DESIGN HEATING OUTDOOR TEMP WB (°F)	CORRECTED COOLING TOT/SENS CAPACITY (MBH)	CORRECTED HEATING CAPACITY (MBH)	VOLTAGE / PHASE	MCA 208/230
BASE BID															
ACCU-1	ACCU-1	MS-1	TRANE/4TYK1609A	80/67	N/A	9	-	16	-	98	N/A	11.4	-	208/1	9
ACCU-2	ACCU-2	MS-2	TRANE/4TYK1609A	80/67	65	9	9.5	16	9	98	37	11.4	12.4	208/1	9
BID OPTION (4)															
CU-1	CU-1	AHU-1, AHU-2, AHU-3, AHU-4	TRANE/4TXM2242A	80/67	65	42	45	21	10.2	98	37	40.4	45	208/1	26
ACCU-3	ACCU-3	MS-3	TRANE/4TYK1609A	80/67	65	9	9.5	16	9	98	37	11.4	12.4	208/1	9

NOTES:
1. INSULATE REFRIGERANT SUCTION LINE PER SPECIFICATIONS.
2. SIZE, ROUTE, INSULATE AND PROVIDE APPURTENANCES FOR DX PIPING SYSTEMS, PER MANUFACTURER RECOMMENDATIONS.
3. PROVIDE WITH FACTORY FURNISHED DISCONNECT SWITCH.

MINI-SPLIT AIR HANDLER UNIT SCHEDULE

TAG	SERVES	MANUFACTURER/MODEL	TYPE	OUTSIDE AIR (CFM)	NOMINAL COOLING CAPACITY (MBH)	NOMINAL HEATING CAPACITY (MBH)	COOLING DESIGN ENTERING TEMP DB/WB (°F)	HEATING DESIGN ENTERING TEMP DB/WB (°F)	REFRIG PIPE DIM LIQUID/SUCTION (INCH)	PEAK FAN AIRFLOW (CFM)	SOUND PRESSURE PER FAN SPEED 208V/230V (DBA) H/M/L	VOLTAGE / PHASE	ELECTRICAL MCA/MFS
BASE BID													
MS-1	C116	TRANE/4MYW1609A	Indoor air handler unit	0	9	-	80.0/67.0	N/A	1/4	-	38/34/28	208/230V/1-PHASE	POWERED BY OUTDOOR
MS-2	D126	TRANE/4MXW1609A	Indoor air handler unit	30	9	9.5	80.0/67.0	65	1/4	-	38/34/28	208/230V/1-PHASE	POWERED BY OUTDOOR
BID OPTION (4)													
AHU-1 THRU 3	D102, D109, D110	TRANE/4MXC8512	Indoor air handler unit	30	12	13	80.0/67.0	65	1/4	353	46/42/37	208/230V/1-PHASE	POWERED BY OUTDOOR
AHU- 4	D118	TRANE/4MXC8518	Indoor air handler unit	30	14.4	16	80.0/67.0	65	1/4	353	46/42/37	208/230V/1-PHASE	POWERED BY OUTDOOR
MS-3	C110	TRANE/4MXW1609A	Indoor air handler unit	30	9	9.5	80.0/67.0	65	1/4	-	38/34/28	208/230V/1-PHASE	POWERED BY OUTDOOR

NOTES:
1. PROVIDE WITH FACTORY FURNISHED DISCONNECT SWITCH.
2. UNIT SHALL MAINTAIN A SETBACK TEMPERATURE OF 85°F (ADJ.) IN COOLING AND 65°F (ADJ.) IN HEATING DURING UNOCCUPIED HOURS SET BY OWNER.
3. PROVIDE WITH FACTORY FURNISHED PROGRAMMABLE THERMOSTAT.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.

VAN CASHEN
118595
LICENSED
PROFESSIONAL ENGINEER
STATE OF TEXAS
04/20/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

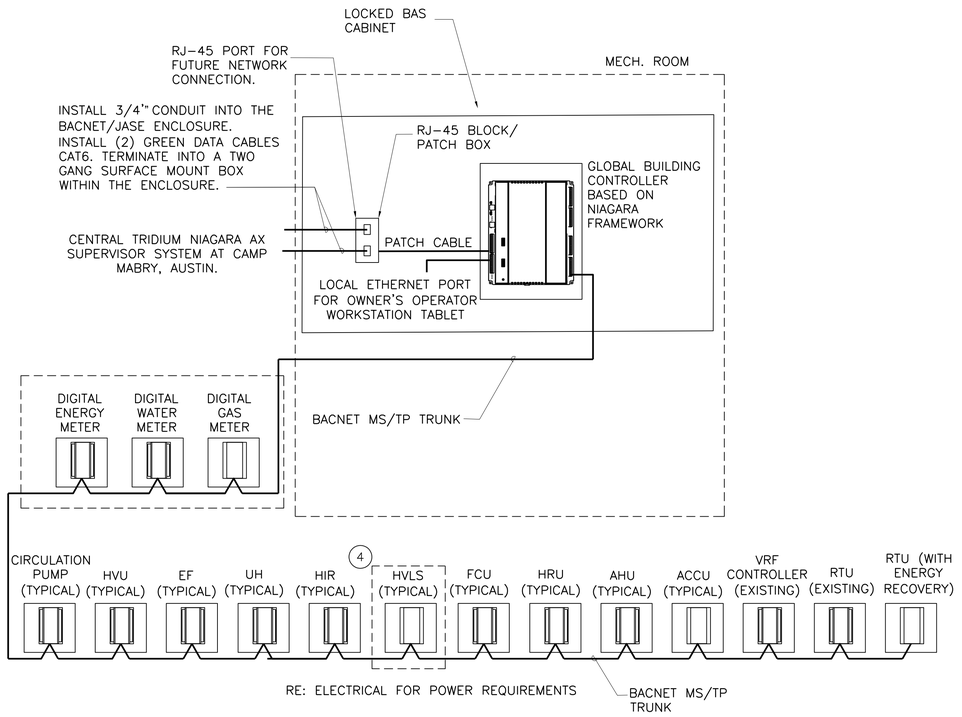
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL SCHEDULES

M-9 (4)

SHT. 56 of 129



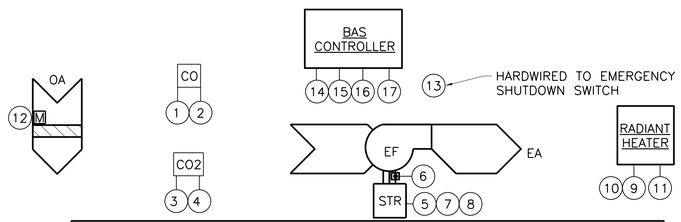
NOTE:

BASE BID: PROVIDE GLOBAL BUILDING CONTROLLER AND DIGITAL ENERGY METERS. METERS TO BE INTEGRATED TO GLOBAL CONTROLLER VIA BACNET MS/TP AS SHOWN.

SECO BID OPTION #2: UTILIZE THE NIAGARA GLOBAL BUILDING CONTROLLER FOR INTEGRATION OF ALL OTHER EQUIPMENT SHOWN ON DIAGRAM AND P&ID DETAILS.

2 (1 / M-10) NETWORK ARCHITECTURE DIAGRAM

NTS



BAS INPUT/OUTPUT POINT LIST

TAG	POINT NAME		AI	AO	DI	DO	ALARM
1	CO CONCENTRATION		X				
2	CO CONCENTRATION SETPOINT					X	
3	CO2 CONCENTRATION		X				
4	CO2 CONCENTRATION SETPOINT					X	
5	EXHAUST FAN ON/OFF	*				X	
6	EXHAUST FAN STATUS	*			X		
7	EXHAUST FAN FAILURE	*					X
8	FAN ENABLE (24/7)	*				X	
9	RADIANT HEATER ON/OFF	*				X	
10	RADIANT HEATER STATUS	*			X		
11	RADIANT HEATER FAILURE	*					X
12	DAMPER POSITION (OPEN/CLOSE)	*		X			
13	EMERGENCY SHUTDOWN (GLOBAL)	*					X
14	HIGH CO ALARM						X
15	HIGH CO2 ALARM						X
16	HIGH CO MASS NOTIFICATION (TO FACP)						X
17	HIGH CO2 MASS NOTIFICATION (TO FACP)						X

* NOTE: THESE POINTS ARE ALREADY MONITORED UNDER THE DRILL HALL VENTILATION CONTROL SEQUENCE.

2 (2 / M-10) ASSEMBLY HALL HAZARDOUS GAS EXHAUST P&ID CONTROL SCHEMATIC

NTS

NOTE: THIS SEQUENCE APPLIES TO EF-6 AND EF-7. IF SECO OPTION 2 IS NOT SELECTED, PROVIDE INDEPENDENT CONTROLLER AND CONTROL AS INDICATED

BAS INPUT/OUTPUT POINT LIST

		HARDWARE POINTS				SOFTWARE POINTS					
TAG	POINT NAME	AI	AO	DI	DO	AV	BV	TREND	ALARM	ADJUSTABLE	SHOW ON GRAPHIC
1	WATER FLOW RATE	X						X			
2	DEMAND							X			X
3	PEAK MONTH-TO-DATE							X			X
4	PEAK TODAY							X			X
5	PEAK YEAR-TO-DATE							X			X
6	USAGE MONTH-TO-DATE							X			X
7	USAGE TODAY							X			X
8	USAGE YEAR-TO-DATE							X			X
9	GAS METER FAILURE								X		

WATER METER POINTS LIST

BAS INPUT/OUTPUT POINT LIST

		HARDWARE POINTS				SOFTWARE POINTS					
TAG	POINT NAME	AI	AO	DI	DO	AV	BV	TREND	ALARM	ADJUSTABLE	SHOW ON GRAPHIC
1	GAS FLOW RATE	X						X			
2	DEMAND							X			X
3	PEAK MONTH-TO-DATE							X			X
4	PEAK TODAY							X			X
5	PEAK YEAR-TO-DATE							X			X
6	USAGE MONTH-TO-DATE							X			X
7	USAGE TODAY							X			X
8	USAGE YEAR-TO-DATE							X			X
9	GAS METER FAILURE								X		

GAS METER POINTS LIST

BAS INPUT/OUTPUT POINT LIST

		HARDWARE POINTS				SOFTWARE POINTS					
TAG	POINT NAME	AI	AO	DI	DO	AV	BV	TREND	ALARM	ADJUSTABLE	SHOW ON GRAPHIC
1	REAL POWER - KW TOTAL					X		X			X
2	REAL ENERGY - KWH TOTAL					X		X			X
3	PWR-DEMAND					X		X			X
4	PWR-DEMAND-PEAK					X		X			X
5	VOLTAGE A-B					X		X			X
6	VOLTAGE A-N					X		X			X
7	VOLTAGE B-C					X		X			X
8	VOLTAGE B-N					X		X			X
9	VOLTAGE C-A					X		X			X
10	VOLTAGE C-N					X		X			X
11	AMP A					X		X			X
12	AMP B					X		X			X
13	AMP C					X		X			X
14	POWER FACTOR A					X		X			X
15	POWER FACTOR B					X		X			X
16	POWER FACTOR C					X		X			X
17	POWER FACTOR TOTAL					X		X			X
18	REACTIVE POWER - KVAR					X		X			X

ELEC. METER POINTS LIST

2

BAS GENERAL NOTES:

1. PROVIDE A TOTALLY NATIVE BACNET BASED DIRECT DIGITAL CONTROL (DDC) SYSTEM INCLUDING A COMPATIBLE OPERATOR WORKSTATION LAPTOP BASED ON THE NETWORK ARCHITECTURE DIAGRAM SHOWN IN DETAIL 1 ON THIS SHEET.
2. THE GLOBAL BUILDING CONTROLLER SHALL BE BASED ON THE TRIDIUM NIAGARA N4 FRAMEWORK AND SHALL BE ABLE TO ESTABLISH AND MAINTAIN TWO WAY COMMUNICATION AND CONTROL WITH THE EXISTING NIAGARA AX SUPERVISOR VIA THE OWNER – FURNISHED RCAS NETWORK. PROVIDE REQUIRED NIAGARA AX LICENSING FOR THE N4 CONTROLLER.
3. THE OWNER SHALL OWN AND SHALL HAVE FULL RIGHTS TO ALL FEATURES OF THE NIAGARA AX SOFTWARE.
4. THE LOCAL BUILDING CONTROLLER/JACE SHALL BE CONFIGURED WITH DCHP ADDRESSING.
5. CONTRACTOR SHALL CONTACT AND COORDINATE WITH TRIDIUM TO ACQUIRE THE STANDARD NIAGARA AX GRAPHICS AND SHALL MODIFY/ALTER THESE GRAPHICS TO MATCH SYSTEMS AND EQUIPMENT IN THIS PROJECT. REFER TO TECHNICAL SPECIFICATION SECTION 23 09 23 FOR MORE INFORMATION.
6. REFER TO TECHNICAL SPECIFICATION SECTION 23 09 23 FOR STANDARD NOMENCLATURE AND FILE NAMING CONVENTIONS.
7. REFER TO TECHNICAL SPECIFICATION SECTION 23 09 23 TO COMPLY WITH REQUIREMENTS OF UMCS-MCX ARMY METERING PROGRAM GUIDANCE FOR ADVANCED METERS.
8. ALL EQUIPMENT (EXISTING AND NEW) SHALL CONNECT TO THE GLOBAL BUILDING CONTROLLER VIA THE BACNET MS/TP TRUNK. PROVIDE REQUIRED CONTROLLERS TO INTERFACE EQUIPMENT

ZONE TEMPERATURE CONTROL:

1. THE BAS SHALL INCLUDE 7-DAY OCCUPANCY SCHEDULES FOR INDIVIDUAL EQUIPMENT AND A 7-DAY MASTER OCCUPANCY SCHEDULE FOR THE BUILDING. THE ZONE TEMPERATURE CONTROL SHALL BE BASED ON OCCUPANCY SCHEDULE AND THE OCCUPANCY STATUS OF THE ROOM (WHERE PROVIDED WITH OCCUPANCY SENSORS).
2. OCCUPIED MODE: THE BUILDING SHALL BE "OCCUPIED" FROM 8 A.M. (ADJ.) TO 6 P.M. (ADJ.), MONDAY THRU FRIDAY. TEMPERATURE SETPOINTS: COOLING: 75°F (ADJ.), HEATING 70°F (ADJ.).
3. UNOCCUPIED MODE: THE BUILDING SHALL BE "UNOCCUPIED" FROM 6 P.M. (ADJ.) TO 8 A.M. (ADJ.) MONDAY THRU FRIDAY AND ENTIRE DAY ON SATURDAY AND SUNDAY. TEMPERATURE SETPOINTS: COOLING: 85°F (ADJ.) AND HEATING: 60°F (ADJ).
4. ZONE SETPOINT ADJUST: THE OCCUPANT SHALL BE ABLE TO ADJUST THE ZONE TEMPERATURE HEATING AND COOLING SET POINTS AT THE ZONE SENSOR BY ±2°F.
5. ZONE UNOCCUPIED OVERRIDE: A TIMED LOCAL OVERRIDE CONTROL SHALL ALLOW AN OCCUPANT TO OVERRIDE THE SCHEDULE AND PLACE THE UNIT INTO AN OCCUPIED MODE FOR AN ADJUSTABLE (INITIALLY SET AT 2 HOURS) PERIOD OF TIME. AT THE EXPIRATION OF THIS TIME, CONTROL OF THE UNIT SHALL AUTOMATICALLY RETURN TO THE MASTER SCHEDULE.
6. ASSEMBLY HALL ZONE TEMPERATURE CONTROL: REFER TO 3/M-11 FOR TEMPERATURE SETPOINTS FOR THE ASSEMBLY HALL.
7. TEMPERATURE CONTROL DEVICES SHALL BE EQUIPPED WITH DEADBANDS THAT COMPLY WITH IECC 2015.

HAZARDOUS EXHAUST SEQUENCE OF OPERATION:

1. ASSEMBLY HALL HAZARDOUS GAS EXHAUST SEQUENCE: THE SYSTEM SHALL BE CONTROLLED BY THE BAS AND OPERATE AS FOLLOWS:
   - 1.1. THE EXHAUST FANS, DAMPERS, AND RADIANT HEATERS SHALL REMAIN ENABLED AT ALL TIMES.
   - 1.2. CARBON DIOXIDE (CO2) MONITORING: A CO2 SENSOR SHALL BE PLACED ON THE DRILL HALL WALL, AT 18" AFF. THE SENSOR SHALL MONITOR CO2 CONCENTRATION IN THE SPACE AND ENABLE THE VENTILATION SYSTEM PER THE FOLLOWING:
     - 1.2.1. THE EXHAUST FAN SHALL ENERGIZE AND THE DAMPERS SHALL OPEN TO MAXIMUM OPEN POSITION WHEN THE CO2 CONCENTRATION (HIGHER OF THE TWO SENSORS INSTALLED) RISES ABOVE THE CO2 SETPOINT OF 1200 PPM (ADJ.). THIS VENTILATION SEQUENCE SHALL OVERRIDE ANY TEMPERATURE BASED SYSTEM CONTROL IN THE DRILL HALL.
     - 1.2.2. THE EXHAUST FAN SHALL DE-ENERGIZE AND THE DAMPERS SHALL CLOSE WHEN THE CO2 CONCENTRATION (HIGHER OF THE TWO SENSORS INSTALLED) FALLS BELOW THE CO2 SETPOINT OF 1100 PPM (ADJ.). THE CONTROLS FOR THE DRILL HALL SHALL REVERT BACK TO THE TEMPERATURE BASED CONTROL SEQUENCES AFTER 15 MINUTES OF CONTINUOUS CO2 CONCENTRATIONS BELOW THE DE-ENERGIZE SETPOINT.
     - 1.2.3. HIGH CO2 ALARM: AN ALARM SHALL BE TRIGGERED ON THE BAS WHEN THE CO2 CONCENTRATION (HIGHER OF THE TWO SENSORS INSTALLED) EXCEEDS 1800 PPM, AND THE SYSTEM IS RUNNING. THE ALARM WILL STOP WHEN THE CO2 CONCENTRATION (HIGHER OF THE TWO SENSORS INSTALLED) FALLS BELOW 1700 PPM, AND THE SYSTEM IS RUNNING.
     - 1.2.4. CO2 MASS NOTIFICATION ALARM: IN THE EVENT THE CO2 CONCENTRATION (HIGHER OF THE TWO SENSORS INSTALLED) EXCEEDS 2000 PPM, A VISUAL AND AN AUDIBLE ALARM SHALL BE GENERATED VIA THE FIRE ALARM MASS NOTIFICATION SYSTEM ALERTING THE BUILDING OCCUPANTS OF THE HIGH CONCENTRATION AND ADVISING THEM TO LEAVE THE BUILDING. REFER TO FIRE ALARM DRAWINGS.
   - 1.3. CARBON MONOXIDE (CO) MONITORING: A CO SENSOR SHALL BE PLACED ON THE DRILL HALL WALL AS SHOWN ON M-4, AT 6'-0" AFF. THE SENSOR SHALL MONITOR CO CONCENTRATION IN THE SPACE AND ENABLE THE VENTILATION SYSTEM UNDER PER THE FOLLOWING:
     - 1.3.1. THE EXHAUST FAN SHALL ENERGIZE AND THE DAMPERS SHALL OPEN TO MAXIMUM OPEN POSITION WHEN THE CO CONCENTRATION (HIGHER OF THE TWO SENSORS INSTALLED) RISES ABOVE THE CO SETPOINT OF 8 PPM (ADJ.). THIS VENTILATION SEQUENCE SHALL OVERRIDE ANY TEMPERATURE BASED SYSTEM CONTROL IN THE DRILL HALL.
     - 1.3.2. THE EXHAUST FAN SHALL DE-ENERGIZE AND THE DAMPERS SHALL CLOSE WHEN THE CO CONCENTRATION (HIGHER OF THE TWO SENSORS INSTALLED) FALLS BELOW THE CO SETPOINT OF 6 PPM (ADJ.). THE CONTROLS FOR THE DRILL HALL SHALL REVERT BACK TO THE TEMPERATURE BASED CONTROL SEQUENCES AFTER 15 MINUTES OF CONTINUOUS CO CONCENTRATIONS BELOW THE DE-ENERGIZE SETPOINT.
     - 1.3.3. HIGH CO ALARM: AN ALARM SHALL BE TRIGGERED ON THE BAS WHEN THE CO CONCENTRATION (HIGHER OF THE TWO SENSORS INSTALLED) EXCEEDS 8 PPM AND THE SYSTEM IS RUNNING. THE ALARM WILL STOP WHEN THE CO CONCENTRATION (HIGHER OF THE TWO SENSORS INSTALLED) FALLS BELOW 6 PPM.
     - 1.3.4. CO MASS NOTIFICATION ALARM: IN THE EVENT THE CO CONCENTRATION EXCEEDS 35 PPM, A VISUAL AND AN AUDIBLE ALARM SHALL BE GENERATED VIA THE FIRE ALARM MASS NOTIFICATION SYSTEM ALERTING THE BUILDING OCCUPANTS OF THE HIGH CONCENTRATION AND ADVISING THEM TO LEAVE THE BUILDING. REFER TO FIRE ALARM DRAWINGS.
     - 1.3.5. THE RADIANT HEATERS SHALL STOP FIRING WHEN THE CO CONCENTRATION EXCEEDS 35 PPM.

SECO OPTIONS "□"

1. PROVIDE OCCUPANCY SENSORS
2. PROVIDE DDC CONTROL SYSTEM

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

STATE OF TEXAS · VAN CASHEN · 118595 · LICENSED · PROFESSIONAL ENGINEER

04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: RWE
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

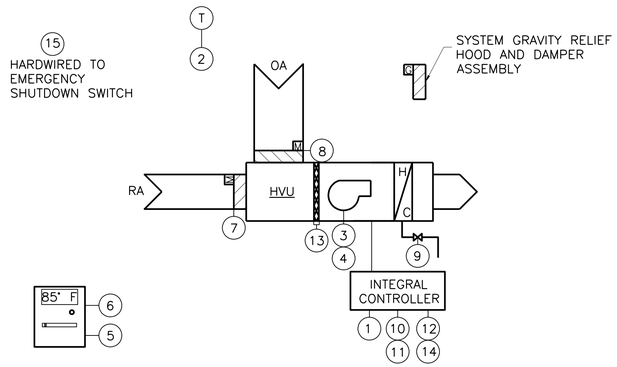
STAR CAMPAIGN FY18 - WESLACO RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL NETWORK ARCHITECTURE DIAGRAM

M-10 2

SHT. 57 of 129



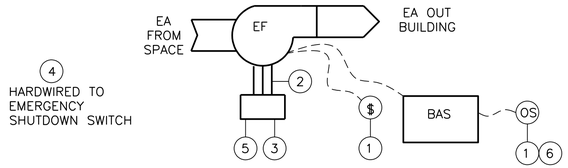
BAS INPUT/OUTPUT POINT LIST						
TAG	POINT NAME	AI	AO	DI	DO	ALARM
1	SYSTEM ENABLE				X	
2	OUTSIDE AIR TEMPERATURE (GLOBAL)	X				
3	SUPPLY FAN ON/OFF				X	
4	SUPPLY FAN STATUS (CT)			X		
5	SPACE AIR TEMPERATURE	X				
6	SPACE AIR TEMPERATURE SETPOINT				X	
7	RETURN AIR DAMPER		X			
8	OUTDOOR AIR DAMPER		X			
9	GAS VALVE POSITION				X	
10	SUPPLY FAN FAILURE					X
11	LOW SPACE AIR TEMPERATURE					X
12	SMOKE DETECTOR					X
13	FILTER ALARM					X
14	EMERGENCY SHUTDOWN (GLOBAL)					X

DIRECT FIRED HEATING VENTILATOR CONTROL SEQUENCE

1. THE HVU SHALL BE CONTROLLED BY THE BAS AND REMAIN ENABLED 24/7. THE BAS CONTRACTOR SHALL PROVIDE THE HVU SYSTEM WITH A BACNET CONTROLLER COMPATIBLE WITH THE TRIDIUM NIAGARA AX FRAMEWORK. THE UNIT SHALL START AND STOP BASED ON THE FOLLOWING CRITERIA: OCCUPANCY SENSORS, FREEZE PROTECTION CONDITIONS, LOCAL OVERRIDE OF ZONE THERMOSTAT, OR MANUAL/REMOTE OVERRIDE THROUGH THE BAS.
2. THE HVU SHALL BE CONTROLLED AS FOLLOWS WHEN THE SPACE IS OCCUPIED (AS DETERMINED BY OCCUPANCY SENSORS):
   - 2.1. SUPPLY FAN: THE SUPPLY FAN SHALL OPERATE CONTINUOUSLY WHEN THE SPACE IS OCCUPIED.
     - 2.2.1. HIGH SPACE TEMPERATURE OPERATIONS [>85°F] (ADJ.): THE HVU SHALL PROVIDE 100% OUTSIDE AIR TO THE SPACE. THE BAS SHALL MODULATE THE OUTSIDE AIR DAMPER TO ITS FULLY OPEN POSITION AND THE RETURN AIR DAMPER TO ITS FULLY CLOSED POSITION. THE GRAVITY RELIEF HOOD SHALL RELIEVE EXCESS PRESSURE FROM THE SPACE.
     - 2.2.2. MODERATE SPACE TEMPERATURE OPERATIONS [55°F < T < 85°F] (ADJ.): THE BAS SHALL SET THE OUTSIDE AIR DAMPER TO THE MINIMUM OUTDOOR AIR POSITION (CFM SPECIFIED ON UNIT SCHEDULE), AND THE RETURN AIR DAMPER SHALL MODULATE TO ALLOW FOR REMAINDER OF THE SYSTEM AIRFLOW. DAMPER POSITIONS TO BE DETERMINED BY TAB FIRM.
     - 2.2.3. LOW SPACE TEMPERATURE OPERATIONS [<55°F] (ADJ.): WHEN THE SPACE TEMPERATURE FALLS BELOW 55°F (ADJ.), UNIT SHALL OPERATE IN HEATING MODE. THE BAS SHALL SET THE OUTSIDE AIR DAMPER TO THE MINIMUM OUTDOOR AIR POSITION (CFM SPECIFIED ON UNIT SCHEDULE), AND THE RETURN AIR DAMPER SHALL MODULATE TO ALLOW FOR REMAINDER OF AIRFLOW. TAB SHALL DETERMINE DAMPER POSITIONS. UPON PROOF OF AIRFLOW, GAS VALVE SHALL MODULATE TO THE OPEN POSITION AND GAS HEATER SHALL FIRE AS REQUIRED TO MAINTAIN A SPACE TEMPERATURE SETPOINT. WHEN THE SPACE TEMPERATURE EXCEEDS 58°F (ADJ.), GAS VALVE SHALL CLOSE. HEATING ELEMENT SHALL NOT BE ALLOWED TO FIRE WITHOUT PROOF OF AIRFLOW.
3. THE HVU SHALL BE CONTROLLED AS FOLLOWS WHEN THE SPACE IS UNOCCUPIED (AS DETERMINED BY OCCUPANCY SENSORS):
   - 3.1. SUPPLY FAN: THE SUPPLY FAN SHALL NOT OPERATE UNLESS MANUALLY OVERRIDDEN FROM THE BAS, LOCAL OVERRIDE FROM THE THERMOSTAT, OR AS REQUIRED FOR FREEZE PROTECTION.
   - 3.2. DAMPER POSITION: THE OUTSIDE AIR DAMPER SHALL BE FULLY CLOSED AND THE RETURN AIR DAMPER SHALL BE FULLY OPEN DURING UNOCCUPIED CONDITIONS.
     - 3.2.1. FREEZE PROTECTION: IN THE EVENT THE SPACE IS UNOCCUPIED AND THE SPACE TEMPERATURE DROPS BELOW BELOW 45°F, THE SUPPLY AIR FAN SHALL RUN AND THE GAS VALVE SHALL BE OPENED. THE BAS SHALL MAINTAIN THE OUTSIDE AIR DAMPER IN THE FULLY CLOSED POSITION AND THE RETURN AIR DAMPER IN THE FULLY OPEN POSITION.
4. EMERGENCY SHUTDOWN: THE UNIT FAN SHALL STOP, THE GAS CONTROL VALVE SHALL CLOSE AND THE OUTSIDE AIR DAMPER SHALL BE MOVED TO THE CLOSED POSITION IN THE EVENT THAT AN EMERGENCY SHUTDOWN BUTTON IS TRIGGERED IN THE FACILITY. NORMAL OPERATIONS SHALL RESUME ONLY AFTER A MANUAL SYSTEM RESET AT THE BAS.
5. THE HVU SHALL BE PROVIDED WITH THE FOLLOWING ALARMS:
   - 5.1. A CURRENT TRANSFORMER INSTALLED ON THE SUPPLY FAN CIRCUIT SHALL SEND AN ALARM TO THE BAS IF THE FAN IS COMMANDED ON AND NO CURRENT IS DETECTED.
   - 5.2. THE BAS SHALL MONITOR THE SPACE THERMOSTAT AND SEND AN ALARM IF THE SPACE TEMPERATURE DROPS BELOW 40°F (ADJ.)
   - 5.3. A SMOKE DETECTOR LOCATED IN THE RETURN AIR DUCTWORK SHALL BE HARD WIRED INTO THE MOTOR CONTROL CIRCUIT TO SHUT DOWN THE FAN AND SEND AN ALARM TO THE BAS IF SMOKE IS DETECTED.
   - 5.4. THE CONTROLLER WILL ACTIVATE AN ALARM WHEN THE FILTER PRESSURE LOSS ACROSS THE FILTER EXCEEDS THE HIGH LIMIT SETPOINT OF 0.7 INCHES STATIC PRESSURE (ADJ.)
   - 5.5. THE CONTROLLER WILL ACTIVATE AN ALARM WHEN AN EMERGENCY SYSTEM SHUTDOWN IS TRIGGERED.

2 (1 / M-11) HEATING VENTILATOR UNIT P&ID CONTROL SCHEMATIC

NTS



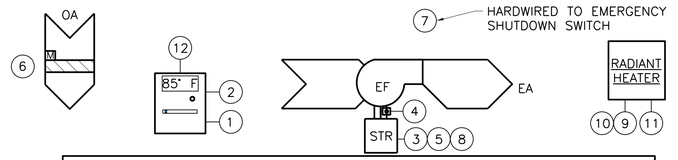
BAS INPUT/OUTPUT POINT LIST						
TAG	POINT NAME	AI	AO	DI	DO	ALARM
1	FAN ON/OFF				X	
2	FAN STATUS			X		
3	FAN FAILURE					X
4	EMERGENCY SHUTDOWN (GLOBAL)					X
5	FAN ENABLE (SWITCH)				X	
6	OCCUPANCY			X		

EF CONTROL SEQUENCE

1. THE SYSTEM SHALL BE CONTROLLED BY THE BAS AND SHALL OPERATE AS FOLLOWS:
   - 1.1. FAN SHALL BE ENABLED WHEN A LIGHT SWITCH IN ANY ROOM SERVED BY THE FAN IS ON. FAN SHALL ENERGIZE WHEN OCCUPANCY SENSOR IN ANY ROOM SERVED BY THE FAN DETECTS OCCUPANCY.
   - 1.2. FAN SHALL DE-ENERGIZE WHEN NO OCCUPANCY IS DETECTED BY ANY OCCUPANCY SENSORS IN ANY OF THE ROOMS SERVED BY THE FAN FOR 15 MINUTES (ADJ.).
2. ALARMS: THE ONBOARD BACNET CONTROLLER SHALL TRANSMIT SYSTEM ALARMS TO THE GRAPHIC USER INTERFACE (GUI). THE ONBOARD CONTROLLER SHALL, AT A MINIMUM, TRACK ALARMS LISTED IN THE I/O POINTS LIST.

2 (2 / M-11) SWITCH CONTROLLED EXHAUST FAN P&ID CONTROL SCHEMATIC

NTS



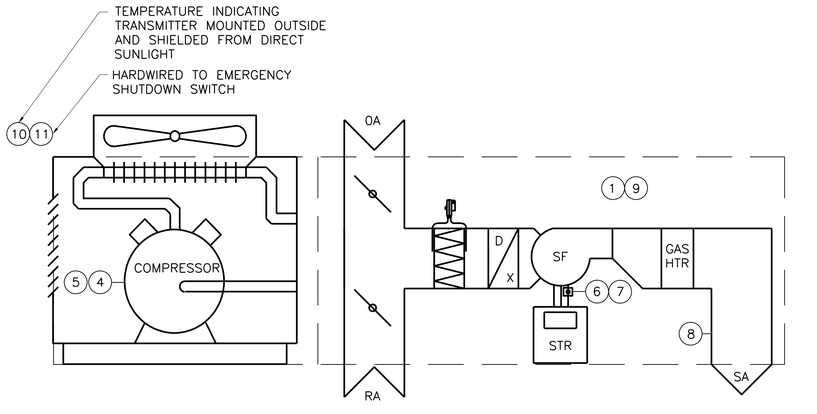
BAS INPUT/OUTPUT POINT LIST						
TAG	POINT NAME	AI	AO	DI	DO	ALARM
1	SPACE AIR TEMPERATURE	X				
2	SPACE AIR TEMPERATURE SETPOINT				X	
3	EXHAUST FAN ON/OFF				X	
4	EXHAUST FAN STATUS			X		
5	EXHAUST FAN FAILURE					X
6	INTAKE DAMPER POSITION (OPEN/CLOSE)				X	
7	EMERGENCY SHUTDOWN (GLOBAL)					X
8	FAN ENABLE (OCCUPIED HOURS)				X	
9	RADIANT HEATER ON/OFF				X	
10	RADIANT HEATER STATUS			X		
11	RADIANT HEATER FAILURE					X
12	OVERRIDE TIMER			X		X

EF & RADIANT HEATER CONTROL SEQUENCE

1. THE SYSTEM SHALL BE CONTROLLED BY THE BAS AND OPERATE AS FOLLOWS:
   - 1.1. THE EXHAUST FAN AND RADIANT HEATER SHALL REMAIN ENABLED DURING OCCUPIED HOURS. THE OCCUPANCY HOURS SHALL BE DETERMINED BASED ON THE MASTER BUILDING SCHEDULE.
   - 1.2. THE EXHAUST FANS SHALL ENERGIZE & THE OA INTAKE DAMPER SHALL OPEN WHEN THE SPACE AIR TEMPERATURE RISES ABOVE THE TEMPERATURE SETPOINT OF 85°F (ADJ.).
   - 1.3. THE RADIANT HEATERS SHALL ENERGIZE WHEN THE SPACE AIR TEMPERATURE DROPS BELOW THE TEMPERATURE SETPOINT OF 55°F (ADJ.).
   - 1.4. USER OVERRIDE: THE EXHAUST SYSTEM WILL BE PROVIDED WITH A TIMER LOCATED NEXT TO ITS THERMOSTAT THAT WILL ENABLE THE USER TO ENERGIZE THE EXHAUST SYSTEM FOR A PERIOD NOT TO EXCEED 2 HRS. (ADJ.).
2. FREEZE PROTECTION: DURING UNOCCUPIED HOURS THE UNIT HEATERS SHALL ENABLE WHEN THE SPACE AIR TEMPERATURE DROPS BELOW 50°F AND ENERGIZE WHEN THE SPACE AIR TEMPERATURE DROPS BELOW THE UNOCCUPIED TEMPERATURE SETPOINT OF 45°F.
3. ALARMS: THE ONBOARD BACNET CONTROLLER SHALL TRANSMIT SYSTEM ALARMS TO THE GUI. THE ONBOARD CONTROLLER SHALL, AT A MINIMUM, TRACK ALARMS LISTED IN THE I/O POINTS LIST.

2 (3 / M-11) ASSEMBLY HALL EXHAUST & HEATER P&ID CONTROL SCHEMATIC

NTS



BAS INPUT/OUTPUT POINT LIST						
TAG	POINT NAME	AI	AO	DI	DO	ALARM
1	RTU ENABLE/DISABLE			X		
2	SPACE TEMPERATURE	X				X
3	SPACE AIR TEMPERATURE SETPOINT	X				
4	COMPRESSOR STATUS			X		
5	COMPRESSOR FAILURE					X
6	SUPPLY FAN STATUS			X		
7	SUPPLY FAN FAILURE					X
8	SUPPLY AIR TEMPERATURE	X				
9	SMOKE DETECTOR STATUS			X		X
10	OUTSIDE AIR TEMPERATURE (GLOBAL)	X				
11	EMERGENCY SHUTDOWN (GLOBAL)					X

ROOFTOP UNIT (RTU) CONTROL:

1. THE EXISTING RTUS SHALL BE INTEGRATED INTO THE BUILDING AUTOMATION SYSTEM. THE BAS CONTRACTOR SHALL ADD A BACNET CONTROLLER TO INTERFACE TO THE EXISTING RTU CONTROLLER. THE BAS CONTRACTOR SHALL ADD CONTROLLERS, SENSORS, CONTROL WIRING, AND OTHER REQUIRED ITEMS TO MEET THE SEQUENCE LISTED BELOW AND TO COVER THE ITEMS REQUIRED IN THE POINTS LIST.
2. THE RTU SHALL BE CONTROLLED BY THE BAS AND SHALL BE ENABLED WHEN THE BUILDING IS IN OCCUPIED MODE. THE BAS CONTRACTOR SHALL PROVIDE THE RTU SYSTEM WITH A BACNET CONTROLLER COMPATIBLE WITH THE TRIDIUM NIAGARA AX FRAMEWORK.
3. THE RTU SHALL BE CONTROLLED AS FOLLOWS WHEN THE SPACE IS OCCUPIED (AS DETERMINED BY BUILDING SCHEDULE IN THE BAS):
   - 3.1. SUPPLY FAN: THE SUPPLY FAN SHALL OPERATE CONTINUOUSLY WHEN THE SPACE IS OCCUPIED.
   - 3.2. THE SPACE AIR TEMPERATURE SETPOINT SHALL BE MONITORED AND THE SYSTEM SHALL BE ENERGIZED TO MAINTAIN THE SETPOINTS 75°F (COOLING) & 70°F (HEATING), (BOTH ADJUSTABLE)
4. PROVIDE ADJUSTABLE SETPOINT THERMOSTAT COMPATIBLE WITH BACNET CONTROLLER.
5. THE BACNET CONTROLLER SHALL COMMUNICATE WITH THE BAS TO ALLOW THE MONITORING AND CONTROL OF I/O POINTS LISTED HERE.
6. ALARMS: BACNET CONTROLLER SHALL TRANSMIT SYSTEM ALARMS TO THE GUI. THE ONBOARD CONTROLLER SHALL, AT A MINIMUM, TRACK ALARMS LISTED IN THE I/O POINTS LIST.
7. EMERGENCY SHUTDOWN: THE UNIT FAN SHALL STOP, THE GAS CONTROL VALVE SHALL CLOSE AND THE OUTSIDE AIR DAMPER SHALL BE MOVED TO THE CLOSED POSITION IN THE EVENT THAT AN EMERGENCY SHUTDOWN BUTTON IS TRIGGERED IN THE FACILITY. NORMAL OPERATIONS SHALL RESUME ONLY AFTER A MANUAL SYSTEM RESET AT THE BAS.
   - 7.1. BAS CONTRACTOR TO PROVIDE APPROPRIATE SIGNALS TO THE EXISTING RTU CONTROLLER TO ACCOMPLISH THE EMERGENCY SHUTDOWN REQUIREMENTS.
8. THE RTU SHALL BE PROVIDED WITH THE FOLLOWING ALARMS:
   - 8.1. A CURRENT TRANSFORMER INSTALLED ON THE SUPPLY FAN CIRCUIT SHALL SEND AN ALARM TO THE BAS IF THE FAN IS COMMANDED ON AND NO CURRENT IS DETECTED.
   - 8.2. THE BAS SHALL MONITOR THE SPACE THERMOSTAT AND SEND AN ALARM IF THE SPACE TEMPERATURE DROPS BELOW 65°F (ADJ.) OR EXCEEDS 85°F (ADJ).
   - 8.3. A SMOKE DETECTOR LOCATED IN THE RETURN AIR DUCTWORK SHALL BE HARD WIRED INTO THE MOTOR CONTROL CIRCUIT TO SHUT DOWN THE FAN AND SEND AN ALARM TO THE BAS IF SMOKE IS DETECTED.
   - 8.4. THE CONTROLLER WILL ACTIVATE AN ALARM WHEN AN EMERGENCY SYSTEM SHUTDOWN IS TRIGGERED.

2 (4 / M-11) ROOFTOP AIR CONDITIONING UNIT CONTROL SCHEMATIC

NTS

STATE OF TEXAS
VAN CASHEN
118595
LICENSED
PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: RWE
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

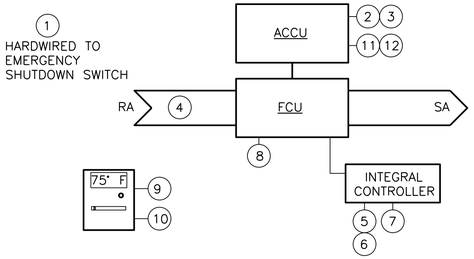
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL P&ID CONTROLS SCHEMATIC

M-11 2

SHT. 58 of 129



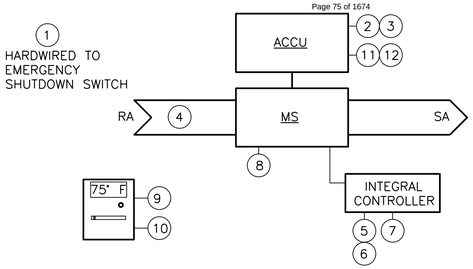
BAS INPUT/OUTPUT POINT LIST						
TAG	POINT NAME	AI	AO	DI	DO	ALARM
1	EMERGENCY SHUTDOWN (GLOBAL)					X
2	COMPRESSOR STATUS			X		
3	COMPRESSOR FAILURE					X
4	RETURN AIR TEMPERATURE	X				
5	FILTER DIFFERENTIAL PRESSURE					X
6	SUPPLY FAN STATUS			X		
7	SUPPLY FAN FAILURE					X
8	CONDENSATE OVERFLOW					X
9	SPACE AIR TEMPERATURE	X				
10	SPACE AIR TEMPERATURE SETPOINT				X	
11	ACCU FAN STATUS			X		
12	ACCU FAN FAILURE					X

MINI-SPLIT CONTROL SEQUENCE
1. THE MINI-SPLIT SYSTEM SHALL REMAIN ENABLED DURING ALL HOURS.
2. MINI-SPLIT CONTROL: THE MINI-SPLIT SYSTEM SHALL BE PROVIDED WITH A FACTORY FURNISHED ON-BOARD BACNET CONTROLLER COMPATIBLE WITH THE TRIDIUM NIAGARA AX FRAMEWORK. THE MANUFACTURER SHALL USE ITS PREFERRED SEQUENCE TO MEET THE FOLLOWING REQUIREMENTS: THE SPACE AIR TEMPERATURE SETPOINT SHALL BE MONITORED AND THE SYSTEM SHALL BE ENERGIZED TO MAINTAIN THE SETPOINTS 75°F (COOLING) & 70°F (HEATING).
3. THE ONBOARD BACNET CONTROLLER SHALL COMMUNICATE WITH THE BAS TO ALLOW THE MONITORING AND CONTROL OF I/O POINTS LISTED HERE. THE SYSTEM SHALL BE ENABLED 24/7.
4. ALARMS: THE ONBOARD BACNET CONTROLLER SHALL TRANSMIT SYSTEM ALARMS TO THE GUI. THE ONBOARD CONTROLLER SHALL, AT A MINIMUM, TRACK ALARMS LISTED IN THE I/O POINTS LIST.

2 1/M-12 MINI-SPLIT (WITH HEATING) P&ID CONTROL SCHEMATIC

NTS

NOTE: THIS SEQUENCE APPLIES TO ACCU-2 THRU 7 AND THEIR ASSOCIATED AIR HANDLER.



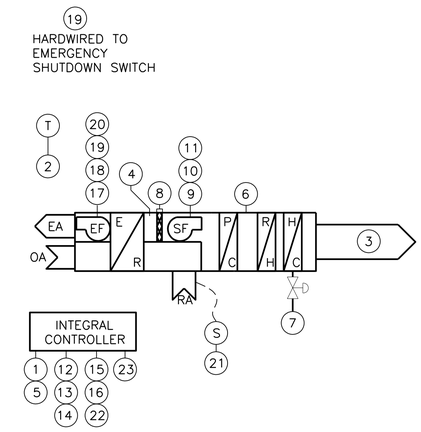
BAS INPUT/OUTPUT POINT LIST						
TAG	POINT NAME	AI	AO	DI	DO	ALARM
1	EMERGENCY SHUTDOWN (GLOBAL)					X
2	COMPRESSOR STATUS			X		
3	COMPRESSOR FAILURE					X
4	RETURN AIR TEMPERATURE	X				
5	FILTER DIFFERENTIAL PRESSURE					X
6	SUPPLY FAN STATUS			X		
7	SUPPLY FAN FAILURE					X
8	CONDENSATE OVERFLOW					X
9	SPACE AIR TEMPERATURE	X				
10	SPACE AIR TEMPERATURE SETPOINT				X	
11	ACCU FAN STATUS			X		
12	ACCU FAN FAILURE					X

MINI-SPLIT CONTROL SEQUENCE
1. THE MINI-SPLIT SYSTEM SHALL REMAIN ENABLED DURING ALL HOURS.
2. MINI-SPLIT CONTROL: THE MINI-SPLIT SYSTEM SHALL BE PROVIDED WITH A FACTORY FURNISHED ON-BOARD BACNET CONTROLLER COMPATIBLE WITH THE TRIDIUM NIAGARA AX FRAMEWORK. THE MANUFACTURER SHALL USE ITS PREFERRED SEQUENCE TO MEET THE FOLLOWING REQUIREMENTS: THE SPACE AIR TEMPERATURE SETPOINT SHALL BE MONITORED AND THE SYSTEM SHALL BE ENERGIZED TO MAINTAIN THE SETPOINTS 75°F.
3. THE ONBOARD BACNET CONTROLLER SHALL COMMUNICATE WITH THE BAS TO ALLOW THE MONITORING AND CONTROL OF I/O POINTS LISTED HERE. THE SYSTEM SHALL BE ENABLED 24/7.
4. ALARMS: THE ONBOARD BACNET CONTROLLER SHALL TRANSMIT SYSTEM ALARMS TO THE GUI. THE ONBOARD CONTROLLER SHALL, AT A MINIMUM, TRACK ALARMS LISTED IN THE I/O POINTS LIST.

2 2/M-12 MINI-SPLIT (COOLING ONLY) P&ID CONTROL SCHEMATIC

NTS

NOTE: THIS SEQUENCE APPLIES TO ACCU-1 AND ITS ASSOCIATED AIR HANDLER.



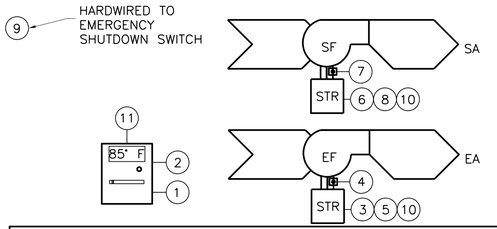
BAS INPUT/OUTPUT POINT LIST						
TAG	POINT NAME	AI	AO	DI	DO	ALARM
1	SYSTEM ENABLE				X	
2	OUTSIDE AIR TEMPERATURE (GLOBAL)	X				
3	SUPPLY AIR TEMPERATURE	X				
4	PRETREATED AIR TEMPERATURE	X				
5	SUPPLY AIR TEMPERATURE SETPOINT				X	
6	COOLING COIL LEAVING AIR TEMPERATURE					
7	GAS VALVE POSITION		X			
8	FILTER DIFFERENTIAL PRESSURE					X
9	SUPPLY FAN ON/OFF				X	
10	SUPPLY FAN STATUS			X		
11	SUPPLY FAN FAILURE					X
12	CONDENSATE OVERFLOW					X
13	COMPRESSOR STATUS			X		
14	COMPRESSOR FAILURE					X
15	CONDENSER FAN STATUS			X		
16	CONDENSER FAN FAILURE					X
17	EMERGENCY SHUTDOWN (GLOBAL)					X
18	EXHAUST FAN ON/OFF				X	
19	EXHAUST FAN STATUS			X		
20	EXHAUST FAN FAILURE					X
21	DUCT SMOKE DETECTOR ALARM					X
22	SUPPLY VFD SPEED		X			
23	EXHAUST VFD SPEED		X			

RTU WITH ENERGY RECOVERY CONTROL SEQUENCE
1. THE RTU SHALL BE CONTROLLED BY THE BAS AND SHALL BE ENABLED WHEN THE BUILDING IS IN OCCUPIED MODE. THE BAS CONTRACTOR SHALL PROVIDE THE RTU SYSTEM WITH A BACNET CONTROLLER COMPATIBLE WITH THE TRIDIUM NIAGARA AX FRAMEWORK.
2. THE RTU SHALL BE CONTROLLED AS FOLLOWS WHEN THE SPACE IS OCCUPIED (AS DETERMINED BY BUILDING SCHEDULE IN THE BAS):
   2.1. SUPPLY FAN: THE SUPPLY FAN SHALL OPERATE CONTINUOUSLY WHEN THE SPACE IS OCCUPIED.
   2.1. EXHAUST FAN: THE EXHAUST FAN SHALL OPERATE CONTINUOUSLY WHEN THE SPACE IS OCCUPIED.
   2.2. THE SPACE AIR TEMPERATURE SETPOINT SHALL BE MONITORED AND THE SYSTEM SHALL BE ENERGIZED TO MAINTAIN THE SETPOINTS 75°F (COOLING) & 70°F (HEATING), (BOTH ADJUSTABLE).
3. PROVIDE ADJUSTABLE SETPOINT THERMOSTAT COMPATIBLE WITH BACNET CONTROLLER.
4. THE BACNET CONTROLLER SHALL COMMUNICATE WITH THE BAS TO ALLOW THE MONITORING AND CONTROL OF I/O POINTS LISTED HERE.
5. ALARMS: BACNET CONTROLLER SHALL TRANSMIT SYSTEM ALARMS TO THE GUI. THE ONBOARD CONTROLLER SHALL, AT A MINIMUM, TRACK ALARMS LISTED IN THE I/O POINTS LIST.
6. EMERGENCY SHUTDOWN: THE UNIT FAN SHALL STOP, THE GAS CONTROL VALVE SHALL CLOSE AND THE OUTSIDE AIR DAMPER SHALL BE MOVED TO THE CLOSED POSITION IN THE EVENT THAT AN EMERGENCY SHUTDOWN BUTTON IS TRIGGERED IN THE FACILITY. NORMAL OPERATIONS SHALL RESUME ONLY AFTER A MANUAL SYSTEM RESET AT THE BAS.
   6.1. BAS CONTRACTOR TO PROVIDE APPROPRIATE SIGNALS TO THE EXISTING RTU CONTROLLER TO ACCOMPLISH THE EMERGENCY SHUTDOWN REQUIREMENTS.
7. THE RTU SHALL BE PROVIDED WITH THE FOLLOWING ALARMS:
   7.1. A CURRENT TRANSFORMER INSTALLED ON THE SUPPLY FAN CIRCUIT SHALL SEND AN ALARM TO THE BAS IF THE FAN IS COMMANDED ON AND NO CURRENT IS DETECTED.
   7.2. THE BAS SHALL MONITOR THE SPACE THERMOSTAT AND SEND AN ALARM IF THE SPACE TEMPERATURE DROPS BELOW 65°F (ADJ.) OR EXCEEDS 85°F (ADJ).
   7.3. A SMOKE DETECTOR LOCATED IN THE RETURN AIR DUCTWORK SHALL BE HARD WIRED INTO THE MOTOR CONTROL CIRCUIT TO SHUT DOWN THE FANS AND SEND AN ALARM TO THE BAS IF SMOKE IS DETECTED.
   7.4. THE CONTROLLER WILL ACTIVATE AN ALARM WHEN AN EMERGENCY SYSTEM SHUTDOWN IS TRIGGERED.

2 5/- RTU W/ ENERGY RECOVERY P&ID CONTROL SCHEMATIC

NTS

NOTE: THIS SEQUENCE APPLIES TO RTU-13



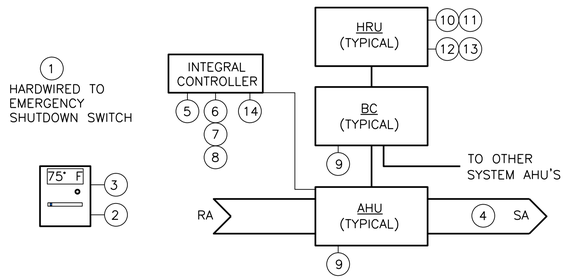
BAS INPUT/OUTPUT POINT LIST						
TAG	POINT NAME	AI	AO	DI	DO	ALARM
1	SPACE AIR TEMPERATURE	X				
2	SPACE AIR TEMPERATURE SETPOINT				X	
3	EXHAUST FAN ON/OFF				X	
4	EXHAUST FAN STATUS			X		
5	EXHAUST FAN FAILURE					X
6	SUPPLY FAN ON/OFF				X	
7	SUPPLY FAN STATUS			X		
8	SUPPLY FAN FAILURE					X
9	EMERGENCY SHUTDOWN (GLOBAL)				X	X
10	FAN ENABLE (OCCUPIED HOURS)				X	X
11	OVERRIDE TIMER			X	X	X

EF CONTROL SEQUENCE
1. THE SYSTEM SHALL BE CONTROLLED BY THE BAS AND OPERATE AS FOLLOWS:
   1.1. THE EXHAUST FAN SHALL REMAIN ENABLED DURING OCCUPIED HOURS. THE OCCUPANCY HOURS SHALL BE DETERMINED BASED ON THE MASTER BUILDING SCHEDULE.
   1.2. THE EXHAUST FANS SHALL ENERGIZE AND THE ASSOCIATED SUPPLY FAN SHALL OPEN WHEN THE SPACE AIR TEMPERATURE RISES ABOVE THE TEMPERATURE SETPOINT OF 85°F (ADJ.).
   1.3. USER OVERRIDE: THE EXHAUST SYSTEM WILL BE PROVIDED WITH A TIMER LOCATED NEXT TO ITS THERMOSTAT THAT WILL ENABLE THE USER TO ENERGIZE THE EXHAUST SYSTEM FOR A PERIOD NOT TO EXCEED 2 HRS. (ADJ.).
2. ALARMS: THE ONBOARD BACNET CONTROLLER SHALL TRANSMIT SYSTEM ALARMS TO THE GUI. THE ONBOARD CONTROLLER SHALL, AT A MINIMUM, TRACK ALARMS LISTED IN THE I/O POINTS LIST.

2 4 3/M-12 LOCKER ROOM EXHAUST FAN P&ID

NTS

NOTE: THIS SEQUENCE APPLIES TO EF-1 AND SF-6



BAS INPUT/OUTPUT POINT LIST						
TAG	POINT NAME	AI	AO	DI	DO	ALARM
1	EMERGENCY SHUTDOWN (GLOBAL)					X
2	SPACE AIR TEMPERATURE	X				
3	SPACE AIR TEMPERATURE SETPOINT (PER AHU)				X	
4	SUPPLY AIR TEMPERATURE (PER AHU)	X				
5	FILTER SIGN (PER AHU)					X
6	SUPPLY FAN ON/OFF (PER AHU)				X	
7	SUPPLY FAN STATUS (PER AHU)			X		
8	SUPPLY FAN FAILURE (PER AHU)					X
9	CONDENSATE OVERFLOW (PER AHU AND BC)					X
10	COMPRESSOR STATUS			X		
11	COMPRESSOR FAILURE					X
12	HRU FAN STATUS			X		
13	HRU FAN FAILURE					X
14	SYSTEM ENABLE				X	

VRF CONTROL SEQUENCE
1. THE EXISTING VRF SYSTEM SHALL BE INTEGRATED INTO THE BUILDING AUTOMATION SYSTEM. THE BAS CONTRACTOR SHALL ADD A BACNET CONTROLLER TO INTERFACE TO THE EXISTING RTU CONTROLLER. THE BAS CONTRACTOR SHALL ADD CONTROLLERS, SENSORS, CONTROL WIRING, AND OTHER REQUIRED ITEMS TO MEET THE SEQUENCE LISTED BELOW AND TO COVER THE ITEMS REQUIRED IN THE POINTS LIST.
2. THE SYSTEM SHALL BE CONTROLLED BY THE BAS AND SHALL BE CONTROLLED AS FOLLOWS:
3. VRF SYSTEM CONTROL: THE VRF SYSTEM SHALL BE PROVIDED WITH FACTORY FURNISHED ON-BOARD BACNET CONTROLLERS THAT ARE COMPATIBLE WITH TRIDIUM NIAGARA AX FRAMEWORK. THE ON-BOARD CONTROLLERS SHALL USE MANUFACTURER PREFERRED CONTROL SEQUENCE TO MAINTAIN THE SPACE TEMPERATURE AT SPECIFIED TEMPERATURE SETPOINT BASED ON OCCUPANCY SCHEDULE AND OCCUPANCY STATUS (BASED ON OCCUPANCY SENSORS). REFER TO SHEET #### FOR MORE INFORMATION ON OCCUPANCY SCHEDULE, OCCUPANCY STATUS AND ZONE TEMPERATURE SETPOINTS.
4. THE ONBOARD BACNET CONTROLLER SHALL COMMUNICATE WITH THE BAS TO ALLOW AT THE MINIMUM MONITORING AND CONTROL OF I/O POINTS LISTED HERE. THE SYSTEM SHALL BE ENABLED BY THE BAS. ALL CONTROL POINTS ON THE I/O POINTS LIST SHALL BE MONITORED AND CONTROLLED FROM THE GRAPHIC USER INTERFACE (GUI).
5. ALARMS: THE ONBOARD BACNET CONTROLLER SHALL TRANSMIT SYSTEM ALARMS TO THE GUI. THE ONBOARD CONTROLLER SHALL, AT A MINIMUM, TRACK ALARMS LISTED IN THE I/O POINTS LIST.

2 4/M-12 VRF P&ID CONTROL SCHEMATIC

NTS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: RWE
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

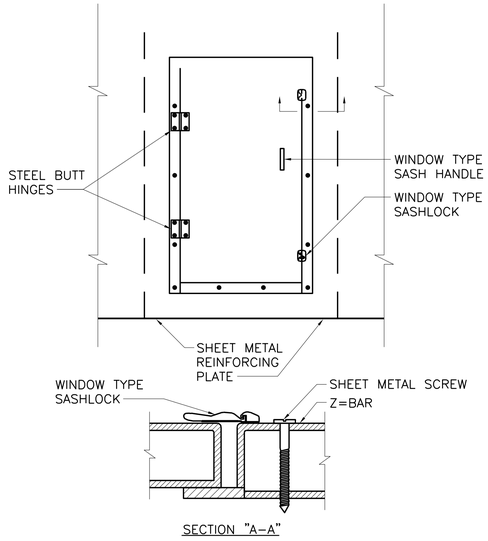
TXARNG CFMO

MECHANICAL P&ID CONTROLS SCHEMATIC

M-12 2/4

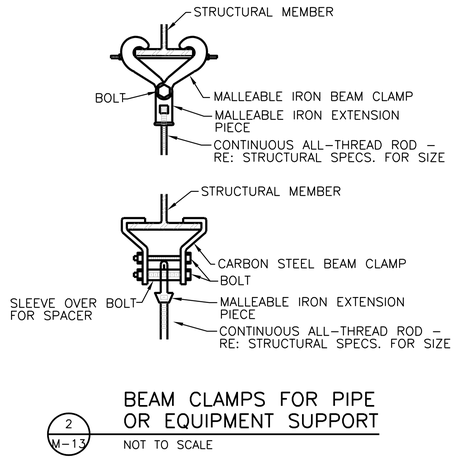
SHT. 59 of 129

STATE OF TEXAS
VAN CASHEN
118595
LICENSED PROFESSIONAL ENGINEER
04/20/2018

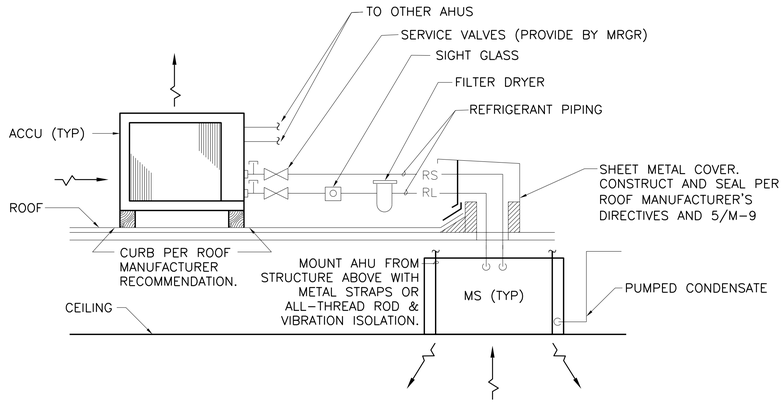


NOTE: INSTALL SO THAT AIR PRESSURE HOLDS DOOR SHUT.

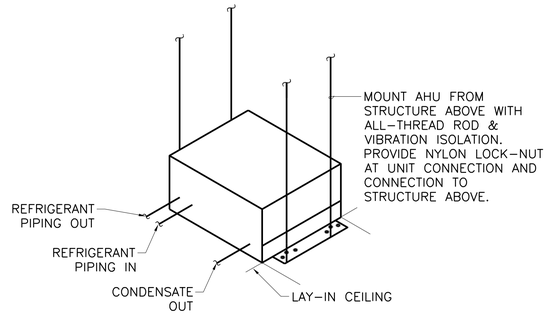
1 M–13 ACCESS DOOR DETAIL
NOT TO SCALE



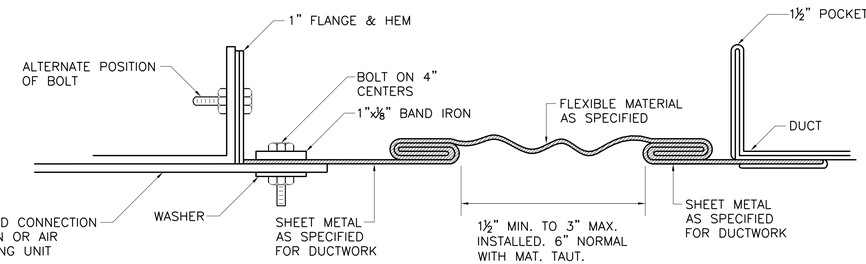
2 M–13 BEAM CLAMPS FOR PIPE OR EQUIPMENT SUPPORT
NOT TO SCALE



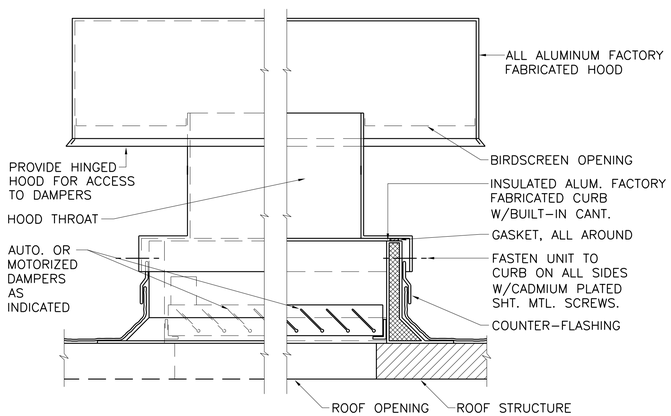
3 M–13 AHU AND CU CONNECTION DETAIL
NOT TO SCALE



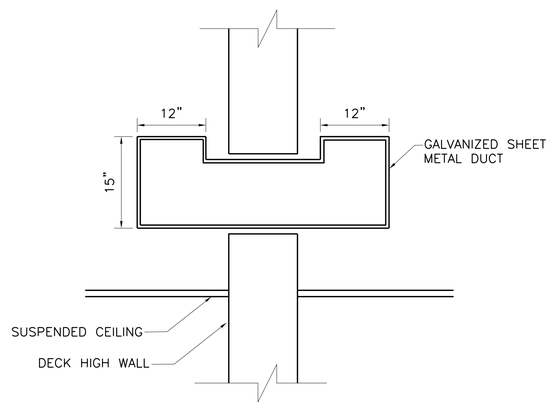
4 M–13 CEILING CASSETTE TYPE AHU
NOT TO SCALE



5 M–13 RECTANGULAR FLEXIBLE CONNECTION DETAIL
NOT TO SCALE



6 M–13 ROOF HOOD (SUPPLY/RELIEF) DETAIL
NOT TO SCALE



7 M–13 TRANSFER DUCT DETAIL
NOT TO SCALE

STATE OF TEXAS
VAN CASHEN
118595
LICENSED
PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
(512) 782–6131
AUSTIN, TEXAS 78763–5218
FAX (512) 782–1481

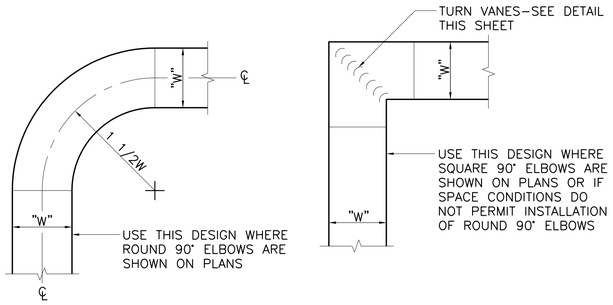
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL DETAILS

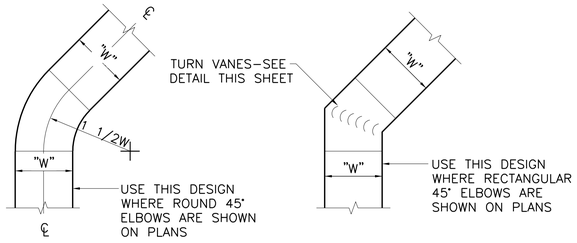
M-13

SHT. 60 of 129



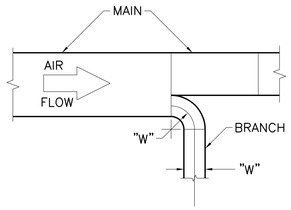
ROUND 90° ELBOW SQUARE 90° ELBOW

CONSTRUCTION OF 90° ELBOWS

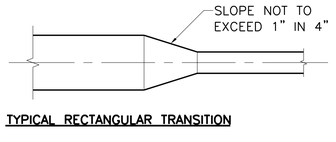


ROUND 45° ELBOW SQUARE 45° ELBOW

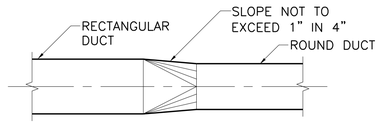
CONSTRUCTION OF 45° ELBOWS



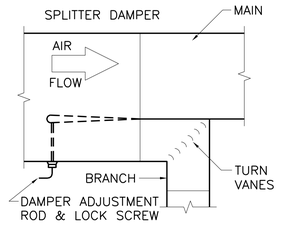
ROUND BRANCH TAKEOFF



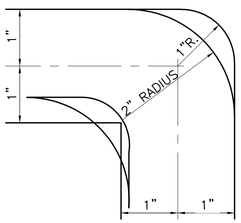
TYPICAL RECTANGULAR TRANSITION



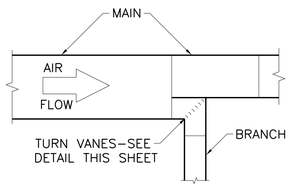
TYPICAL RECTANGULAR TO ROUND TRANSITION



TYPICAL SPLITTER DAMPER

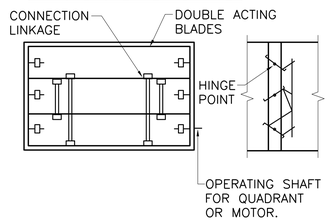


DETAIL OF TURN VANES



SQUARE BRANCH TAKEOFF

CONSTRUCTION OF BRANCH TAKEOFFS FROM MAIN



TYPICAL VOLUME DAMPER

DETAILS OF THE LOW VELOCITY DUCT LAYOUT

NTS

INSTALLATION NOTES

1. ALL DUCTS SHALL BE CONSTRUCTED AND ERECTED IN A NEAT AND WORKMANLIKE MANNER.
2. DUCTS SHALL BE CONSTRUCTED OF THE WEIGHTS, GAGES AND MATERIAL SHOWN IN THE SCHEDULE ON THESE DRAWINGS.
3. THE DIMENSION SHOWN FOR ALL DUCTS SHOWN IN PLAN GIVE THE WIDTH FIRST AND THEN THE HEIGHT.
4. DUCT RISERS SHOULD BE SUPPORTED BY ANGLES AT EVERY FLOOR.
5. AIR TURN SHALL BE INSTALLED IN ALL ABRUPT ELBOWS TO PREVENT TURBULENCE.
6. DUCTS SHALL BE SECURELY ATTACHED TO THE BUILDING CONSTRUCTION IN AN APPROVED MANNER.
7. DIVERGING TRANSITION PIECES SHALL BE MADE AS GRADUAL AS POSSIBLE.
8. INSTALL FIRE DAMPERS IN ACCORDANCE WITH UL 555.
9. ACCESS PANELBOWS SHOULD BE PLACED BEFORE AND/OR AFTER EQUIPMENT INSTALLED IN THE DUCT.
10. DUCT AREA SHOULD NOT BE DECREASED MORE THAN 10 PERCENT WHEN OBSTRUCTIONS CANNOT BE AVOIDED, AND THEN A STREAMLINED FITTING SHOULD BE USED.
11. FLEXIBLE FABRIC CONNECTIONS (OR EQUAL) SHOULD BE USED ON BOTH INLETS AND OUTLETS OF ALL FANS AND AIR HANDLING UNITS.
12. JOINTS AND SEAMS OF SUPPLY DUCTS SHALL BE FASTENED SECURELY AND MADE AIR TIGHT.

STATE OF TEXAS
VAN CASHEN
118595
LICENSED
PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL DUCT DETAILS

M-14

SHT. 61 of 129

PLUMBING LEGEND

SYMBOL	DESCRIPTION	ABBREVIATION
	SANITARY SEWER	SS
	VENT	V
180HW	HOT WATER (180°)	HW(180°)
140HW	HOT WATER (140°)	HW(140°)
	HOT WATER (127°)	HW
	HOT WATER RETURN	HWR
	COLD WATER	CW
RD	ROOF DRAIN	RD
OFD	OVERFLOW DRAIN	OFD
G	NATURAL GAS	G
A	COMPRESSED AIR	A
TP	TRAP PRIMER	TP
FOS	FUEL OIL SUPPLY	FOS
FOR	FUEL OIL RETURN	FOR
D	DRAIN	D
PS	PUMPED SANITARY WASTE	PS
CD	CONDENSATE DRAIN	CD
PC	PUMPED CONDENSATE DRAIN	PC
GW	GREASE LADEN WASTE	GW
AW	ACID WASTE	AW
AV	ACID WASTE VENT	AV
XX	EXISTING PIPING	
XX	EXISTING PIPING TO BE REMOVED (DEMO PLAN ONLY)	
	DIRECTION OF PITCH DOWN (SLOPE)	
	DIRECTION OF FLOW	
FCO	FLOOR CLEANOUT	FCO
PCO	PLUG CLEANOUT	PCO
WCO	WALL CLEANOUT	WCO
GCO	GRADE CLEANOUT	GCO
DGCO	DOUBLE GRADE CLEANOUT	DGCO
NFWH or HB	NON-FREEZE WALL HYDRANT or HOSE BIBB	NFWH or HB
	SHUT-OFF VALVE (SEE SPECIFICATIONS FOR TYPE)	
	PRESSURE BALANCING VALVE	
	VALVE IN RISER (TYPE AS SPECIFIED OR NOTED)	
	RELIEF VALVE	
	REDUCER OR INCREASER FITTING	
	UNION	
	PIPE TURNING AND RISING UP	
	PIPE TURNING AND DROPPING DOWN	
	TEE OUT OF TOP OF PIPE	
	TEE OUT OF BOTTOM OF PIPE	
	CAP ON END OF PIPE	
	FLOOR DRAIN	FD
	FLOOR SINK	FS
RD	ROOF DRAIN	RD
OFD	OVERFLOW DRAIN	OFD
1/8"/FT	1/8" PER FOOT SLOPE	
1/4"/FT	1/4" PER FOOT SLOPE	
	AMERICANS WITH DISABLITIES ACT	ADA
	ABOVE FINISHED GRADE	AFG
	ABOVE FINISHED FLOOR	AFF
	BELOW FINISHED FLOOR	BFF
	BELOW FINISHED GRADE	BFG
	COLD WATER FIXTURE UNITS	CWFU'S
	DOUBLE CHECK BACKFLOW PREVENTER	DCBFP
	DRAINAGE WASTE AND VENT	DWV
	FIXTURE UNIT	F.U.
	GALLONS PER HOUR	GPH
	GALLONS PER MINUTE	GPM
	HORSE POWER	HP
	INVERT ELEVATION OR FLOW LINE	I.E.
	NOT TO SCALE	NTS
	RECOVERY	REC
	REDUCED PRESSURE BACKFLOW PREVENTER	RPBFP
	REFER TO:	RE:
	SANITARY WASTE FIXTURE UNITS	SWFU'S
	TEXAS ACCESSIBILITIES STANDARD	TAS
	TEMPERATURE	TEMP
	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY	TCEQ
	TYPICAL	TYP
	UNDERFLOOR	U/F
	VENT THROUGH ROOF	VTR
	WITH	W/
X / P-X — RISER NUMBER; SHEET WHERE RISER DIAGRAM IS SHOWN	PLUMBING RISER LOCATOR	
PLAN/DETAIL NUMBER — X / –	DRAWING/DETAIL REFERENCE	RE: X/PX
	POINT OF NEW TO EXISTING CONNECTION	

NOTE: ALL SYMBOLS AND ABBREVIATIONS SHOWN ARE NOT NECESSARILY USED ON THE DRAWINGS.

ELECTRIC INSTANTANEOUS WATER HEATER SCHEDULE

MARK	LOCATION	SERVES	TEMP RISE	OUTLET GPM	TURN ON GPM	KW	V/PH/AMP	MANUFACTURER AND MODEL	COMMENTS
EWH1	RESTROOM	LAVATORIES	56°F	0.5	0.3	4.1	208/1/20	EEMAX #EX4208T	THERMOSTAT SET AT 105°F

GENERAL NOTES

1. THIS PROJECT IS DESIGNED BASED ON THE FOLLOWING CODES: INTERNATIONAL PLUMBING CODE 2015, INTERNATIONAL ENERGY CONSERVATION CODE 2009, WITH LOCAL AMENDMENTS. UFC 3-401-01 MECHANICAL ENGINEERING, UFC 3-410-01 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS, WITH CHANGE 1, UFC-3-420-01 PLUMBING SYSTEMS, UFC 3-600-01 FIRE PROTECTION ENGINEERING FOR FACILITIES, UFC 4-010-01 DOD MINIMUM ANTITERRORISM STANDARDS FOR BUILDINGS, UFC-4-024-01 PROCEDURES FOR DESIGNING AIRBORNE CHEMICAL PROTECTION FOR BUILDINGS.
2. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR THE EXACT LOCATION OF ALL CEILING MOUNTED DEVICES.
3. REFER TO ARCHITECTURAL INTERIOR ELEVATION DRAWINGS, WHERE THE ARCHITECT HAS DRAWN SUCH ELEVATIONS, FOR THE LOCATIONS OF ALL WALL MOUNTED DEVICES. OTHERWISE INSTALL PER INDUSTRY STANDARDS, CODES AND/OR ORDINANCES OF THE AUTHORITY HAVING JURISDICTION.
4. COORDINATE ALL SLAB PENETRATIONS AND SLEEVES PRIOR TO EACH CONCRETE POUR.
5. PROVIDE ACCESS DOORS FOR INSTALLATION IN WALLS AND CEILINGS WHERE ACCESS IS REQUIRED TO CONCEALED PLUMBING EQUIPMENT, VALVES, CONTROLS AND OTHER DEVICES.
6. INSTALL PIPING TO PROVIDE THE MAXIMUM POSSIBLE CLEAR HEIGHT UNDERNEATH. MAINTAIN A MINIMUM OF 10 INCHES ABOVE FINISHED CEILING TO PROVIDE CLEARANCE FOR LIGHTING FIXTURES.
7. COORDINATE THE EXACT LOCATION OF FLOOR DRAINS WITH THE ARCHITECTURAL DRAWINGS AND MECHANICAL EQUIPMENT LOCATIONS PRIOR TO INSTALLATION OF DRAINS.
8. COORDINATE WORK WITH ARCHITECTURAL FEATURES, PIPING, EQUIPMENT, MECHANICAL WORK, ELECTRICAL WORK, AND BUILDING STRUCTURE TO AVOID INTERFERENCES.

GENERAL NOTES (CONTINUED)

9. PROVIDE RATED INTUMESCENT CAULK OR PUTTY AT ALL FIRE RATED PENETRATION LOCATIONS, INCLUDING BUT NOT LIMITED TO STAIRWELLS, CORRIDORS, AND MECHANICAL OR ELECTRICAL EQUIPMENT ROOMS. ESCUTCHEONS ARE NOT REQUIRED, HOWEVER THE CAULK OR PUTTY SHALL BE INSTALLED SMOOTH AND FLUSH TO THE SURROUNDING SURFACE.
10. MINIMUM SLOPE FOR DRAINAGE PIPE WITHIN 5'-0" OF BUILDING IS ¼" PER FOOT FOR 2½" DIAMETER AND LESS AND ⅛" PER FOOT FOR 3" DIAMETER AND GREATER. MINIMUM SLOPE FOR DRAINAGE PIPE BEYOND 5'-0" OF BUILDING IS 1%.
11. ANY PENETRATIONS DUE TO INSTALLATION OF NEW EQUIPMENT OR PATCHING OF ROOF DUE TO MOVING OR THE DEMOLITION OF EXISTING EQUIPMENT ARE TO BE REVIEWED AND APPROVED BY EXISTING ROOFING COMPANY HOLDING THE WARRANTY. CONTRACTOR SHALL NOT PERFORM ANY WORK ON THE ROOF UNTIL A WRITTEN APPROVAL TO PROCEED IS OBTAINED FROM THE ROOFING COMPANY HOLDING THE WARRANTY. DETAILS TO BE APPROVED BY ROOFING COMPANY BEFORE ANY WORK IS PERFORMED. A COPY OF THE LETTER GIVING THE NOTICE TO PROCEED ALONG WITH DETAILS FOR CURBS OR OTHER WORK TO BE SUBMITTED TO OWNER, OWNER'S REPRESENTATIVE, OWNER'S INSPECTOR AND ARCHITECT. REFER TO SPECIFICATION SECTION 07 01 50 REPAIR OF ROOF.
12. WHERE THESE DOCUMENTS INDICATE THE REMOVAL AND REPLACEMENT OF WALL HYDRANTS OR OTHER COMPONENTS, THE INSTALLATION OF THE NEW COMPONENT SHALL INCLUDED REPLACING BRICKWORK TO MATCH THE EXISTING BRICKWORK AS REQUIRED. USE NON-SHRINK GROUT. PROVIDE A CLEAR NON-SLUMPING ONE PART, 100% SILICONE RUBBER ACETOXY SEALANT AROUND COMPONENT, INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS. SILA-SEAL OR APPROVED EQUAL.
13. WHERE EXISTING PENETRATIONS THROUGH THE ROOF ARE REUSED, OR NEW ROOF OPENINGS ARE REQUIRED, PROTECT OPENING WATER-TIGHT DURING RAIN EVENTS DURING CONSTRUCTION.
14. VERIFY AVAILABLE WATER PRESSURE ON SITE PRIOR TO BEGINNING CONSTRUCTION. THE MINIMUM AVAILABLE PRESSURE SHALL BE 55 PSIG FLOWING 150 GPM

PLUMBING FIXTURE ROUGH-IN SCHEDULE

MARK	DESCRIPTION	ROUGH-IN (INCHES) W	V	HW	CW	REMARKS
WC1	WATER CLOSET	4"	2"	–	1"	FLOOR MOUNTED, FLUSH VALVE TYPE, ADA/TAS ACCESSIBLE
WC2	WATER CLOSET	4"	2"	–	1"	FLOOR MOUNTED, FLUSH VALVE TYPE
UR1	URINAL	2"	2"	–	3/4"	WALL MOUNTED, ADA/TAS ACCESSIBLE
UR2	URINAL	2"	2"	–	3/4"	WALL MOUNTED
L1	LAVATORY	2"	2"	1/2"	1/2"	COUNTER-TOP MOUNTED, OVAL, W/HARD-WIRED ELECTRICAL INFRARED SENSOR FAUCET, ADA/TAS ACCESSIBLE
SSK1	SERVICE SINK	3"	2"	1/2"	1/2"	28"x28" FLOOR MOUNTED, CORNER, 5-SIDED, TERRAZO OR MOLDED STONE
EWC1	ELECTRIC WATER COOLER	2"	2"		1/2"	WALL MOUNTED, DUAL, HI-LO TYPE W/APRON ON HIGH UNIT AND WITH BOTTLE FILLER, ADA/TAS ACCESSIBLE
EWC2	ELECTRIC WATER COOLER	2"	2"		1/2"	WALL MOUNTED, HI TYPE W/APRON ON HIGH UNIT AND WITH BOTTLE FILLER, ADA/TAS ACCESSIBLE
SH1	SHOWER (STANDARD)	2"FD	2"	1/2"	1/2"	BUILT-UP TYPE ENCLOSURE, WITH MIXING VALVE, SHOWER HEAD AND DRAIN
SH2	SHOWER (ACCESSIBLE)	2"FD	2"	1/2"	1/2"	WIDE, BUILT-UP TYPE ENCLOSURE, WITH MIXING VALVE, HAND HELD SPRAYER, SHOWER ARM, 5'-0" FLEXIBLE HOSE, IN-LINE VACUUM BREAKER, SLIDE BAR, DRAIN, ADA/TAS ACCESSIBLE
SH3	SHOWER (STANDARD)	2"FD	2"	1/2"	1/2"	BUILT-UP TYPE ENCLOSURE, WITH MIXING VALVE, SHOWER HEAD AND OFFSET DRAIN IN TROUGH

NOTE:
REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION, ACCEPTABLE MANUFACTURER AND MODEL NUMBER ON PLUMBING FIXTURES.

NATURAL GAS TANKLESS WATER HEATER SCHEDULE

MARK	LOCATION	INPUT MIN BTU/HR.	INPUT MAX BTU/HR.	ELEMENT DATA W	V	PH	HZ	FLOW RATE TEMP RISE °F	FLOW GPM	MANUFACTURER AND MODEL NO.	REMARKS
GWH1 (BANK1)	WATER HEATER ROOM D129	19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	(3) MANIFOLDED WATER HEATERS
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
GWH2 (BANK2)	WATER HEATER ROOM D129	19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	(3) MANIFOLDED WATER HEATERS
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
GWH3 (BANK3)	WATER HEATER ROOM D129	19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	(4) MANIFOLDED WATER HEATERS
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
GWH4 (BANK4)	WATER HEATER ROOM D129	19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	(4) MANIFOLDED WATER HEATERS
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
GWH5 (BANK5)	WATER HEATER ROOM D129	19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	(4) MANIFOLDED WATER HEATERS
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	
		19,900	199,900	350	120	1	60	57	6.8	NAVIEN, NPE-240S-NG	

NOTE:
1. SET OUTLET TEMPERATURE TO 127°F MAX.
2. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.

STATE OF TEXAS — VAN CASHEN — 118595 — LICENSED — PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

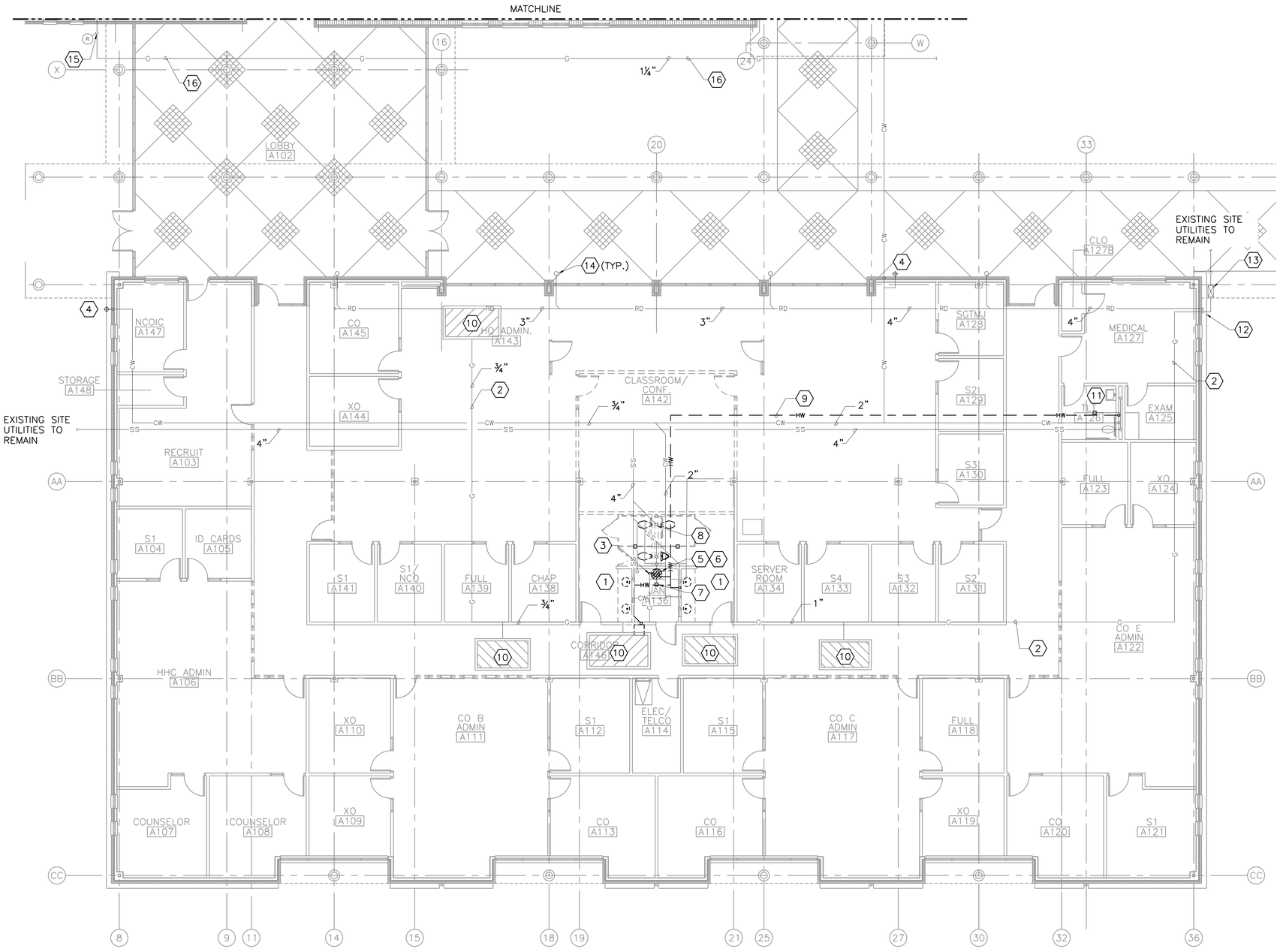
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING LEGEND, GENERAL NOTES, DETAIL AND SCHEDULES

P-0

SHT. 62 of 129



DEMOLITION FLOOR PLAN – A

1/8"=1'-0"

GENERAL NOTES:

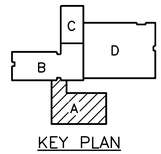
1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM TO REMAIN AS IS UNLESS INDICATED OTHERWISE.

NOTES BY SYMBOL "⬡"

1. ALL PLUMBING FIXTURES AND ASSOCIATED PIPING WITHIN RESTROOM AND JAN. ROOM TO BE REMOVED. REMOVE FLOOR DRAIN AND PLUG REMAINING PIPE BELOW FLOOR. PATCH FLOOR TO MATCH EXISTING.
2. EXISTING NATURAL GAS PIPING ON ROOF TO REMAIN.
3. EXISTING NATURAL GAS PIPE DOWN THROUGH ROOF TO REMAIN.
4. REMOVE EXISTING RECESSED WALL HYDRANT.
5. REMOVE EXISTING NATURAL GAS-FIRED TANK TYPE WATER HEATER AND ASSOCIATED PIPING. REMOVE FLUE DUCT THRU ROOF AND PATCH ROOF. COORDINATE WITH ROOFING CONTRACTOR.
6. REMOVE EXISTING THERMOSTATIC MIXING VALVE STATION ON WALL AND ASSOCIATED PIPING AS INDICATED.
7. EXISTING FLOOR DRAIN TO REMAIN.
8. EXISTING VENT THROUGH ROOF (VTR) TO REMAIN.
9. REMOVE EXISTING DOMESTIC HOT WATER PIPING.
10. EXISTING HVAC RTU TO REMAIN.
11. EXISTING PLUMBING FIXTURES AND FLOOR DRAIN TO REMAIN.
12. EXISTING GAS RISER TO REMAIN.
13. EXISTING GAS METER ASSEMBLY TO REMAIN.
14. EXISTING ROOF DRAIN DOWNSPOUTS TO REMAIN.
15. EXISTING 1¼" GAS RISER AND REGULATOR TO REMAIN.
16. EXISTING GAS PIPE BELOW FLOOR TO REMAIN.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN WING.



KEY PLAN

VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER
04/20/2018

0 4' 8' 16'
1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

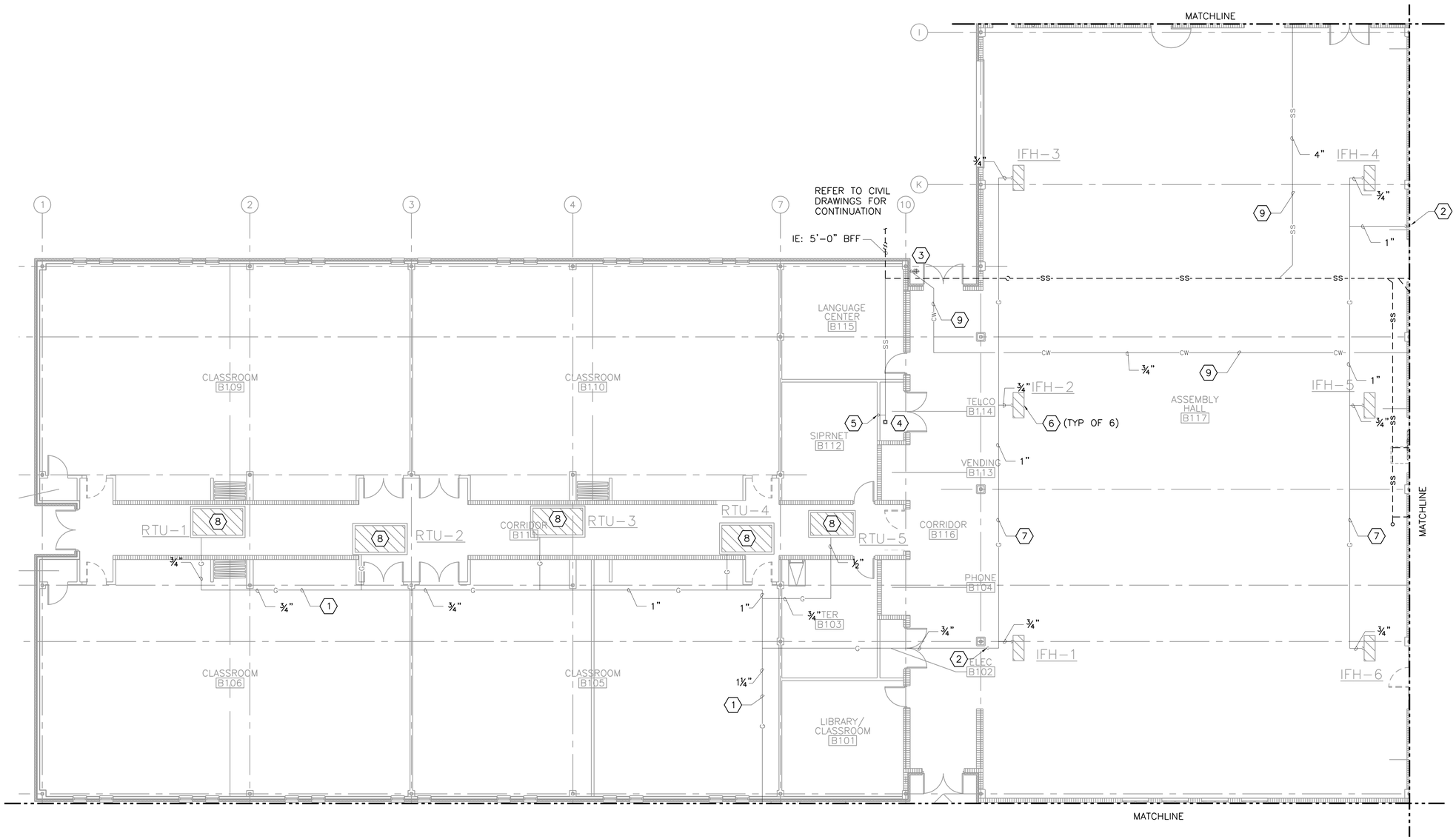
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING DEMOLITION FLOOR PLAN - A

P-1 (5)

SHT. 63 of 129



NORTH PLAN NORTH / NORTH TRUE NORTH — 1/8"=1'-0"

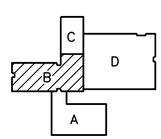
DEMOLITION FLOOR PLAN – B

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM TO REMAIN AS IS UNLESS INDICATED OTHERWISE.

NOTES BY SYMBOL "⬡"

1. EXISTING GAS PIPING ON ROOF TO REMAIN.
2. EXISTING GAS PIPE THROUGH WALL TO REMAIN.
3. REMOVE EXISTING RECESSED WALL HYDRANT.
4. EXISTING FLOOR DRAIN TO REMAIN.
5. EXISTING VENT THROUGH ROOF (VTR) TO REMAIN.
6. EXISTING GAS FIRED INFRA-RED UNIT HEATERS TO REMAIN.
7. EXISTING GAS PIPING IN JOIST SPACE ABOVE ASSEMBLY HALL TO REMAIN.
8. EXISTING GAS FIRED HVAC ROOF-TOP UNIT TO REMAIN.
9. EXISTING PIPING BELOW FLOOR TO REMAIN.



KEY PLAN

VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER 04/20/2018

0 4' 8' 16'
1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

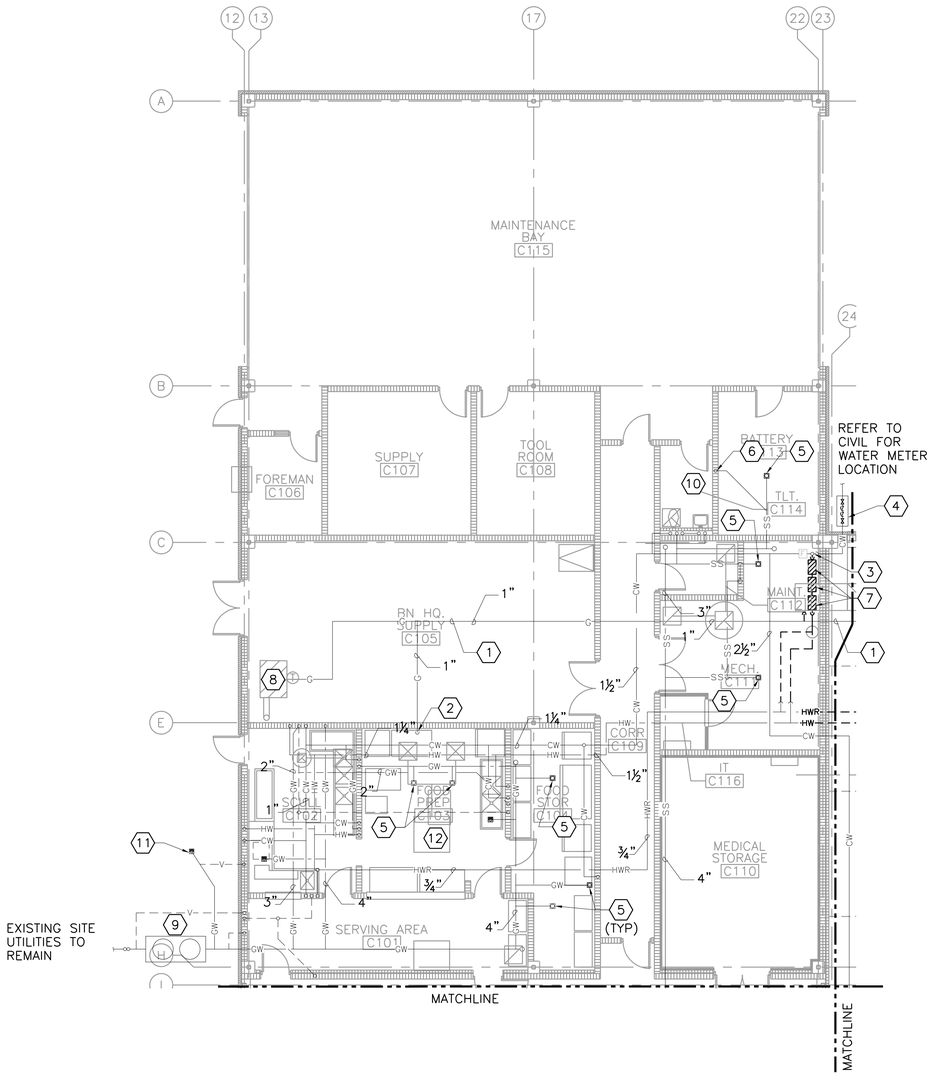
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING DEMOLITION FLOOR PLAN- B

P-2

SHT. 64 of 129



NORTH PLAN NORTH / NORTH TRUE NORTH

1 — DEMOLITION FLOOR PLAN – C

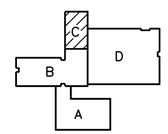
1/8"=1'-0"

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM TO REMAIN AS IS UNLESS INDICATED OTHERWISE.

NOTES BY SYMBOL "⬡"

1. EXISTING GAS PIPING ON ROOF TO REMAIN.
2. EXISTING GAS PIPE DOWN THROUGH ROOF TO REMAIN.
3. EXISTING VALVED 3" DOMESTIC WATER RISER TO REMAIN.
4. EXISTING 3" BACKFLOW PREVENTOR IN VAULT TO REMAIN.
5. EXISTING FLOOR DRAIN TO REMAIN.
6. EXISTING VENT THROUGH ROOF (VTR) TO REMAIN.
7. REMOVE EXISTING NATURAL GAS FIRED INSTANTANEOUS WATER HEATERS, ASSOCIATED PIPING AS INDICATED AND CAP REMAINING PIPE.
8. EXISTING GAS FIRED HVAC EQUIPMENT TO REMAIN.
9. EXISTING CONCRETE GREASE SEPARATOR TO REMAIN. PUMP OUT AND PROPERLY DISPOSE OF GREASE LADEN WASTE. AFTER SEPARATOR IS COMPLETELY EMPTY AND DRY, CLEAN SEPARATOR INTERIOR WITH ALKALINE DEGREASER AND PRESSURE WASH. PERMANENTLY INJECT ALL CRACKS WITH COMMERCIAL GRADE LOW PRESSURE CRACK SEALANT. SEAL INTERIOR CONCRETE SURFACES WITH SILICONATE MULTI-SURFACE SMOOTH WB PENETRATING SEALANT.
10. EXISTING PLUMBING FIXTURES TO REMAIN.
11. EXISTING 3" CAN WASH DRAIN TO REMAIN.
12. ALL PIPING AND EQUIPMENT IN KITCHEN AREA TO REMAIN.



KEY PLAN

VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER
04/20/2018

0 4' 8' 16'
1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

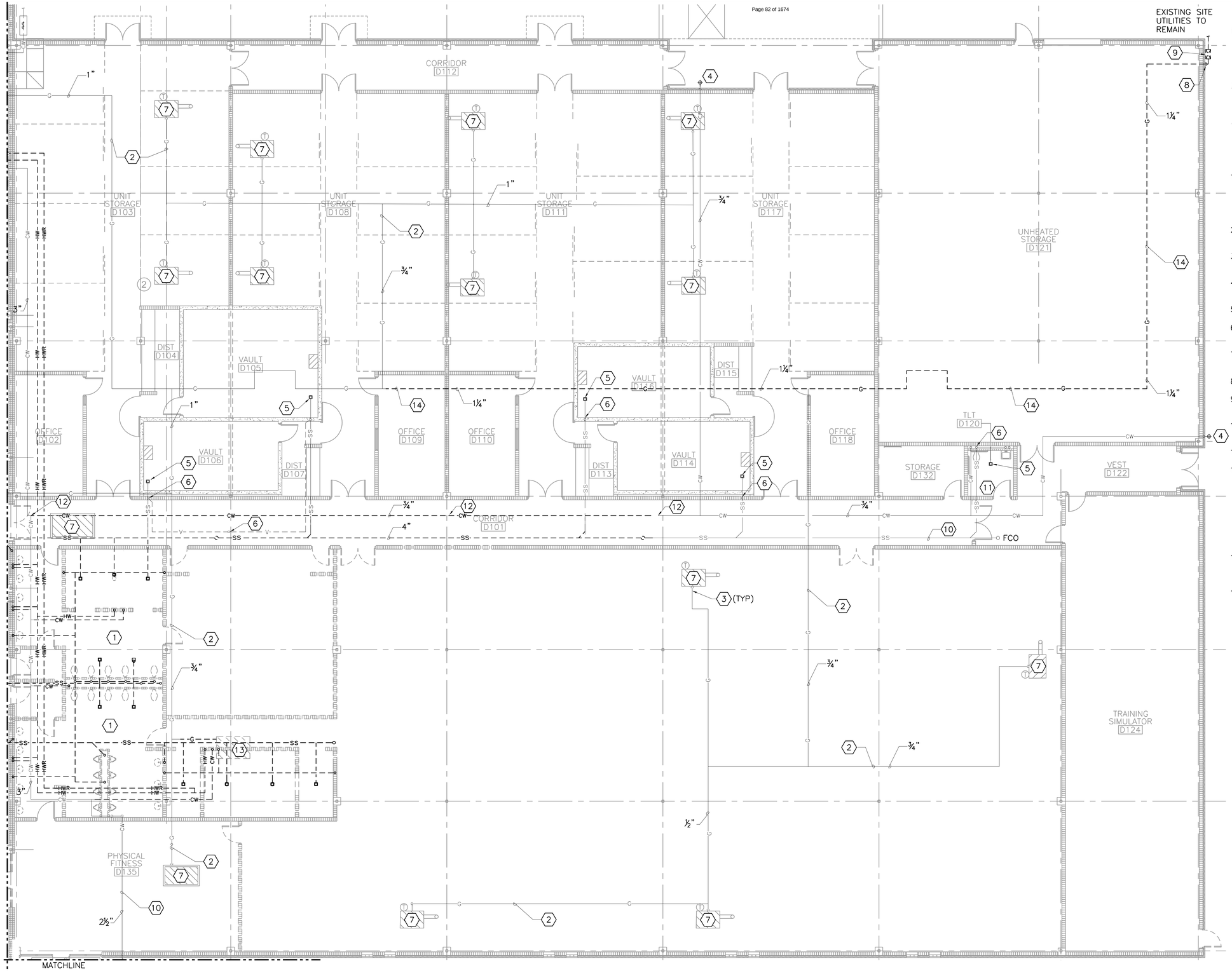
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING DEMOLITION FLOOR PLAN - C

P-3

SHT. 65 of 129



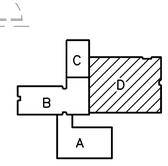
GENERAL NOTES:

1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM TO REMAIN AS IS UNLESS INDICATED OTHERWISE.

NOTES BY SYMBOL "⬡"

1. ALL PLUMBING FIXTURES AND ASSOCIATED PIPING WITHIN RESTROOMS AND JAN. ROOM TO BE REMOVED. REMOVE FLOOR DRAIN AND PLUG REMAINING PIPE BELOW FLOOR.
2. EXISTING NATURAL GAS PIPING ON ROOF TO REMAIN.
3. EXISTING NATURAL GAS PIPE DOWN THROUGH ROOF TO REMAIN.
4. REMOVE EXISTING RECESSED WALL HYDRANT.
5. EXISTING FLOOR DRAIN TO REMAIN.
6. EXISTING VENT THROUGH ROOF (VTR) TO REMAIN.
7. EXISTING GAS FIRED HVAC EQUIPMENT TO REMAIN.
8. EXISTING GAS RISER TO BE DEMOLISHED.
9. EXISTING GAS METER ASSEMBLY TO BE DEMOLISHED.
10. EXISTING PIPING BELOW FLOOR TO REMAIN.
11. EXISTING PLUMBING FIXTURES TO REMAIN.
12. EXISTING CW PIPE TO REMAIN IN SERVICE UNTIL CONSTRUCTION IS OF NEW RESTROOM AND SHOWER AREAS ARE COMPLETE. THE EXISTING CW PIPING IS TO BE REMOVED FOLLOWING THE INSTALLMENT OF ALL NEW CW PIPING SERVING THESE AREAS IS COMPLETED AND OPERATIONAL INCLUDING SERVICE SWITCH OVER.
13. GAS FIRED HVAC UNIT TO BE DEMOLISHED. DEMOLISH ASSOCIATED GAS PIPING AND CAP.
14. DEMOLISH GAS PING ON ROOF AS INDICATED.

DEMOLITION FLOOR PLAN – D
1/8"=1'-0"



KEY PLAN

VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER
04/20/2018

0 4' 8' 16'
1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

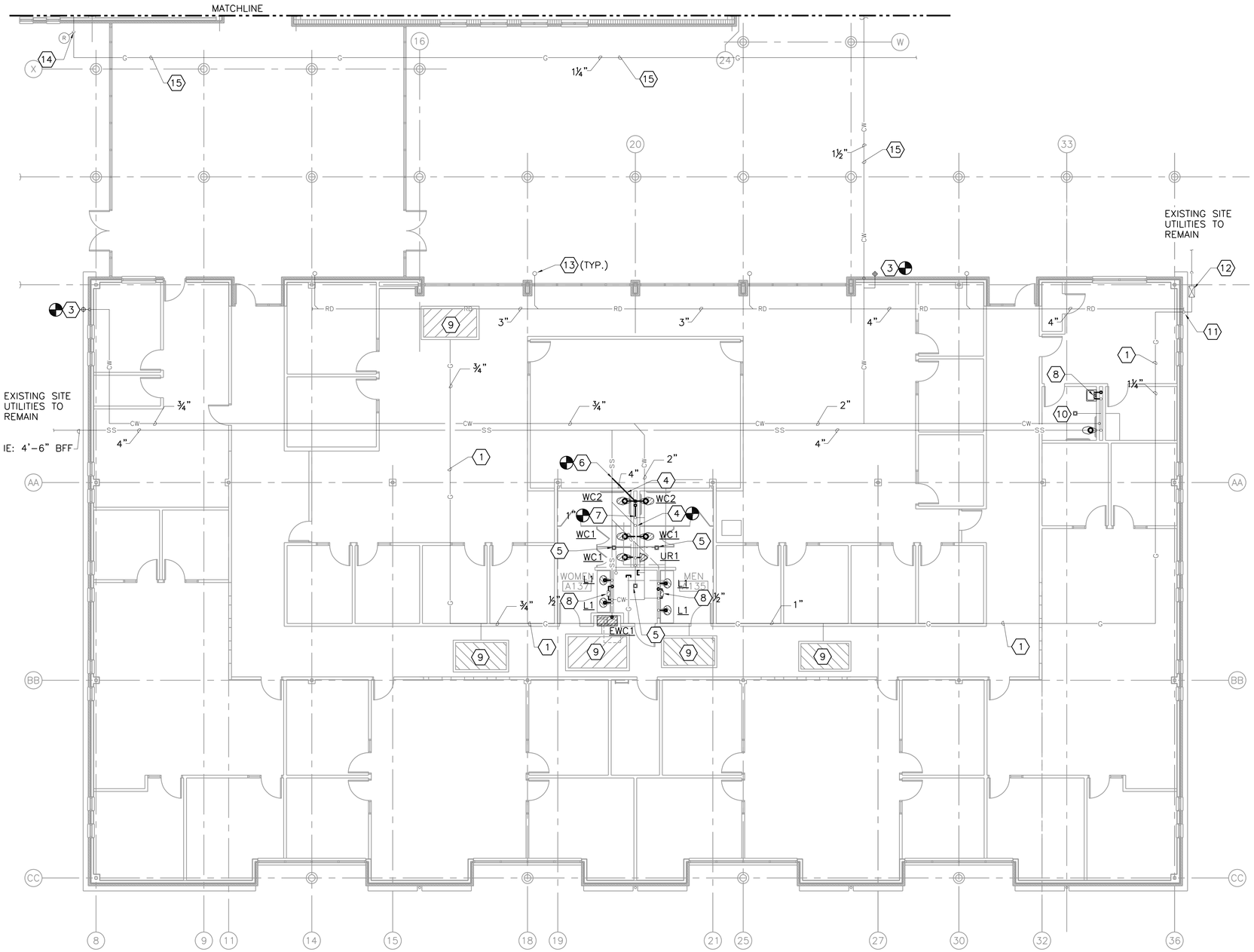
STAR CAMPAIGN FY18 - WESLACO RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING DEMOLITION FLOOR PLAN - D

P-4

SHT. 66 of 129



FLOOR PLAN – A

1/8"=1'-0"

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM TO REMAIN AS IS UNLESS INDICATED OTHERWISE.
4. PROVIDE NEW TRAP SEAL DEVICE IN ALL EXISTING AND NEW FLOOR DRAINS, FLOOR SINKS, AND HUB DRAINS.
5. ALL EXTERIOR AND INTERIOR NATURAL GAS PIPING TO BE PAINTED SAFETY YELLOW.

NOTES BY SYMBOL "⬡"

1. EXISTING NATURAL GAS PIPING ON ROOF.
2. NEW 4" SANITARY SEWER PIPE.
3. NEW ¾" NON-FREEZE RECESSED WALL HYDRANT WITH INTEGRAL VACUUM BREAKER. PROVIDE WATER-PROOF SEALANT AROUND NEW WALL HYDRANT.
4. EXISTING 3" VTR TO BE REUSED. CONNECT NEW AND EXISTING VENT PIPING ABOVE CEILING TO EXISTING 3" VTR.
5. NEW 4" FLOOR DRAIN WITH TRAP SEAL DEVICE.
6. CONNECT NEW SS PIPE INTO EXISTING SS PIPE UNDERFLOOR/GRADE.
7. CONNECT NEW CW PIPE TO EXISTING CW PIPE IN PLUMBING CHASE.
8. NEW ELECTRIC INSTANTANEOUS WATER HEATER EWH1 MOUNTED ON BACK WALL BELOW COUNTER/LAVATORY. EXTEND/CONNECT CW, HW AND ELEC ACCORDINGLY, ON GFCI CIRCUITS. PROVIDE SHUT-OFF VALVE ON CW SUPPLY TO EWH1.
9. EXISTING HVAC EQUIPMENT.
10. EXISTING PLUMBING FIXTURES.
11. EXISTING GAS RISER TO REMAIN.
12. EXISTING GAS METER ASSEMBLY TO REMAIN.
13. EXISTING ROOF DRAIN DOWNSPOUTS TO REMAIN.
14. EXISTING 1¼" GAS RISER AND REGULATOR TO REMAIN.
15. EXISTING PIPING BELOW GRADE TO REMAIN.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN WING.

KEY PLAN

04/20/2018

0 4' 8' 16'

1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

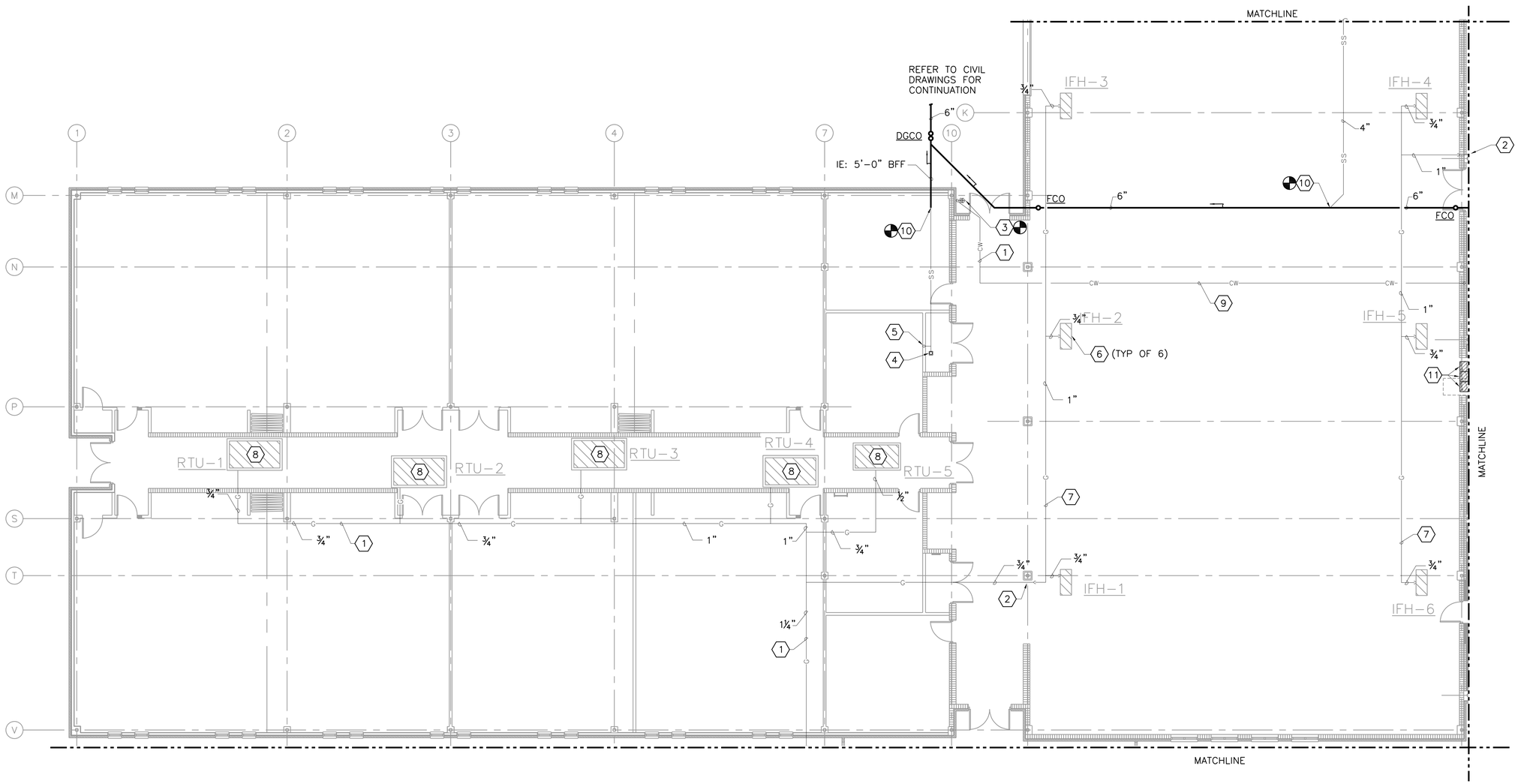
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING
FLOOR PLAN - A

P-5 (5)

SHT. 67 of 129



GENERAL NOTES:

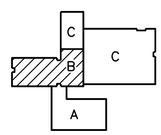
1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM TO REMAIN AS IS UNLESS INDICATED OTHERWISE.
4. PROVIDE NEW TRAP SEAL DEVICE IN ALL EXISTING AND NEW FLOOR DRAINS, FLOOR SINKS, AND HUB DRAINS.
5. ALL EXTERIOR AND INTERIOR NATURAL GAS PIPING TO BE PAINTED SAFETY YELLOW.

NOTES BY SYMBOL "⬡"

1. EXISTING NATURAL GAS PIPING ON ROOF.
2. EXISTING NATURAL GAS PIPE THROUGH WALL.
3. NEW ¾" NON-FREEZE RECESSED WALL HYDRANT WITH INTEGRAL VACUUM BREAKER. PROVIDE WATER-PROOF SEALANT AROUND NEW WALL HYDRANT.
4. EXISTING FLOOR DRAIN. PROVIDE NEW TRAP SEAL DEVICE.
5. EXISTING VENT THROUGH ROOF (VTR).
6. EXISTING GAS FIRED INFRA-RED UNIT HEATERS.
7. EXISTING GAS PIPING IN JOIST SPACE ABOVE ASSEMBLY HALL.
8. EXISTING GAS FIRED HVAC ROOF-TOP UNIT.
9. EXISTING PIPING BELOW FLOOR.
10. CONNECT NEW SS PIPE INTO EXISTING SS PIPE UNDERFLOOR/GRADE.
11. NEW ELECTRIC WATER COOLERS RE: ENLARGED FLOOR PLAN 1/P-9.

NORTH PLAN NORTH / NORTH TRUE NORTH — 1 — FLOOR PLAN – B

1/8"=1'-0"



KEY PLAN

STATE OF TEXAS — VAN CASHEN — 118595 — LICENSED PROFESSIONAL ENGINEER — 04/20/2018

0 4' 8' 16'

1/8"=1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

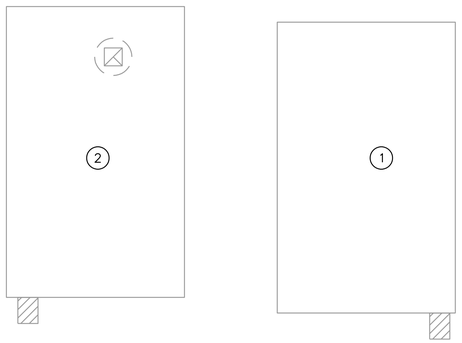
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

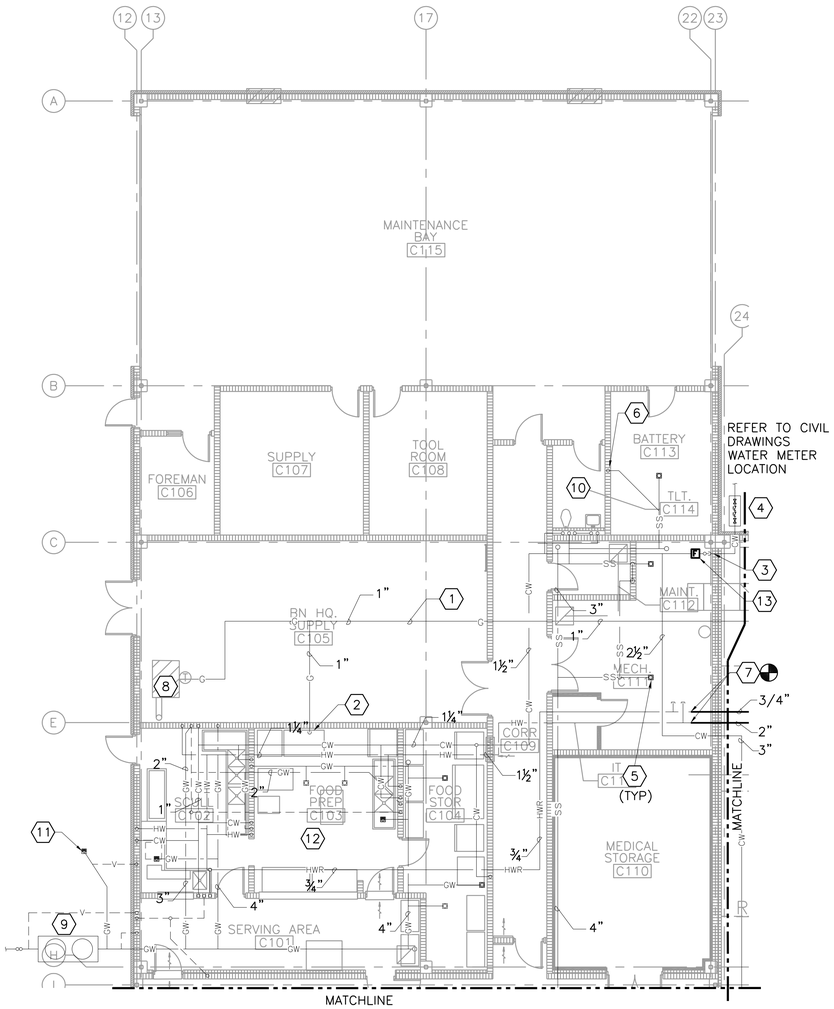
TXARNG CFMO

PLUMBING
FLOOR PLAN - B

P-6

SHT. 68 of 129





NORTH PLAN NORTH NORTH TRUE NORTH 1/– FLOOR PLAN – C

1/8"=1'–0"

GENERAL NOTES:

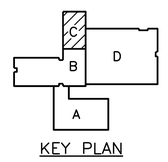
1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G–1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P–0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM TO REMAIN AS IS UNLESS INDICATED OTHERWISE.
4. PROVIDE NEW TRAP SEAL DEVICE IN ALL EXISTING AND NEW FLOOR DRAINS, FLOOR SINKS, AND HUB DRAINS.
5. ALL EXTERIOR AND INTERIOR GAS PIPING TO BE PAINTED SAFETY YELLOW.

NOTES BY SYMBOL "⬡"

1. EXISTING GAS PIPING ON ROOF.
2. EXISTING GAS PIPE DOWN THROUGH ROOF.
3. EXISTING VALVED 3" DOMESTIC WATER RISER.
4. EXISTING 3" BACKFLOW PREVENTOR IN VAULT.
5. EXISTING FLOOR DRAIN.
6. EXISTING VENT THROUGH ROOF (VTR).
7. CONNECT NEW 2" HW AND 3/4" HWR PIPE AND EXTEND AS INDICATED.
8. EXISTING GAS FIRED HVAC EQUIPMENT.
9. EXISTING CONCRETE GREASE SEPARATOR TO REMAIN. PUMP OUT AND PROPERLY DISPOSE OF GREASE LADEN WASTE. AFTER SEPARATOR IS COMPLETELY EMPTY AND DRY, CLEAN SEPARATOR INTERIOR WITH ALKALINE DEGREASER AND PRESSURE WASH. PERMANENTLY INJECT ALL CRACKS WITH COMMERCIAL GRADE LOW PRESSURE CRACK SEALANT. SEAL INTERIOR CONCRETE SURFACES WITH SILICONATE MULTI–SURFACE SMOOTH WB PENETRATING SEALANT.
10. EXISTING PLUMBING FIXTURES TO REMAIN.
11. EXISTING 3" CAN WASH DRAIN.
12. ALL PIPING AND EQUIPMENT IN KITCHEN AREA TO REMAIN IN SERVICE.
13. PROVIDE NEW DIGITAL FLOW METER WITH VALVED BYPASS ASSEMBLY. WATER METER PROVIDED BY BUILDING AUTOMATION SYSTEM CONTRACTOR. RE: SPECIFICATION 230923.

BID OPTIONS "◯"

1. CONNECT TEMPORARY RESTROOM BUILDING TO EXISTING DOMESTIC WATER TEMPORARY CONNECTION. CONNECT TEMPORARY RESTROOM BUILDING INTO EXISTING TEMPORARY SANITARY WASTE CONNECTION. CONTRACTOR TO FIELD VERIFY EXACT LOCATION OF EXISTING CONNECTIONS.
2. CONNECT TEMPORARY SHOWER BUILDING TO EXISTING DOMESTIC WATER TEMPORARY CONNECTION. CONNECT TEMPORARY SHOWER BUILDING INTO EXISTING TEMPORARY SANITARY WASTE CONNECTION. CONTRACTOR TO FIELD VERIFY EXACT LOCATION OF EXISTING CONNECTIONS.



KEY PLAN



0 4' 8' 16'

1/8"=1'–0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO

CAMP MABRY P.O. BOX 5218
(512) 782–6131
AUSTIN, TEXAS 78763–5218
FAX (512) 782–1481

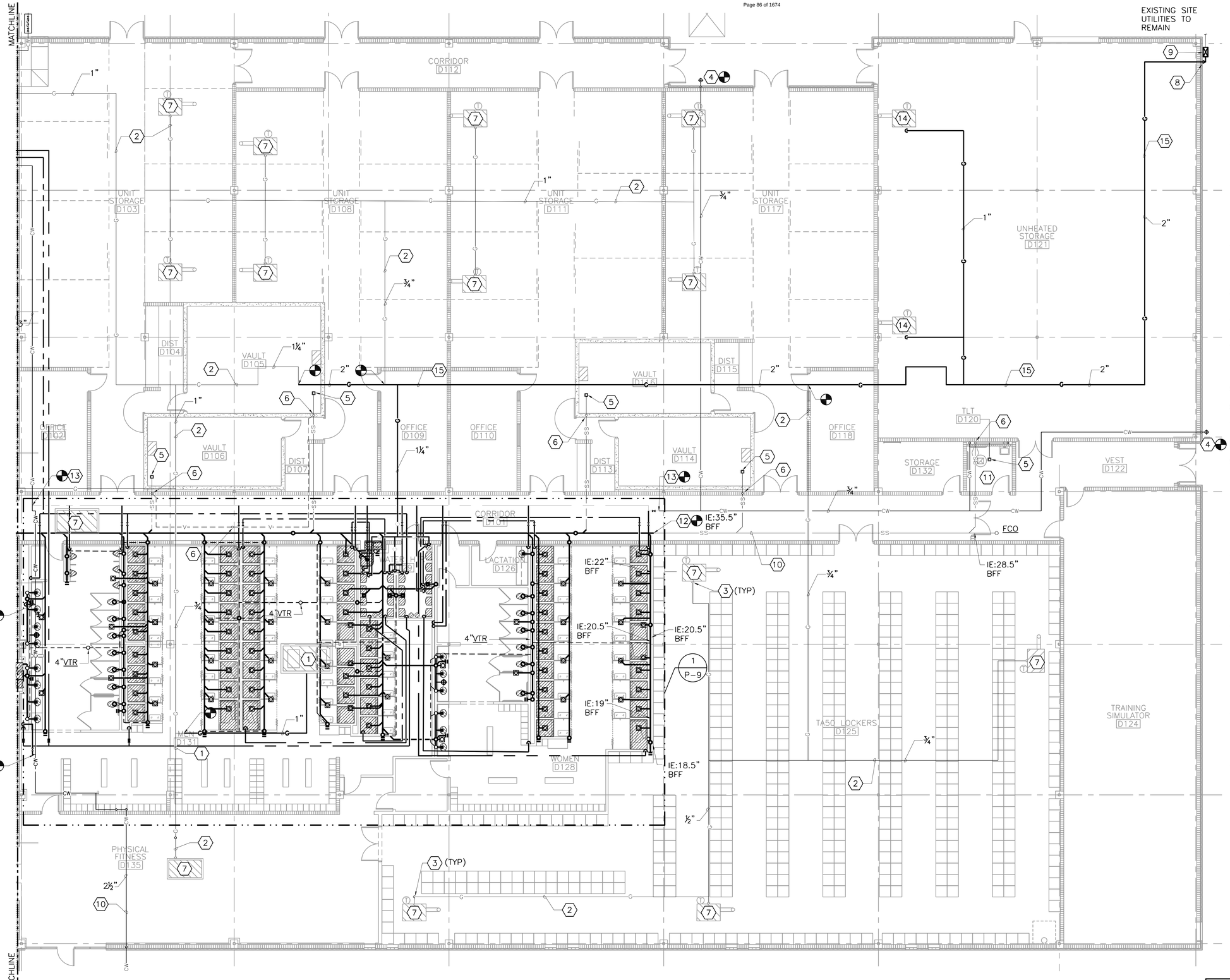
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING
FLOOR PLAN - C

P-7

SHT. 69 of 129



FLOOR PLAN – D

1/8"=1'-0"

KEY PLAN

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM TO REMAIN AS IS UNLESS INDICATED OTHERWISE.
4. PROVIDE NEW TRAP SEAL DEVICE IN ALL EXISTING AND NEW FLOOR DRAINS, FLOOR SINKS, AND HUB DRAINS.
5. ALL EXTERIOR AND INTERIOR NATURAL GAS PIPING TO BE PAINTED SAFETY YELLOW.

NOTES BY SYMBOL "⬡"

1. NEW GAS FIRED HVAC UNIT. CONNECT INTO EXISTING AS INDICATED. PROVIDE WITH SHUT-OFF VALVE AND GAS DIRT LEG.
2. EXISTING NATURAL GAS PIPING ON ROOF.
3. EXISTING NATURAL GAS PIPE DOWN THROUGH ROOF.
4. NEW 3/4" NON-FREEZE RECESSED WALL HYDRANT WITH INTEGRAL VACUUM BREAKER. PROVIDE WATER-PROOF SEALANT AROUND NEW WALL HYDRANT.
5. EXISTING FLOOR DRAIN.
6. EXISTING VENT THROUGH ROOF (VTR).
7. EXISTING GAS FIRED HVAC EQUIPMENT.
8. NEW GAS 2" RISER UP TO ROOF.
9. NEW METER AND REGULATOR TO PROVIDE 1537 CFH WITH AN INCOMING GAS PRESSURE OF 15 PSIG AND A DISCHARGE PRESSURE OF 5 PSIG. PROVIDE TRANSCEIVER CAPABLE OF INTERFACE WITH THE BACNET SYSTEM WITH A PULSE OUTPUT. GAS METER PROVIDED BY BUILDING AUTOMATION SYSTEM CONTRACTOR. RE: SPECIFICATION 230923.
10. EXISTING PIPING BELOW FLOOR.
11. EXISTING PLUMBING FIXTURES TO REMAIN.
12. CONNECT NEW SS PIPE INTO EXISTING SS PIPE UNDERFLOOR GRADE.
13. EXISTING CW PIPE TO REMAIN IN SERVICE UNTIL CONSTRUCTION IS OF NEW RESTROOM AND SHOWER AREAS ARE COMPLETE. THE EXISTING CW PIPING IS TO BE REMOVED FOLLOWING THE INSTALLMENT OF ALL NEW CW PIPING SERVING THESE AREAS IS COMPLETED AND OPERATIONAL INCLUDING SERVICE SWITCH OVER.
14. NEW GAS FIRED UNIT HEATERS IN D121. ROUTE GAS PIPING FROM ROOF ABOVE, COORDINATE ROOF PENETRATION WITH ROOF WARRANTY. PROVIDE WITH SHUT-OFF VALVE AND GAS DIRT LEG.
15. NEW GAS PIPE ON ROOF.

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

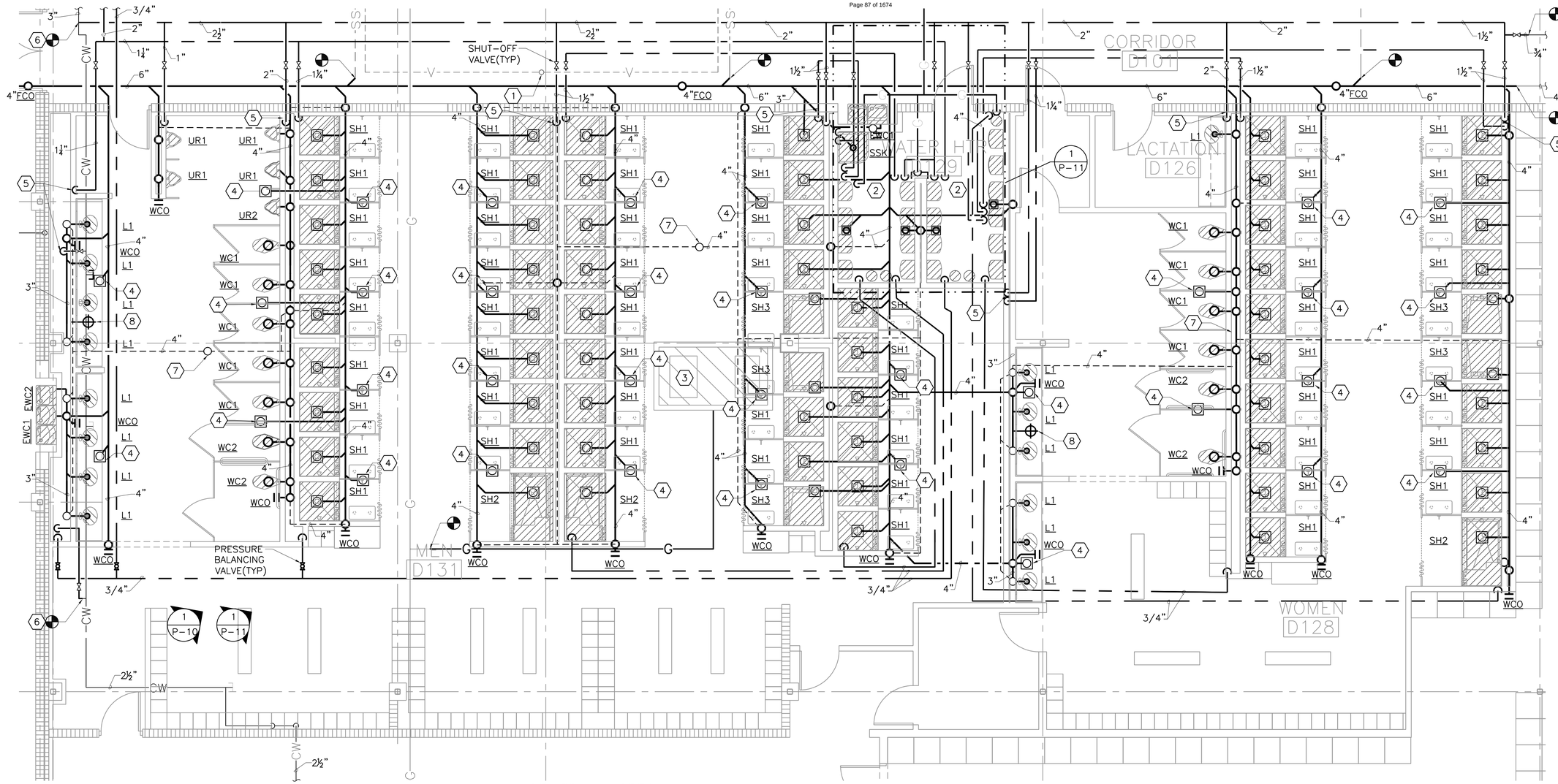
VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER STATE OF TEXAS
04/20/2018

0 4' 8' 16'
1/8"=1'-0"

PLUMBING
FLOOR PLAN - D

P-8

SHT. 70 of 129



NOTES BY SYMBOL "⬡"

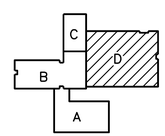
1. EXISTING VTR TO REMAIN.
2. NEW NATURAL GAS-FIRED INSTANTANEOUS TANKLESS WATER HEATERS. 200 CFH EACH AT 10" W.C. 18 REQUIRED FOR NEW LAYOUT. RE: 1, 2 & 3/P-12 AND SCHEDULE ON SHEET P-0.
3. NEW GAS FIRED HVAC UNIT.
4. NEW 2" FLOOR DRAIN WITH TRAP GUARD INSERT.
5. DROP HW AND CW FROM ABOVE INTO PLUMBING CHASE TO SERVE BATTERY OF PLUMBING FIXTURES.
6. EXISTING CW PIPE TO REMAIN IN SERVICE UNTIL CONSTRUCTION IS OF NEW RESTROOM AND SHOWER AREAS ARE COMPLETE. THE EXISTING CW PIPING IS TO BE REMOVED FOLLOWING THE INSTALLMENT OF ALL NEW CW PIPING SERVING THESE AREAS IS COMPLETED AND OPERATIONAL INCLUDING SERVICE SWITCH OVER.
7. NEW 4" VTR. COORDINATE ROOF PENETRATION WITH ROOFING WARRANTY.
8. NEW ½" HOSE BIBB UNDER COUNTER AT 12" AFF.

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM NOT SHOWN FOR CLARITY.
4. PROVIDE NEW TRAP SEAL DEVICE IN ALL EXISTING AND NEW FLOOR DRAINS, FLOOR SINKS, AND HUB DRAINS.
5. ALL EXTERIOR AND INTERIOR NATURAL GAS PIPING TO BE PAINTED SAFETY YELLOW.

NOTE:
ENTIRE EXISTING CONCRETE FLOOR SLAB TO BE REMOVED/REPLACED IN RESTROOM, SHOWER AND LOCKER AREAS DURING CONSTRUCTION. COORDINATE NEW UNDER FLOOR SS PIPE INSTALLATION WITH NEW CONCRETE SLAB, GRADE BEAMS AND SLAB INSTALLATION. RE: STRUCTURAL DRAWINGS FOR CONCRETE SLAB REMOVAL, REPLACEMENT, TRENCHING AND BACKFILL.

NORTH PLAN NORTH NORTH TRUE NORTH 1 — ENLARGED FLOOR PLAN
1/4"=1'-0"



KEY PLAN



04/20/2018

0 1' 2' 4' 8'
1/4"=1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

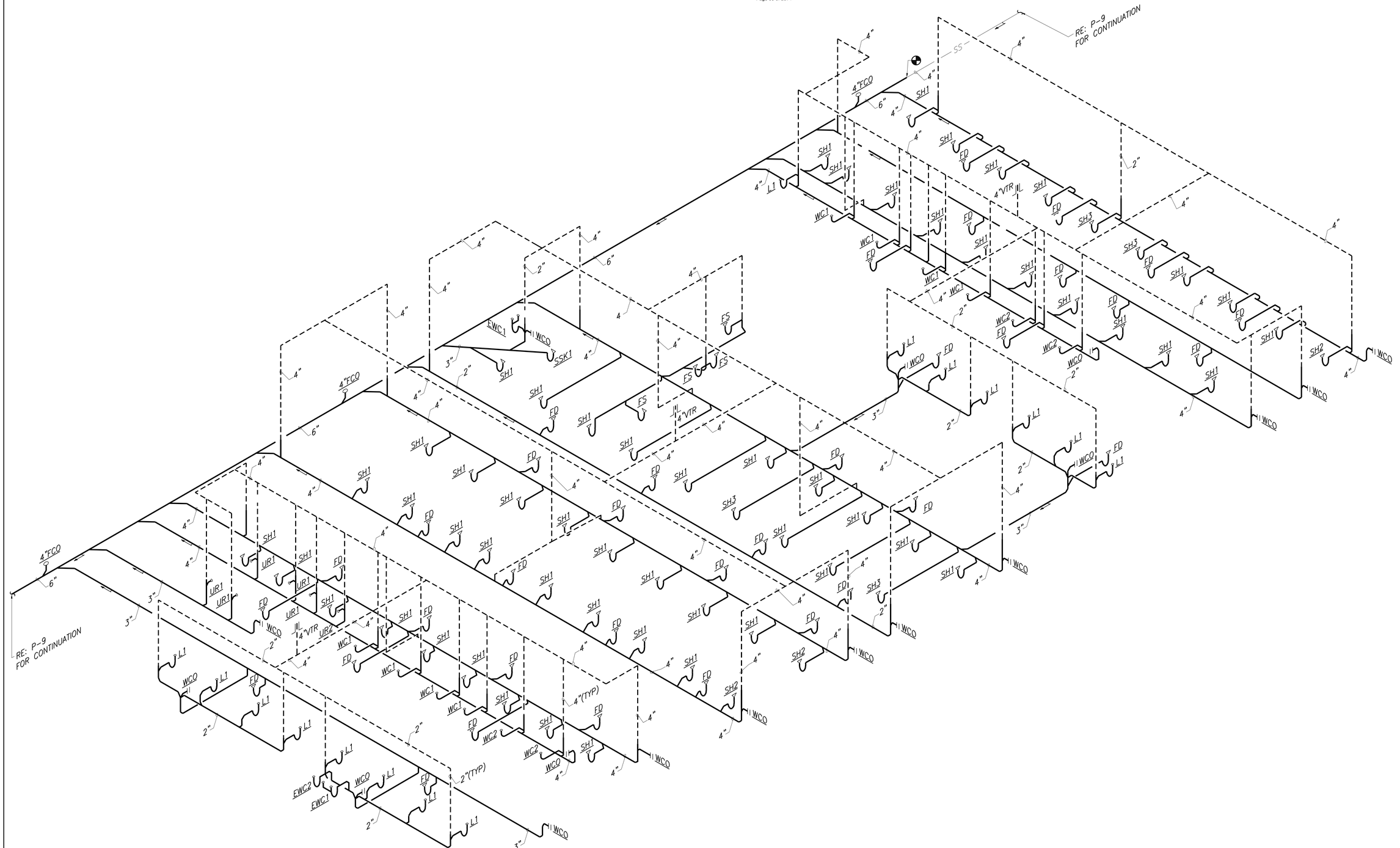
NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING
ENLARGED FLOOR PLAN
P-9
SHT. 71 of 129



SANITARY WASTE & VENT RISER

1 SANITARY RISER DIAGRAM
NOT TO SCALE

STATE OF TEXAS
VAN CASHEN
118595
LICENSED
PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

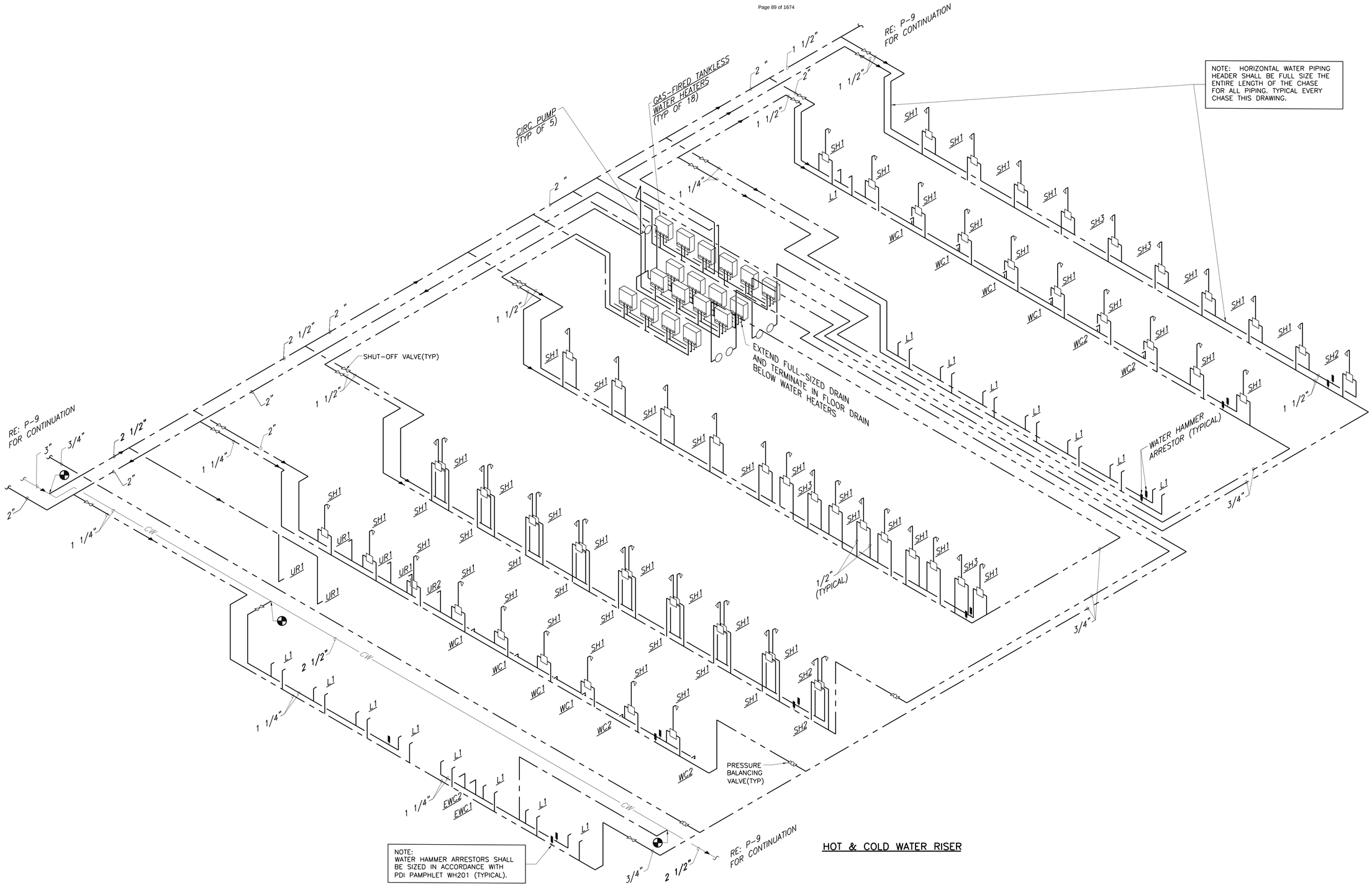
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING
SANITARY
RISER DIAGRAMS

P-10

SHT. 72 of 129



HOT & COLD WATER RISER

1 DOMESTIC WATER RISER DIAGRAM
NOT TO SCALE

VAN CASHEN
118595
LICENSED PROFESSIONAL ENGINEER
04/20/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

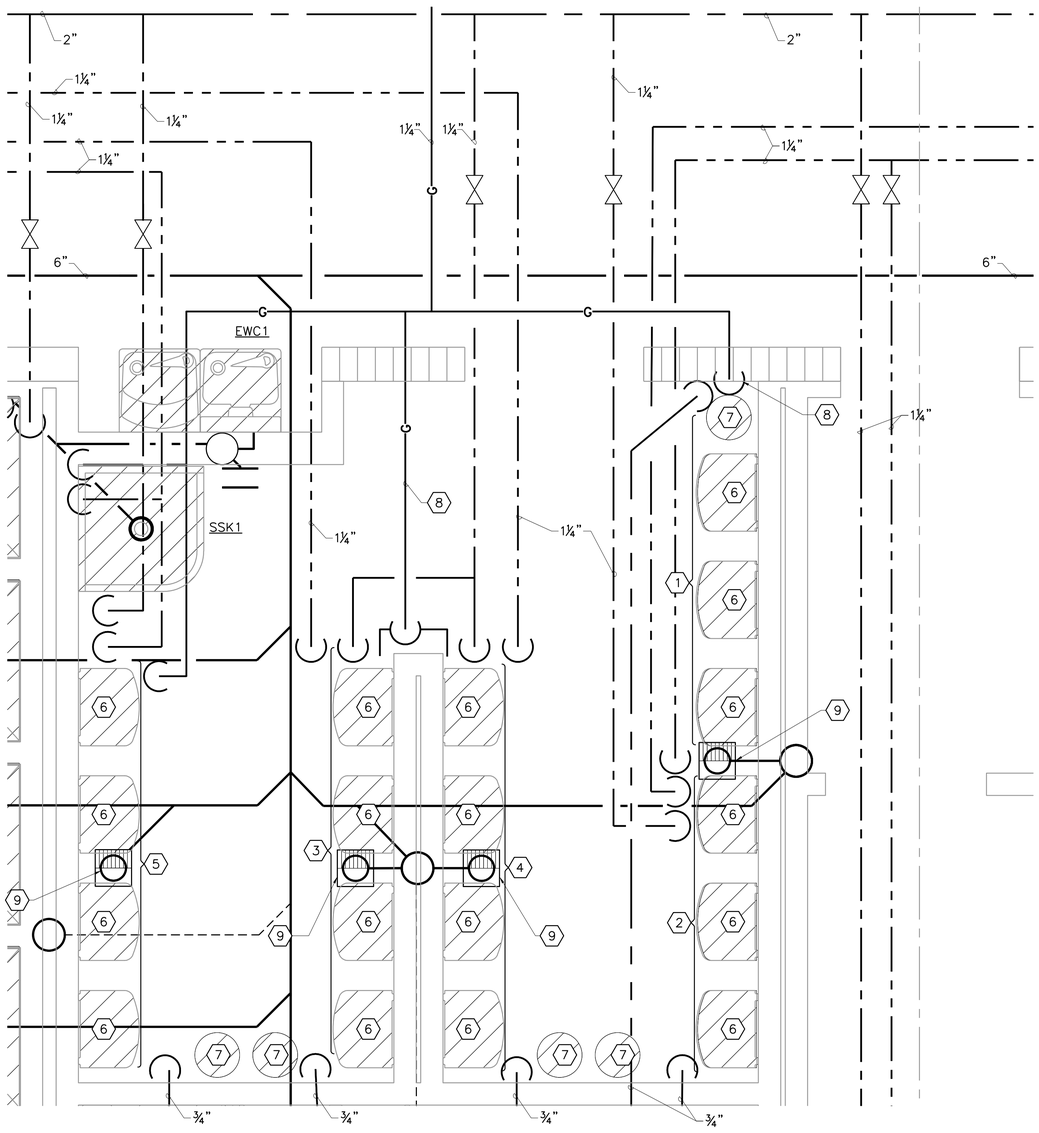
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING DOMESTIC WATER RISER DIAGRAMS

P-11

SHT. 73 of 129



ENLARGED FLOOR PLAN – WATER HEATER ROOM D129

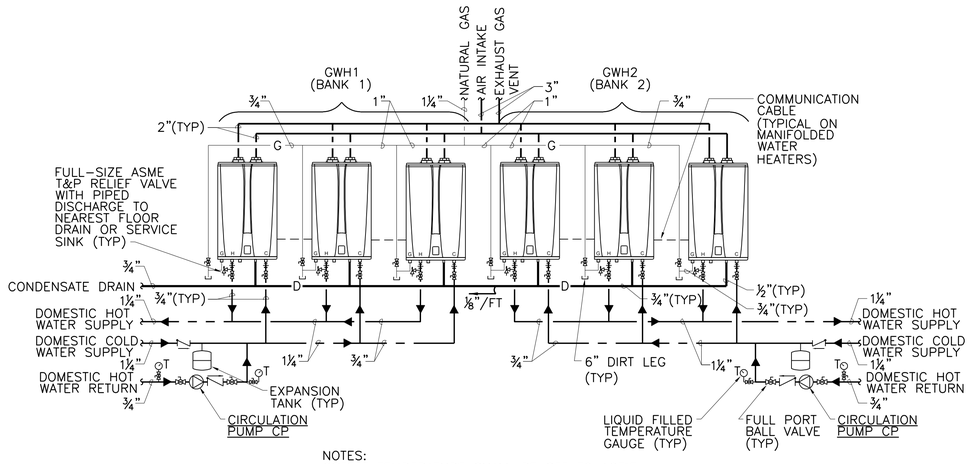
3/4"=1'-0"

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. PROVIDE NEW TRAP SEAL DEVICE IN ALL EXISTING AND NEW FLOOR DRAINS, FLOOR SINKS, AND HUB DRAINS.
4. ALL EXTERIOR AND INTERIOR NATURAL GAS PIPING TO BE PAINTED SAFETY YELLOW.

NOTES BY SYMBOL "⬡"

1. GAS WATER HEATER GWH1 (BANK 1), SUPPLYING WOMENS RESTROOMS AND SHOWERS.
2. GAS WATER HEATER GWH2 (BANK 2), SUPPLYING WOMENS RESTROOMS AND SHOWERS.
3. GAS WATER HEATER GWH3 (BANK 3), SUPPLYING MENS RESTROOMS AND SHOWERS.
4. GAS WATER HEATER GWH4 (BANK 4), SUPPLYING MENS RESTROOMS AND SHOWERS.
5. GAS WATER HEATER GWH5 (BANK 5), SUPPLYING MENS RESTROOMS AND SHOWERS.
6. NEW NATURAL GAS-FIRED INSTANTANEOUS TANKLESS WATER HEATERS. GWH1 THROUGH GWH5. 200 CFH EACH AT 10" W.C. 18 REQUIRED FOR NEW LAYOUT. RE:1/P-0 FOR SCHEDULES, RE: 2&3/P-12 FOR DETAILS.
7. NEW HOT WATER CIRCULATION PUMP WITH 24/7 PROGRAMMABLE TIMER. PROGRAM TO RUN WEEKENDS BETWEEN 6:00AM AND 9:00PM. ADJUSTABLE FOR USER CONTROL, CONTROLLED BY BAS SYSTEM IF INSTALLED. RE: DETAIL 2&3/P-12.
8. NEW NATURAL GAS SUPPLY DOWN TO WATER HEATERS.
9. NEW 4" FLOOR SINK WITH HALF GRATE AND TRAP GUARD INSERT.

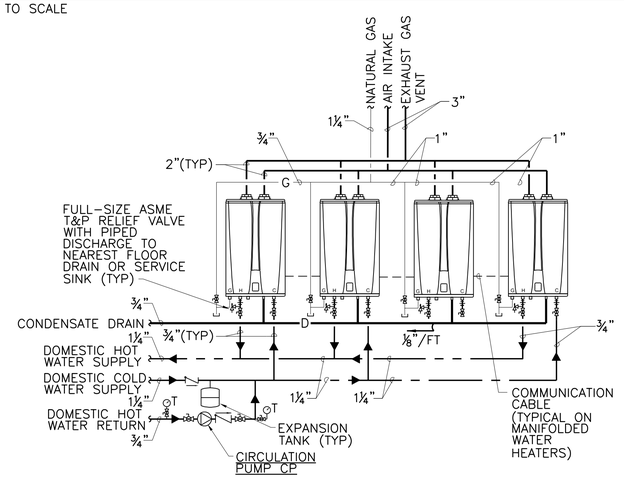


NOTES:
OUTLET TEMPERATURE SHALL BE SET TO 127°F.

WATER HEATER ROOM D129

2 – NATURAL GAS-FIRED TANKLESS WATER HEATER DETAIL (GWH BANK 1 & 2)

NOT TO SCALE



NOTES:
OUTLET TEMPERATURE SHALL BE SET TO 127°F.

WATER HEATER ROOM D129

3 – NATURAL GAS-FIRED TANKLESS WATER HEATER DETAIL (GWH BANK 3, 4, 5)

NOT TO SCALE

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING WATER HEATER ROOM AND DETAILS

P-12

SHT. 74 of 129

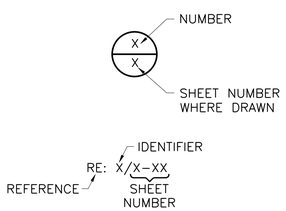
STATE OF TEXAS
VAN CASHEN
118595
LICENSED
PROFESSIONAL ENGINEER
04/20/2018

0 6" 1' 2'
3/4"=1'-0

ABBREVIATIONS	
AC	ALTERNATING CURRENT
AF	AMP FRAME
AFD	ADJUSTABLE FREQUENCY DRIVE
AFF	ABOVE FINISHED FLOOR OR GRADE
AG	ABOVE GRADE
AGSB	ABOVE GROUND SPLICE BOX
AIC	AMPERES INTERRUPTING CAPACITY
AL OR ALUM	ALUMINUM
AMP OR A	AMPERE
AT	AMP TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
C.	CONDUIT
CB	CIRCUIT BREAKER
C/C	CENTER TO CENTER
CHH	COMMUNICATION MANHOLE/HANDHOLE
CKT	CIRCUIT
CLF	CURRENT LIMITING FUSE
CONT.	CONTINUATION
CP	CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CS	CONTROL SWITCH OR COMBINATION STARTER
CT	CURRENT TRANSFORMER
CU	COPPER
DC	DIRECT CURRENT
DI	DOOR INTERLOCK
DN	DOWN
DP	DIFFERENTIAL PRESSURE
DWG	DRAWING
EMH	ELECTRICAL MANHOLE/HANDHOLE
EC	EMPTY CONDUIT
ELEC	ELECTRICAL
ELEV	ELEVATION
EM	EMERGENCY
EHH	ELECTRICAL MANHOLE
EO	ELECTRICALLY OPERATED
ETM	ELAPSED TIME METER
EUC	ELECTRIC UTILITY CO.
EXIST.	EXISTING
FBO	FURNISHED BY OTHERS
FO	FIBER OPTIC
FRP	FIBERGLASS REINFORCED POLYESTER
FT	FEET
FU	FUSE
G. OR GRD	GROUND
GA.	GAUGE
GCP	GENERATOR CONTROL PANEL
GEN	GENERATOR
GFI	GROUND FAULT INTERRUPTER
GFS	GROUND FAULT SENSING
GO	GATE OPERATOR
GRS	GALVANIZED RIGID STEEL
HH	HANDHOLE
HP	HORSEPOWER
HT	HEIGHT
HTP	HEAT TRACE PANEL
HTR	HEATER
HZ	HERTZ
ID	INTERNAL DIAMETER
IMH	INSTRUMENT MANHOLE
INST	INSTRUMENT
IRP	INTERPOSING RELAY PANEL
JB	JUNCTION BOX
KVA	KILOVOLT–AMPERE
KW	KILOWATT
LA	LIGHTNING ARRESTER
LC	LIGHTNING CONTACTOR
LED	LIGHT EMITTING DIODE
LGTS ON LTG	LIGHTS/LIGHTING
LP	LIGHTING PANEL
LSIG	LONG, SHORT, INSTANTANEOUS, GROUND
MBFV	MOTOR OPERATED BUTTERFLY VALVE
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MFR	MANUFACTURER
MFR'S	MANUFACTURER'S
MH	MANHOLE
ML	MULTILIN
MOV	MOTOR OPERATED VALVE
MLO	MAIN LUGS ONLY
MPR	MOTOR PROTECTION RELAY
MR	MULTIRATIO
MTD	MOUNTED
MTG	MOUNTING
MTS	MANUAL TRANSFER SWITCH

ABBREVIATIONS	
NC or N.C.	NORMALLY CLOSED
NF	NON–FUSED
NO or N.O.	NORMALLY OPEN OR NUMBER
NO.	NUMBER
OD	OUTSIDE DIAMETER
OHE	OVERHEAD ELECTRIC
OL	OVERLOAD
OLX	OVERLOAD CONTROL RELAY
P	POLE
PB	PULL BOX OR PUSH BUTTON
PC	PHOTOCELL
PCC	PUMP CONTROL CONSOLE
PFR	PHASE FAILURE RELAY
PH	PHASE
PL.	PLATE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PPR	PHASE PROTECTIVE RELAY
PR.	PAIR OR PAIR CABLE
PT	POTENTIAL TRANSFORMER
PTT	PUSH TO TEST TYPE
PVC	POLYVINYL CHLORIDE
QTY	QUANTITY
RC	REMOTE CONTROL
RCP	RELAY CONTROL PANEL
REC.	CIRCUIT RECLOSURE
RECP	RECEPTACLES
REQD.	REQUIRED
RTD	RESISTANCE TEMPERATURE DETECTOR
RTU	REMOTE TERMINAL UNIT
SC	SURGE CAPACITOR
SCH	SCHEMATIC
SCTB	SHORT CIRCUIT TERMINAL BLOCK
SEC	SECONDS OR SECONDARY
SHLD. OR SH	SHIELD OR SHIELDED
SHT	SHEET
SN OR S/N	SOLID NEUTRAL
SPD	SURGE PROTECTION DEVICES
SSRVS	SOLID–STATE REDUCED VOLTAGE STARTER
SS	STAINLESS STEEL
ST	STARTER
STA.	STATION
STC	SIGNAL TERMINATION CABINET
SV	SOLENOID VALVE
SW	SWITCH
SWGR	SWITCHGEAR
TC	TERMINATION CABINET OR TRAY CABLE
TEL	TELEPHONE
TO	TIME DELAY ON OPENING
TR.	TRIAD
TS	TEMPERATURE SWITCH
TW	TWISTED
TYP	TYPICAL
UG	UNDERGROUND
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTP	UNSHIELDED TWISTED PAIR CABLE
V	VOLTS
VAR.	VARIABLE
VFD	VARIABLE FREQUENCY DRIVE
VFI	VACUUM FAULT INTERUPTER
VO	VALVE OPERATOR
W	WITH, WIRE OR WATT
WP	WEATHERPROOF
WR	WEATHER RESISTANT
XFMR	TRANSFORMER
XMTR	TRANSMITTER
XP	EXPLOSION PROOF

NOTE:
THIS IS A STANDARD LEGEND. THEREFORE, NOT ALL OF THIS INFORMATION MAY BE USED ON THIS PROJECT.



PLAN SYMBOL	DESCRIPTION
b A	LIGHTING FIXTURE "A" – FIXTURE TYPE "b" – SWITCH NUMBER
A	EMERGENCY BATTERY PACK LIGHT FIXTURE "A" – FIXTURE TYPE
X	CEILING MOUNTED EXIT SIGN "X" – FIXTURE TYPE
X	WALL MOUNTED EXIT SIGN ARROW INDICATES DIRECTION OF EGRESS "X" – FIXTURE TYPE
FACP	FIRE ALARM CONTROL PANEL
F	MANUAL PULL STATION
	CEILING MOUNTED STROBE
	WALL MOUNTED STROBE
	SMOKE DETECTOR
	HEAT DETECTOR
	HORN
	COMBINATION STROBE/HORN
	CONDUIT, EXPOSED/SURFACE MOUNTED
	CONDUIT OR DUCTBANK, CONCEALED
	CONDUIT, EXPOSED/SURFACE MOUNTED, TURNING UP
	CONDUIT, EXPOSED/SURFACE MOUNTED, TURNING DOWN
	CONDUIT STUBBED OUT AND CAPPED
OHE OHE	OVERHEAD ELECTRIC LINE
UGE UGE	UNDERGROUND ELECTRIC LINE
OHP OHP	OVERHEAD PRIMARY LINE
UGP UGP	UNDERGROUND PRIMARY LINE
OHS OHS	OVERHEAD SECONDARY LINE
UGS UGS	UNDERGROUND SECONDARY LINE
OHC OHC	OVERHEAD COMMUNICATION LINE
UGC UGC	UNDERGROUND COMMUNICATION LINE
OHFO OHFO	OVERHEAD FIBER OPTIC LINE
UGFO UGFO	UNDERGROUND FIBER OPTIC LINE
	FLEXIBLE METAL CONDUIT
	HEAT TRACE
2(3 #3/0, #2G., 3"C.)	DENOTES A QUANTITY OF TWO (2) 3–INCH CONDUITS EACH CONTAINING THREE NO. 3/0 AWG CONDUCTORS AND ONE NO.2 AWG GROUND CONDUCTOR
2–2/C#16	DENOTES A QUANTITY OF TWO INSTRUMENT CABLES. EACH CONSISTS OF TWO NO.16 AWG CONDUCTORS
3-4"C	THREE 4–INCH CONDUITS
MC1–XXX 4 #14, #14G., ¾"C (2#14 SPARE)	CABLE TAG FOUR #14 CONTROL OR POWER CONDUCTORS, ONE #14 GROUND CONDUCTOR. ALL CONDUCTORS IN A ¾" CONDUIT. TWO OF THE FOUR #14 CONTROL OR POWER CONDUCTORS ARE SPARE.
LA–1,3	HOMERUN, CIRCUITS 1 AND 3 RUN TO PANEL LA 2 #12, #12G., 3/4"C. UNLESS NOTED OTHERWISE
$b	SINGLE POLE SWITCH "b" – INDICATES SWITCH LEG SHALL CONTROL LIGHT FIXTURES WITH "b" – DESIGNATION
$Xc	MULTI POLE SWITCH "x" – INDICATES NUMBER OF POLE "c" – INDICATES SWITCH SHALL CONTROL LIGHT FIXTURES WITH "c" DESIGNATION
$M	MANUAL MOTOR STARTER /DISCONNECT
$3	3 WAY SWITCH
$4	4 WAY SWITCH
$D D	DIMMER LIGHTING CONTROL SWITCH
$TM TM	TIME SWITCH
	DUPLEX RECEPTACLE, 20A, 120V, 2P, 3W "C" – MOUNTED ABOVE COUNTERTOP "GFI" OR "GF" – GROUND FAULT INTERRUPTER TYPE "WP" – WEATHERPROOF
F	FLOOR MOUNTED RECEPTACLE
	SIMPLEX RECEPTACLE, GROUNDED TYPE
	QUADPLEX RECEPTACLE

PLAN SYMBOL	DESCRIPTION
J J	JUNCTION BOX
PB	PULL BOX
TC	TERMINAL CABINET
OS	OCCUPANCY SENSOR
PC	PHOTOCELL
PW	PREWIRED
MH	MANHOLE
M	UTILITY METER
M	MOTORIZED LOUVER
DAMP	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 12 CONSTRUCTION UNLESS OTHERWISE NOTED
WET	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 4 CONSTRUCTION UNLESS OTHERWISE NOTED
CORROSIVE	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 4X CONSTRUCTION UNLESS OTHERWISE NOTED
CLASS I, DIV.1, GROUP D	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL CONFORM TO N.E.C REQUIREMENTS FOR THE HAZARDOUS AREA CLASSIFICATION SHOWN

ONE–LINE OR CONTROL DIAGRAM	PLAN	DESCRIPTION
	OR	PANEL
5	M	MOTOR, NUMBER DESIGNATES HORSEPOWER
VM *	-	VOLTMETER (WITH SWITCH IF 3–PHASE)
AM *	-	AMMETER (WITH SWITCH IF 3–PHASE)
*	-	METER * WM – WATTMETER WHM – WATTHOUR METER WHDM – WATTHOUR DEMAND METER WHDR – WATTHOUR DEMAND RECORDER PF – POWER FACTOR METER ETM – ELAPSED TIME METER TRANSDUCER AX – CURRENT TRANSDUCER WX – WATT TRANSDUCER
#	-	RELAY, NO. AS INDICATED 25 – SYNCHRONISM CHECK RELAY 27 – UNDER VOLTAGE RELAY 38 – BEARING PROTECTIVE DEVICE 40 – LOSS OF EXCITATION RELAY 42 – RUNNING CONTACTOR/PILOT RELAY 46 – REVERSE PHASE/PHASE BALANCE/CURRENT RELAY 47 – PHASE SEQUENCE VOLTAGE RELAY 48 – MACHINE OR TRANSFORMER THERMAL RELAY 50 – INSTANTANEOUS OVERCURRENT RELAY 50G – INSTANTANEOUS GROUND 51 – TIME OVER CURRENT RELAY, GROUNDING RESISTOR TYPE 51N – TIME OVERCURRENT RELAY, RESIDUAL TYPE 51V – TIME OVERCURRENT RELAY WITH VOLTAGE RESTRAINT 59 – OVER VOLTAGE RELAY 60 – NEGATIVE SEQUENCE VOLTAGE RELAY 62 – TIME DELAY RELAY 63 – OVER PRESSURE RELAY 67 – AC DIRECTIONAL OVERCURRENT RELAY 83 – AUTOMATIC SELECTIVE CONTROL OR TRANSFER RELAY 86 – LOCKING–OUT RELAY 87 – DIFFERENTIAL PROTECTIVE RELAY B – SUFFIX INDICATES "BUS" G – SUFFIX INDICATES "GENERATOR" GF – GROUND FAULT IR – INTERPOSING RELAY PFR – PHASE FAILURE, PHASE REVERSAL, UNDERVOLTAGE, OVERVOLTAGE RELAY ST – SHUNT TRIP T – SUFFIX INDICATES "TRANSFORMER" TRP CAP – CAPACITOR TRIP X – SUFFIX INDICATES "AUXILIARY"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763–5218
(512) 782–6131
FAX (512) 782–1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

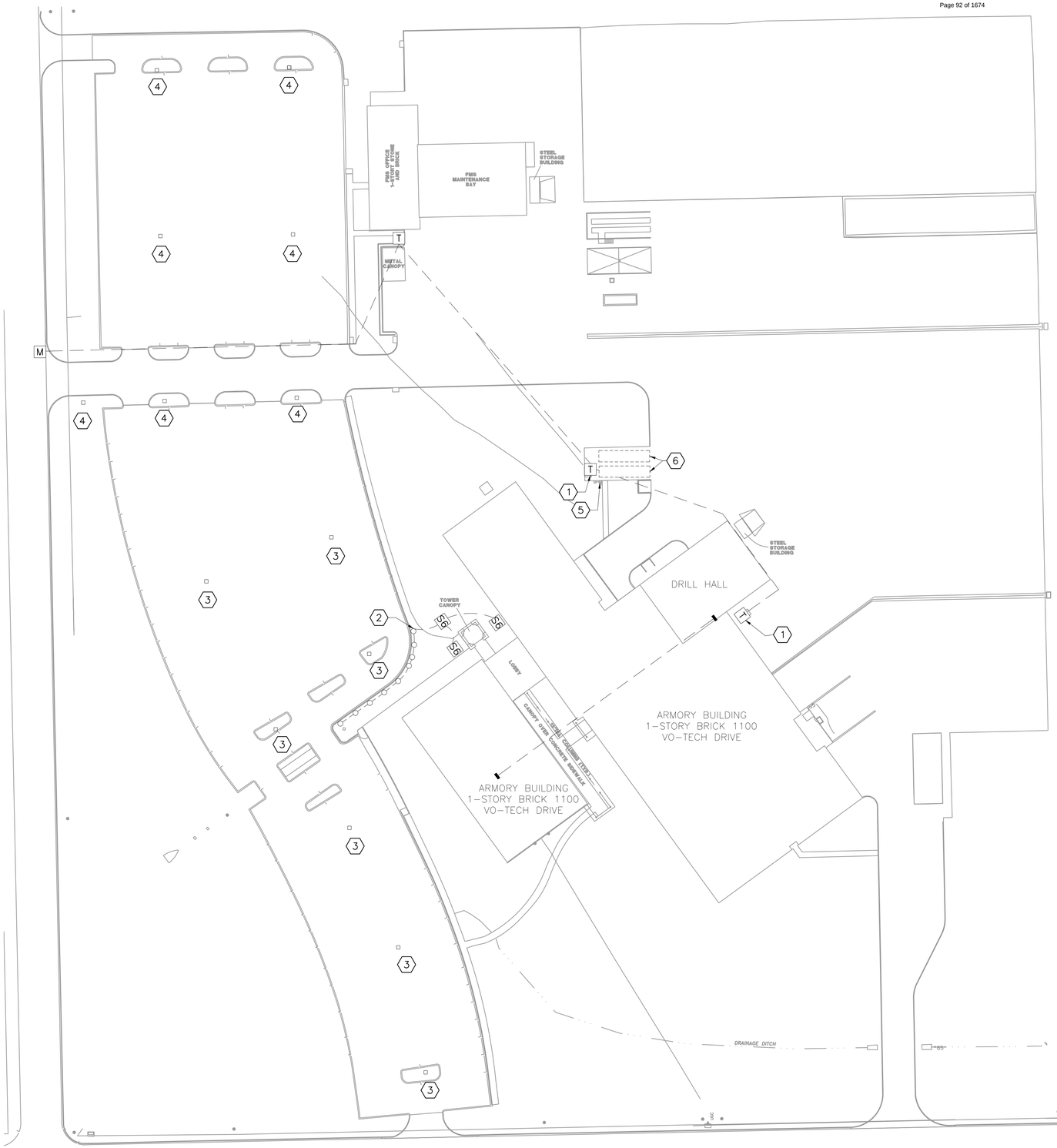
TXARNG CFMO

ELECTRICAL LEGEND

E-0

SHT. 75 of 129

TERESA CASTILLON 111323 LICENSED PROFESSIONAL ENGINEER STATE OF TEXAS
4/20/18
Teresa Castillon



NORTH TRUE

1 — ELECTRICAL SITE PLAN

1"= 50'-0"

0 50' 100'

SCALE IN FEET

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, SWITCHES, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
3. ALL EXISTING TO REMAIN CIRCUITS SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.

NOTES BY SYMBOL "⬡"

1. EXISTING UTILITY TRANSFORMER TO REMAIN.
2. BOLLARDS WITH 50W HPS LAMPS SHALL REMAIN.
3. LED LIGHT FIXTURES/POLES SHALL REMAIN.
4. EXISTING LIGHT POLES WITH 1000W HPS LAMPS SHALL REMAIN.

(1)(2) 5. EXISTING ELECTRICAL SERVICE SHALL BE USED TO SERVE TEMPORARY BUILDINGS. RE: 2/E-23 FOR ONE-LINE DIAGRAM.

(1)(2) 6. TEMPORARY SHOWER AND RESTROOM BUILDINGS. RE: 1/A-3.

BID OPTIONS "◯"

1. TEMPORARY RESTROOM BUILDING.
2. TEMPORARY SHOWER BUILDING.

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18
Teresa Castillo

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL
ELECTRICAL SITE PLAN

E-1

SHT. 76 of 129

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REMOVE ALL LIGHT FIXTURES, EXIT SIGNS, AND SWITCHES SHOWN HATCHED. REMOVE ASSOCIATED CIRCUITRY TO NEAREST JUNCTION BOX. SWITCH BACK BOXES MAY REMAIN WHERE SWITCHES WILL BE INSTALLED IN SAME LOCATION DURING THE CONSTRUCTION PHASE.
3. FIXTURES AND DEVICES SHOWN AT A LIGHT LINE WEIGHT SHALL REMAIN. RETAIN EXISTING CONDUCTORS AND CONDUITS FOR REUSE WHERE FEASIBLE.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ALL ABANDONED CONDUIT. FIELD VERIFY ALL REQUIREMENTS. INCLUDE ALL COSTS IN BASE BID.
5. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, SWITCHES, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
6. THE ELECTRICAL DEMOLITION DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE PROVIDED TO CONVEY THE GENERAL SCOPE OF WORK. ALL EXISTING LIGHT FIXTURES, SWITCHES ETC. SHALL BE FIELD VERIFIED PRIOR TO BEGINNING WORK OR SUBMITTING PRICES. IT IS THE INTENT OF THESE DOCUMENTS THAT ALL EXISTING LIGHT FIXTURES, SWITCHES, AND ASSOCIATED RACEWAYS, CIRCUITRY, AND EQUIPMENT IN THIS AREA BE DEMOLISHED UNLESS OTHERWISE NOTED.
7. ALL EXISTING TO REMAIN CIRCUITS SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.
8. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN BUILDING EXTERIOR WALLS SHALL BE SEALED WATER TIGHT. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN INTERIOR WALLS SHALL BE PATCHED AND FIREPROOFED AS REQUIRED TO MAINTAIN THE INTEGRITY OF THE PARTITION.
9. GROUT AND SEAL ALL PENETRATIONS WHERE CONDUIT HAS BEEN REMOVED.

NOTES BY SYMBOL "⬡"

(5) 1. IF BID OPTION NO. 5 IS SELECTED, REMOVE LIGHT FIXTURE AND SWITCH. RETAIN CONDUCTORS AND CONDUIT FOR REUSE AS MUCH AS PRACTICAL. . ENSURE THAT ADJACENT LIGHT FIXTURES TO REMAIN ARE CONNECTED BACK TO THE APPROPRIATE LIGHTING CIRCUIT. IF BID OPTION NO. 5 IS NOT SELECTED, LIGHT FIXTURES SHALL REMAIN AS THEY ARE.

(6) 2. IF BID OPTION NO. 6 IS SELECTED, REMOVE EXTERIOR LIGHT FIXTURES. RETAIN WIRING AND CONDUIT FOR REUSE AS MUCH AS PRACTICAL. IF BID OPTION NO. 6 IS NOT SELECTED, LIGHT FIXTURES ALL REMAIN AS THEY ARE.

(6) 3. IF BID OPTION NO. 6 IS SELECTED, REMOVE LIGHTING CONTACTORS, TIMERS, AND ASSOCIATED CIRCUITRY BACK TO SOURCE. FIELD VERIFY EXISTING CONDITIONS AND REQUIREMENTS.

(6) 4. IF BID OPTION NO. 6 IS SELECTED, GROUND MOUNTED LIGHT FIXTURES. RETAIN WIRING AND CONDUIT FOR REUSE AS MUCH AS PRACTICAL. IF BID OPTION NO. 6 IS NOT SELECTED, LIGHT FIXTURES ALL REMAIN AS THEY ARE.

BID OPTIONS "◯"

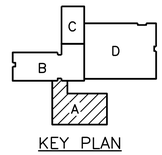
5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN WING.
6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/BUILDING SIGN.



NORTH TRUE / NORTH PLAN

1 — LIGHTING DEMOLITION PLAN – AREA 'A'

1/8"=1'-0"



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

Teresa Castillón

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING DEMOLITION PLAN - AREA 'A'

E-2

SHT. 77 of 129

GENERAL NOTES:

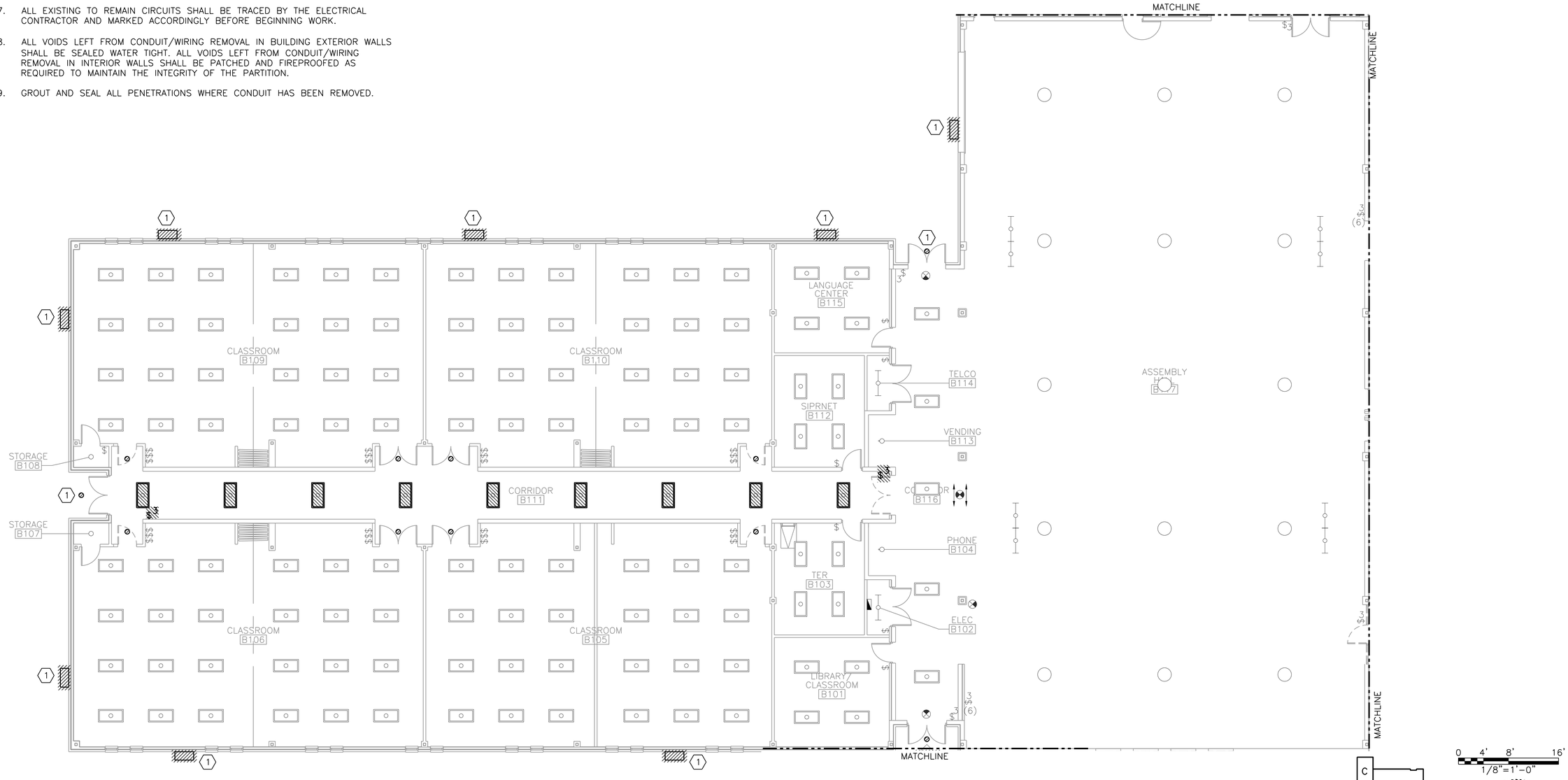
1. A SUMMARY OF THE PROJECT BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REMOVE ALL LIGHT FIXTURES, EXIT SIGNS, AND SWITCHES SHOWN HATCHED. RETAIN CIRCUITRY FOR REUSE. SWITCH BACK BOXES MAY REMAIN WHERE SWITCHES WILL BE INSTALLED IN SAME LOCATION DURING THE CONSTRUCTION PHASE.
3. FIXTURES AND DEVICES SHOWN AT A LIGHT LINE WEIGHT SHALL REMAIN. RETAIN EXISTING CONDUCTORS AND CONDUITS FOR REUSE WHERE FEASIBLE.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ALL ABANDONED CONDUIT. FIELD VERIFY ALL REQUIREMENTS. INCLUDE ALL COSTS IN BASE BID.
5. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, SWITCHES, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
6. THE ELECTRICAL DEMOLITION DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE PROVIDED TO CONVEY THE GENERAL SCOPE OF WORK. ALL EXISTING LIGHT FIXTURES, SWITCHES ETC. SHALL BE FIELD VERIFIED PRIOR TO BEGINNING WORK OR SUBMITTING PRICES. IT IS THE INTENT OF THESE DOCUMENTS THAT ALL EXISTING LIGHT FIXTURES, SWITCHES, AND ASSOCIATED RACEWAYS, CIRCUITRY, AND EQUIPMENT IN THIS AREA BE DEMOLISHED UNLESS OTHERWISE NOTED.
7. ALL EXISTING TO REMAIN CIRCUITS SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.
8. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN BUILDING EXTERIOR WALLS SHALL BE SEALED WATER TIGHT. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN INTERIOR WALLS SHALL BE PATCHED AND FIREPROOFED AS REQUIRED TO MAINTAIN THE INTEGRITY OF THE PARTITION.
9. GROUT AND SEAL ALL PENETRATIONS WHERE CONDUIT HAS BEEN REMOVED.

NOTES BY SYMBOL "⬡"

(6) 1. IF BID OPTION NO. 6 IS SELECTED, REMOVE EXTERIOR LIGHT FIXTURES. RETAIN EXISTING CIRCUITRY FOR REUSE. IF BID OPTION NO. 6 IS NOT SELECTED, LIGHT FIXTURES ALL REMAIN AS THEY ARE.

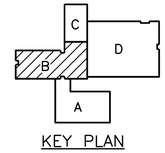
BID OPTIONS "◯"

6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/ BUILDING SIGN.



NORTH TRUE / NORTH PLAN — 1 — LIGHTING DEMOLITION PLAN – AREA 'B'

1/8"=1'-0"



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

STATE OF TEXAS — TERESA CASTILLÓN — 111323 — LICENSED PROFESSIONAL ENGINEER — 4/20/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

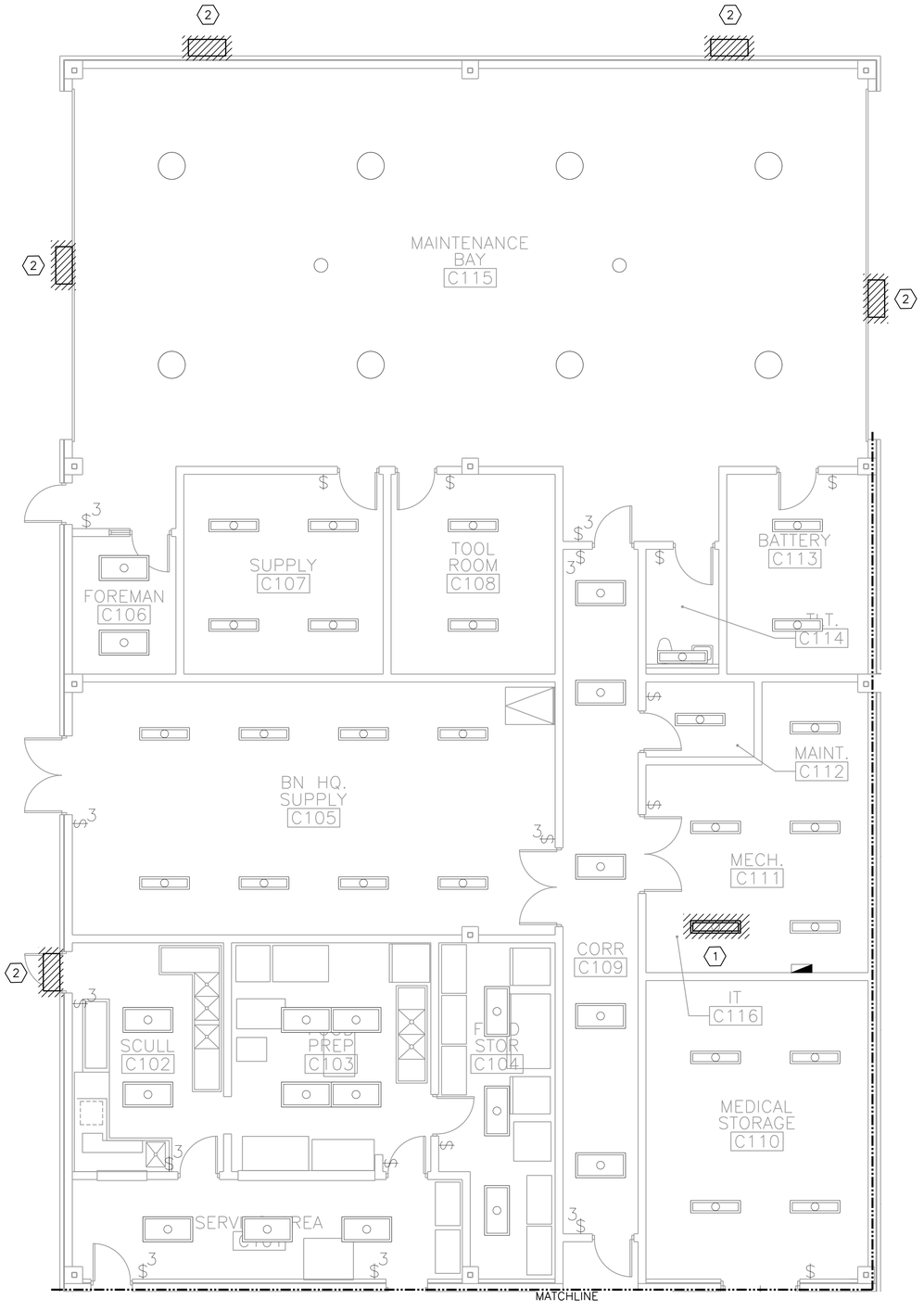
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING DEMOLITION PLAN - AREA 'B'

E-3

SHT. 78 of 129



LIGHTING DEMOLITION PLAN – AREA 'C'

3/16"=1'-0"

TRUE NORTH / PLAN NORTH

GENERAL NOTES:

1. REMOVE ALL LIGHT FIXTURES, EXIT SIGNS, AND SWITCHES SHOWN HATCHED. RETAIN EXISTING CIRCUITRY FOR REUSE. SWITCH BACK BOXES MAY REMAIN WHERE SWITCHES WILL BE INSTALLED IN SAME LOCATION DURING THE CONSTRUCTION PHASE.
2. FIXTURES AND DEVICES SHOWN AT A LIGHT LINE WEIGHT SHALL REMAIN. RETAIN EXISTING CONDUCTORS AND CONDUITS FOR REUSE WHERE FEASIBLE.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ALL ABANDONED CONDUIT. FIELD VERIFY ALL REQUIREMENTS. INCLUDE ALL COSTS IN BASE BID.
4. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, SWITCHES, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
5. THE ELECTRICAL DEMOLITION DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE PROVIDED TO CONVEY THE GENERAL SCOPE OF WORK. ALL EXISTING LIGHT FIXTURES, SWITCHES ETC. SHALL BE FIELD VERIFIED PRIOR TO BEGINNING WORK OR SUBMITTING PRICES. IT IS THE INTENT OF THESE DOCUMENTS THAT ALL EXISTING LIGHT FIXTURES, SWITCHES, AND ASSOCIATED RACEWAYS, CIRCUITRY, AND EQUIPMENT IN THIS AREA BE DEMOLISHED UNLESS OTHERWISE NOTED.
6. ALL EXISTING TO REMAIN CIRCUITS SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.
7. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN BUILDING EXTERIOR WALLS SHALL BE SEALED WATER TIGHT. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN INTERIOR WALLS SHALL BE PATCHED AND FIREPROOFED AS REQUIRED TO MAINTAIN THE INTEGRITY OF THE PARTITION.
8. GROUT AND SEAL ALL PENETRATIONS WHERE CONDUIT HAS BEEN REMOVED.

NOTES BY SYMBOL "⬡"

1. REMOVE LIGHT FIXTURE. RETAIN EXISTING CIRCUITRY FOR REUSE.
6 2. IF BID OPTION NO. 6 IS SELECTED, REMOVE EXTERIOR LIGHT FIXTURES AND ASSOCIATED CIRCUITRY. IF BID OPTION NO. 6 IS NOT SELECTED, LIGHT FIXTURES ALL REMAIN AS THEY ARE.

BID OPTIONS "◯"

6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/BUILDING SIGN.

KEY PLAN

0 4' 8'

3/16"=1'-0"

STATE OF TEXAS — TERESA CASTILLON — 111323 — LICENSED PROFESSIONAL ENGINEER — 4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: JF
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 (512) 782-6131
AUSTIN, TEXAS 78763-5218 FAX (512) 782-1481

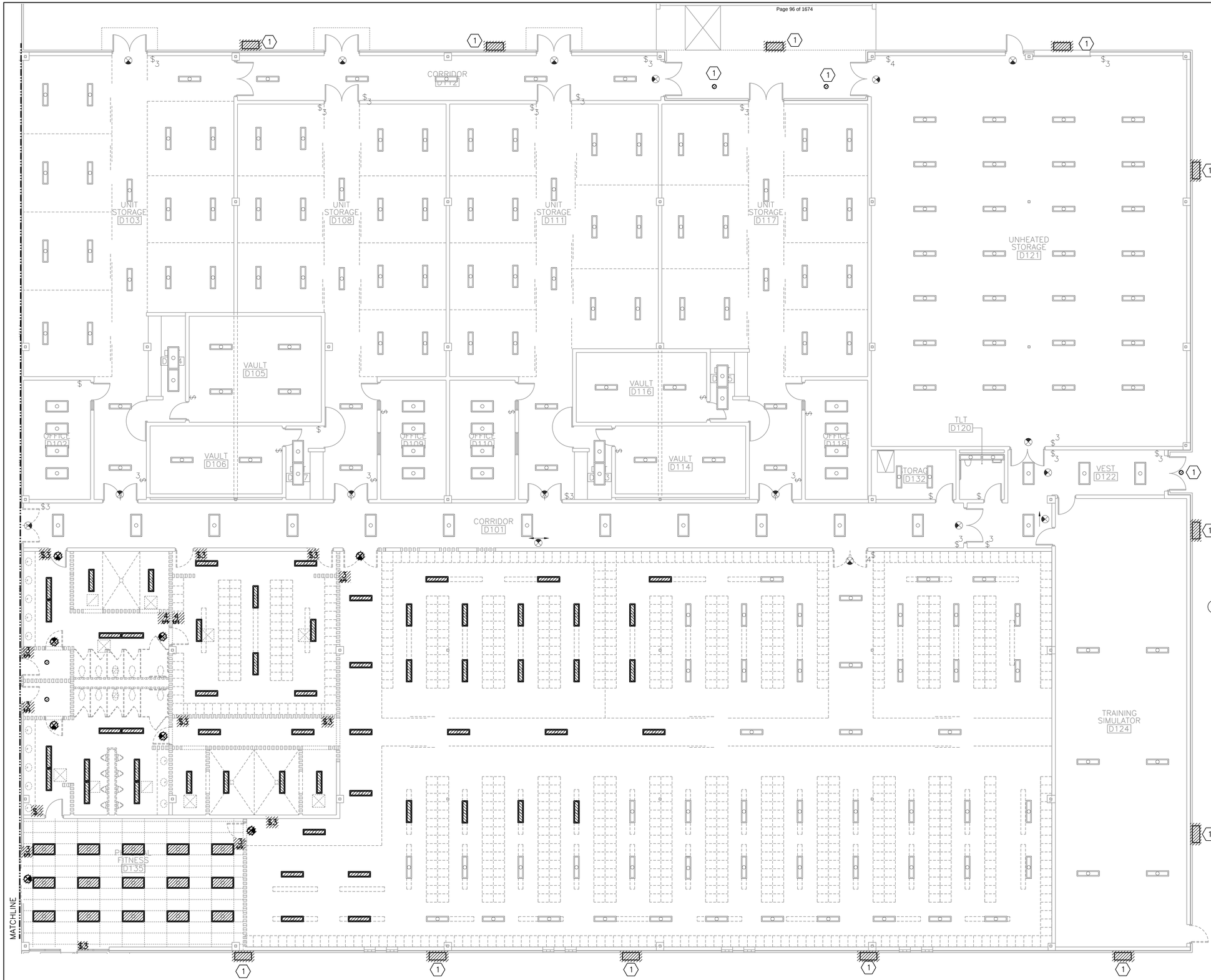
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING DEMOLITION PLAN - AREA 'C'

E-4

SHT. 79 of 129



GENERAL NOTES:

1. A SUMMARY OF THE PROJECT BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REMOVE ALL LIGHT FIXTURES, EXIT SIGNS, AND SWITCHES SHOWN HATCHED. RETAIN EXISTING CIRCUITRY FOR REUSE. SWITCH BACK BOXES MAY REMAIN WHERE SWITCHES WILL BE INSTALLED IN SAME LOCATION DURING THE CONSTRUCTION PHASE.
3. FIXTURES AND DEVICES SHOWN AT A LIGHT LINE WEIGHT SHALL REMAIN. RETAIN EXISTING CONDUCTORS AND CONDUITS FOR REUSE WHERE FEASIBLE.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ALL ABANDONED CONDUIT. FIELD VERIFY ALL REQUIREMENTS. INCLUDE ALL COSTS IN BASE BID.
5. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, SWITCHES, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
6. THE ELECTRICAL DEMOLITION DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE PROVIDED TO CONVEY THE GENERAL SCOPE OF WORK. ALL EXISTING LIGHT FIXTURES, SWITCHES ETC. SHALL BE FIELD VERIFIED PRIOR TO BEGINNING WORK OR SUBMITTING PRICES. IT IS THE INTENT OF THESE DOCUMENTS THAT ALL EXISTING LIGHT FIXTURES, SWITCHES, AND ASSOCIATED RACEWAYS, CIRCUITRY, AND EQUIPMENT IN THIS AREA BE DEMOLISHED UNLESS OTHERWISE NOTED.
7. ALL EXISTING TO REMAIN CIRCUITS SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.
8. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN BUILDING EXTERIOR WALLS SHALL BE SEALED WATER TIGHT. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN INTERIOR WALLS SHALL BE PATCHED AND FIREPROOFED AS REQUIRED TO MAINTAIN THE INTEGRITY OF THE PARTITION.
9. GROUT AND SEAL ALL PENETRATIONS WHERE CONDUIT HAS BEEN REMOVED.

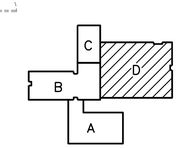
NOTES BY SYMBOL "⬡"

(6) 1. IF BID OPTION NO. 6 IS SELECTED, REMOVE EXTERIOR LIGHT FIXTURES. RETAIN EXISTING CIRCUITRY FOR REUSE. IF BID OPTION NO. 6 IS NOT SELECTED, LIGHT FIXTURES ALL REMAIN AS THEY ARE.

BID OPTIONS "◯"

6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/ BUILDING SIGN.

LIGHTING DEMOLITION PLAN – AREA 'D'
1/8"=1'-0"



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING DEMOLITION PLAN - AREA 'D'

E-5

SHT. 80 of 129

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TERESA CASTILLON 111323 LICENSED PROFESSIONAL ENGINEER 4/20/18

GENERAL NOTES

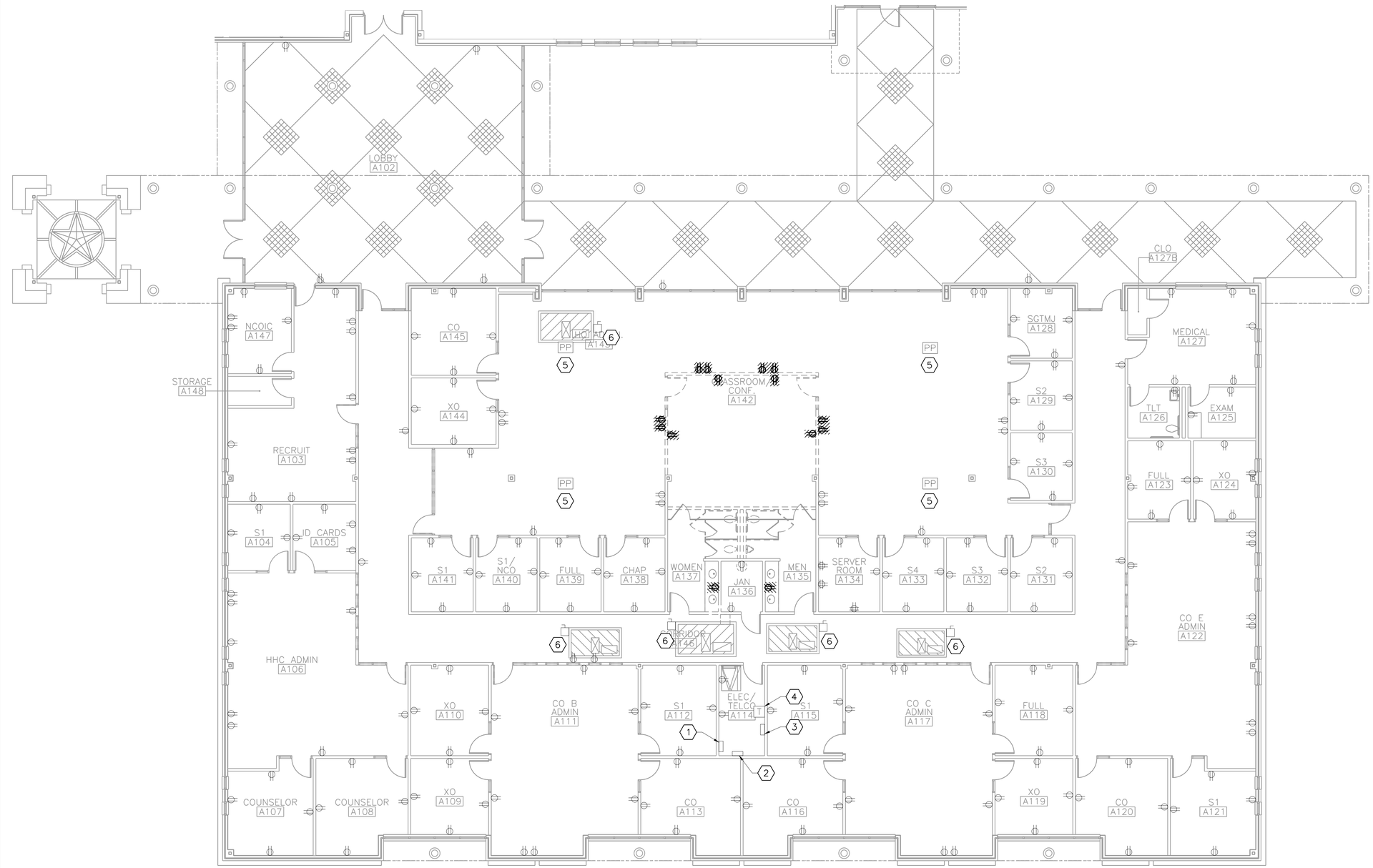
1. RETAIN THE RECEPTACLE CIRCUITS FOR REUSE DURING THE CONSTRUCTION PHASE OF THE PROJECT. LABEL CIRCUIT CONDUCTORS WITH THE ROOM NUMBER SERVED.
2. NOT ALL RECEPTACLES AND OTHER DEVICES ARE SHOWN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING RECEPTACLES AND DEVICES AND PROVIDING POWER FOR DEVICES TO REMAIN FOR A COMPLETE AND OPERATIONAL SYSTEM AT NO ADDITIONAL COST TO THE OWNER. THE CONTRACTOR SHALL PROVIDE ALL CONDUCTORS AND CONDUIT AS REQUIRED.
3. ALL EQUIPMENT AND DEVICES SHOWN HATCHED SHALL BE REMOVED. REMOVE ASSOCIATED WIRING AND CONDUIT BACK TO SOURCE.
4. THE ELECTRICAL DEMOLITION DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE PROVIDED TO CONVEY THE GENERAL SCOPE OF WORK. ALL EXISTING DEVICES SHALL BE FIELD VERIFIED PRIOR TO BEGINNING WORK OR SUBMITTING PRICES. IT IS THE INTENT OF THESE DOCUMENTS THAT ALL EXISTING ELECTRICAL RACEWAYS, CIRCUITRY, AND ELECTRICAL EQUIPMENT IN THIS AREA BE DEMOLISHED UNLESS OTHERWISE NOTED.
5. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, GEAR, DISCONNECTS, MOTOR STARTERS, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
6. ALL RECEPTACLES AND JUNCTION BOXES SHOWN HATCHED SHALL BE REMOVED. REMOVE ASSOCIATED WIRING BACK NEAREST JUNCTION BOX. REMOVE ALL SURFACE MOUNTED CONDUIT.
7. ALL EXISTING CIRCUITS TO REMAIN SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.
8. GROUT AND SEAL ALL PENETRATIONS WHERE CONDUIT HAS BEEN REMOVED.
5. 9. ALL RECEPTACLES SHOWN HATCHED ON THIS SHEET ARE PART OF BID OPTION NO. 5. IF BID OPTION NO. 5 IS NOT SELECTED, EXISTING RECEPTACLES SHALL REMAIN AS THEY ARE.

NOTES BY SYMBOL "⬡"

1. 480Y/277V,3ø,4W,400A PANEL "AM1" SHALL REMAIN.
2. 480Y/277V,3ø,4W,125A PANEL "AH1" SHALL REMAIN.
3. 208Y/120V,3ø,4W,225A PANEL "AL1" SHALL REMAIN.
4. 480–208Y/120V,3ø,4W TRANSFORMER SHALL REMAIN.
5. POWER POLE CIRCUITRY SHALL REMAIN.
6. DISCONNECT SWITCH AND ASSOCIATED WIRING AND CONDUCTORS SHALL REMAIN. ASSOCIATED CONVENIENCE RECEPTACLE SHALL REMAIN.

BID OPTIONS "◯"

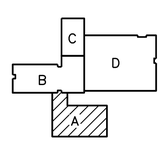
5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN WING.



NORTH TRUE NORTH PLAN

1 — POWER DEMOLITION PLAN – AREA 'A'

1/8"=1'–0"



KEY PLAN

0 4' 8' 16'

1/8"=1'–0"

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED PROFESSIONAL ENGINEER
4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763–5218
(512) 782–6131 FAX (512) 782–1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL POWER DEMOLITION PLAN - AREA 'A'

E-6

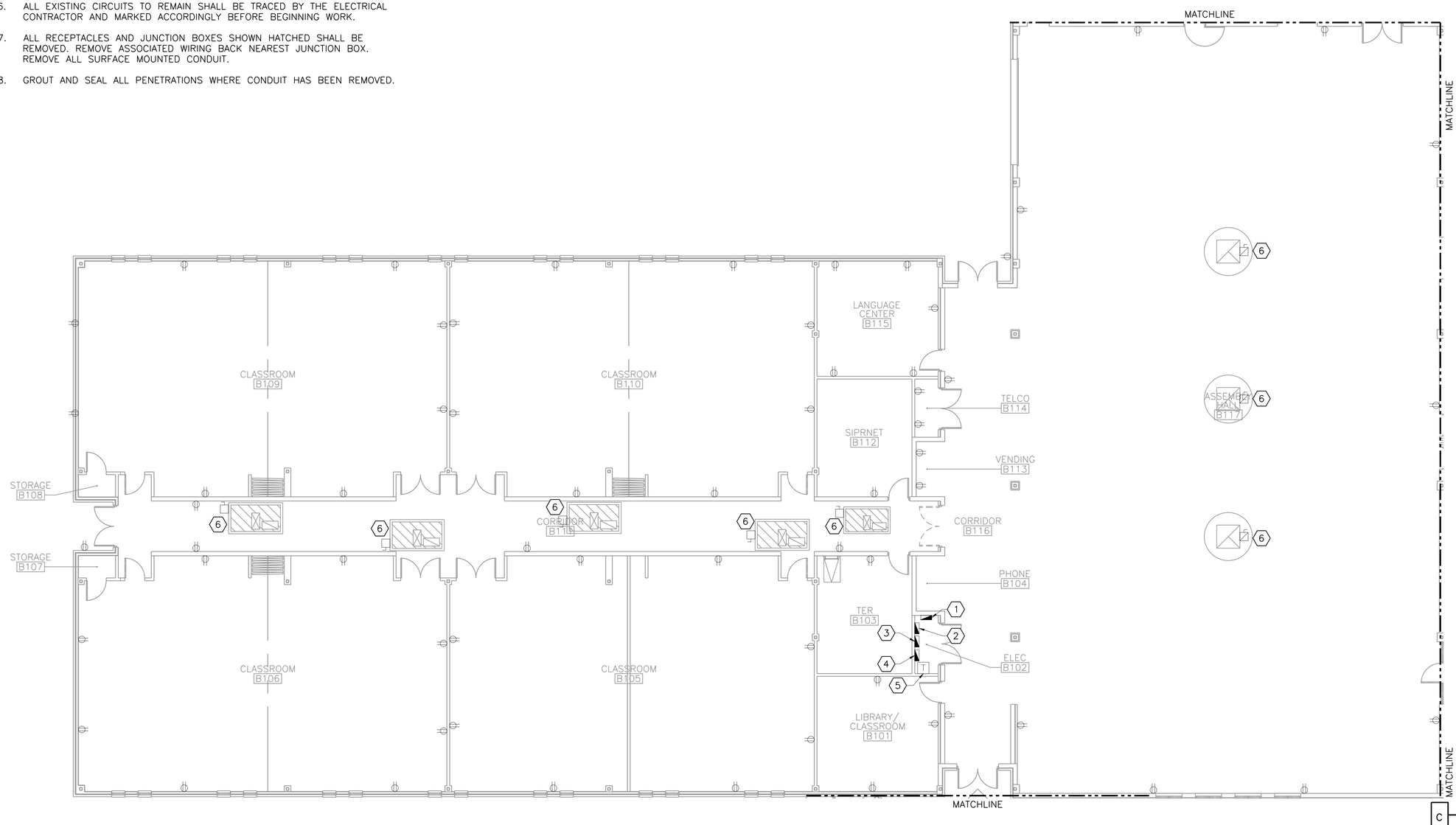
SHT. 81 of 129

GENERAL NOTES

1. RETAIN THE RECEPTACLE CIRCUITS FOR REUSE DURING THE CONSTRUCTION PHASE OF THE PROJECT. LABEL CIRCUIT CONDUCTORS WITH THE ROOM NUMBER SERVED.
2. NOT ALL RECEPTACLES AND OTHER DEVICES ARE SHOWN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING RECEPTACLES AND DEVICES AND PROVIDING POWER FOR DEVICES TO REMAIN FOR A COMPLETE AND OPERATIONAL SYSTEM AT NO ADDITIONAL COST TO THE OWNER. THE CONTRACTOR SHALL PROVIDE ALL CONDUCTORS AND CONDUIT AS REQUIRED.
3. ALL EQUIPMENT AND DEVICES SHOWN HATCHED SHALL BE REMOVED. REMOVE ASSOCIATED CIRCUITRY BACK TO SOURCE.
4. THE ELECTRICAL DEMOLITION DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE PROVIDED TO CONVEY THE GENERAL SCOPE OF WORK. ALL EXISTING DEVICES SHALL BE FIELD VERIFIED PRIOR TO BEGINNING WORK OR SUBMITTING PRICES. IT IS THE INTENT OF THESE DOCUMENTS THAT ALL EXISTING ELECTRICAL RACEWAYS, CIRCUITRY, AND ELECTRICAL EQUIPMENT IN THIS AREA BE DEMOLISHED UNLESS OTHERWISE NOTED.
5. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, GEAR, DISCONNECTS, MOTOR STARTERS, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
6. ALL EXISTING CIRCUITS TO REMAIN SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.
7. ALL RECEPTACLES AND JUNCTION BOXES SHOWN HATCHED SHALL BE REMOVED. REMOVE ASSOCIATED WIRING BACK NEAREST JUNCTION BOX. REMOVE ALL SURFACE MOUNTED CONDUIT.
8. GROUT AND SEAL ALL PENETRATIONS WHERE CONDUIT HAS BEEN REMOVED.

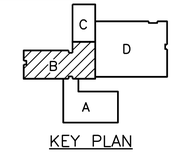
NOTES BY SYMBOL "⬡"

1. 208Y/120V,3ø,4W PANEL "BL1" SHALL REMAIN.
2. 208Y/120V,3ø,4W,225A PANEL "AL1" SHALL REMAIN.
3. 480Y/277V,3ø,4W,125A PANEL "BH1" SHALL REMAIN.
4. 480Y/277V,3ø,4W,400A PANEL "BM1" SHALL REMAIN.
5. 480Y–208Y/120V,3ø,4W TRANSFORMER SHALL REMAIN.
6. EXISTING ELECTRICAL DISCONNECT SWITCH AND ASSOCIATED WIRING AND CONDUIT SHALL REMAIN. ASSOCIATED CONVENIENCE RECEPTACLE SHALL REMAIN.



NORTH TRUE / NORTH PLAN — 1 — POWER DEMOLITION PLAN – AREA 'B'

1/8"=1'–0"



KEY PLAN

0 4' 8' 16'

1/8"=1'–0"

STATE OF TEXAS — TERESA CASTILLON — 111323 — LICENSED PROFESSIONAL ENGINEER — 4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763–5218
(512) 782–6131 FAX (512) 782–1481

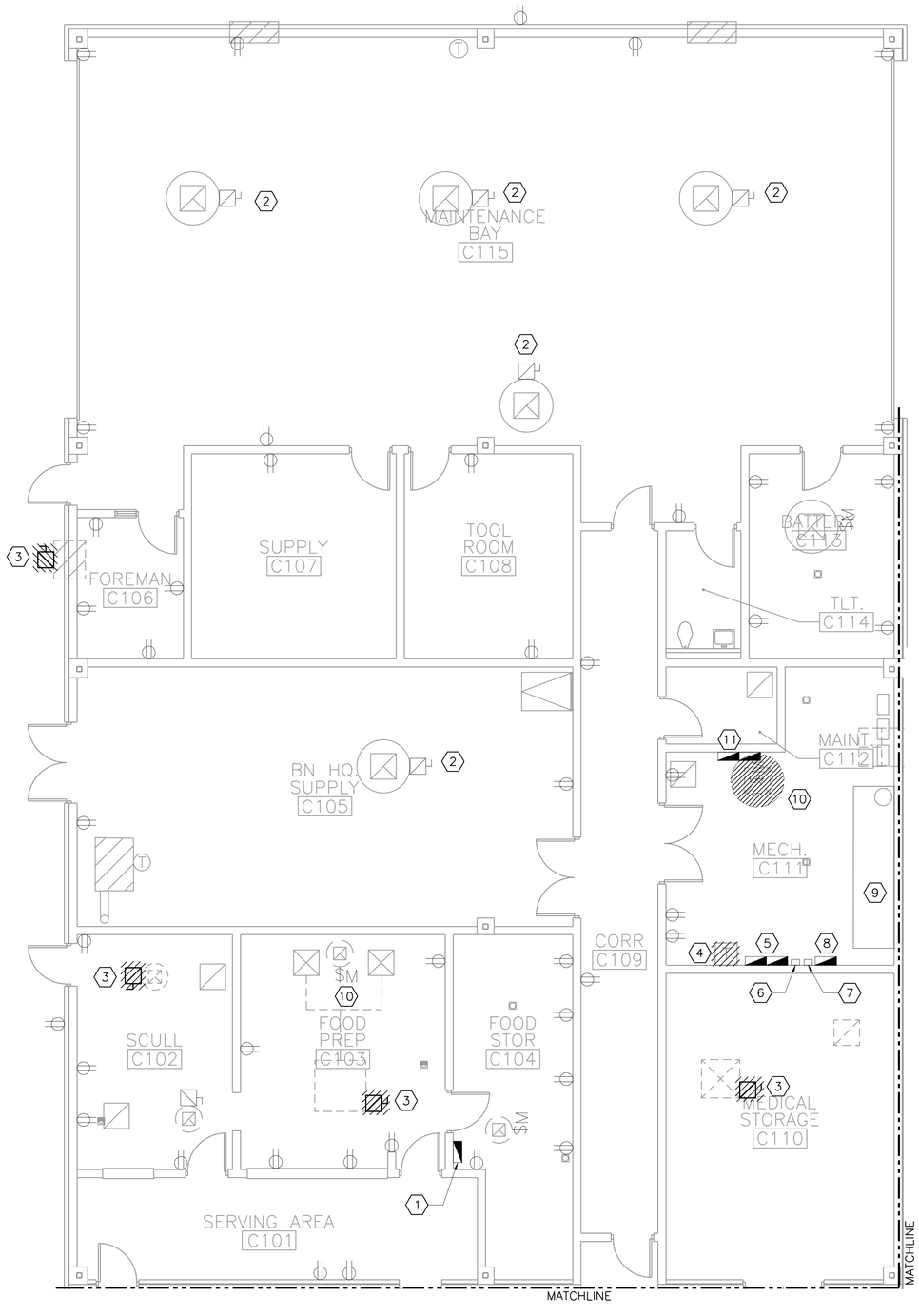
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL POWER DEMOLITION PLAN-AREA 'B'

E-7

SHT. 82 of 129



NORTH TRUE NORTH 1 – PLAN

POWER DEMOLITION PLAN – AREA 'C'

3/16"=1'-0"

GENERAL NOTES

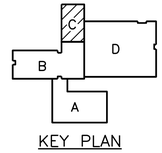
1. RETAIN THE RECEPTACLE CIRCUITS FOR REUSE DURING THE CONSTRUCTION PHASE OF THE PROJECT. LABEL CIRCUIT CONDUCTORS WITH THE ROOM NUMBER SERVED.
2. NOT ALL RECEPTACLES AND OTHER DEVICES ARE SHOWN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING RECEPTACLES AND DEVICES AND PROVIDING POWER FOR DEVICES TO REMAIN FOR A COMPLETE AND OPERATIONAL SYSTEM AT NO ADDITIONAL COST TO THE OWNER. THE CONTRACTOR SHALL PROVIDE ALL CONDUCTORS AND CONDUIT AS REQUIRED.
3. ALL EQUIPMENT AND DEVICES SHOWN HATCHED SHALL BE REMOVED. REMOVE ASSOCIATED CIRCUITRY BACK TO SOURCE.
4. THE ELECTRICAL DEMOLITION DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE PROVIDED TO CONVEY THE GENERAL SCOPE OF WORK. ALL EXISTING DEVICES SHALL BE FIELD VERIFIED PRIOR TO BEGINNING WORK OR SUBMITTING PRICES. IT IS THE INTENT OF THESE DOCUMENTS THAT ALL EXISTING ELECTRICAL RACEWAYS, CIRCUITRY, AND ELECTRICAL EQUIPMENT IN THIS AREA BE DEMOLISHED UNLESS OTHERWISE NOTED.
5. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, GEAR, DISCONNECTS, MOTOR STARTERS, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
6. ALL EXISTING CIRCUITS TO REMAIN SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.
7. ALL RECEPTACLES AND JUNCTION BOXES SHOWN HATCHED SHALL BE REMOVED. REMOVE ASSOCIATED WIRING BACK NEAREST JUNCTION BOX. REMOVE ALL SURFACE MOUNTED CONDUIT.
8. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN BUILDING EXTERIOR WALLS SHALL BE SEALED WATER TIGHT. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN INTERIOR WALLS SHALL BE PATCHED AND FIREPROOFED AS REQUIRED TO MAINTAIN THE INTEGRITY OF THE PARTITION.
9. GROUT AND SEAL ALL PENETRATIONS WHERE CONDUIT HAS BEEN REMOVED.

NOTES BY SYMBOL "⬡"

1. 480–208Y/120V, 3PH, 4W PANEL KL1 SHALL REMAIN.
2. DISCONNECT SWITCH AND ASSOCIATED WIRING AND CONDUIT SHALL REMAIN.
3. (4) IF BID OPTION NO.4 IS SELECTED, REMOVE DISCONNECT SWITCH AND ALL ASSOCIATED WIRING AND CONDUIT BACK TO SOURCE. IF OPTION IS NOT SELECTED, DISCONNECT AND ASSOCIATED CIRCUITRY SHALL REMAIN.
4. 480Y–208Y/120V,3ø,4W TRANSFORMER "CT1" SHALL BE REMOVED AND RELOCATED. METERS LOCATED ON THE WALL BEHIND TEH TRANSFORMER SHALL BE RELOCATED WITH THE TRANSFORMER.
5. 208Y/120V,3ø,4W,400A PANEL "CL1" SHALL REMAIN.
6. TIMECLOCK SHALL REMAIN.
7. LIGHTING CONTACTOR SHALL REMAIN.
8. 480/277V,3ø,4W,125A PANEL CH1 SHALL REMAIN.
9. 480Y/277V,3ø,4W,1200A MAIN DISTRIBUTION PANEL "DPC" SHALL REMAIN.
10. (4) IF BID OPTION NO.4 IS SELECTED, REMOVE SWITCH AND ALL ASSOCIATED WIRING AND CONDUIT BACK TO SOURCE. IF OPTION IS NOT SELECTED, ELECTRICAL SHALL REMAIN AS IS. RETAIN CONVENIENCE RECEPTACLE.
11. 480Y/277V,3ø,4W,225A PANEL "CM1" SHALL REMAIN.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.



KEY PLAN

0 4' 8'

3/16"=1'-0"

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763–5218
(512) 782–6131 FAX (512) 782–1481

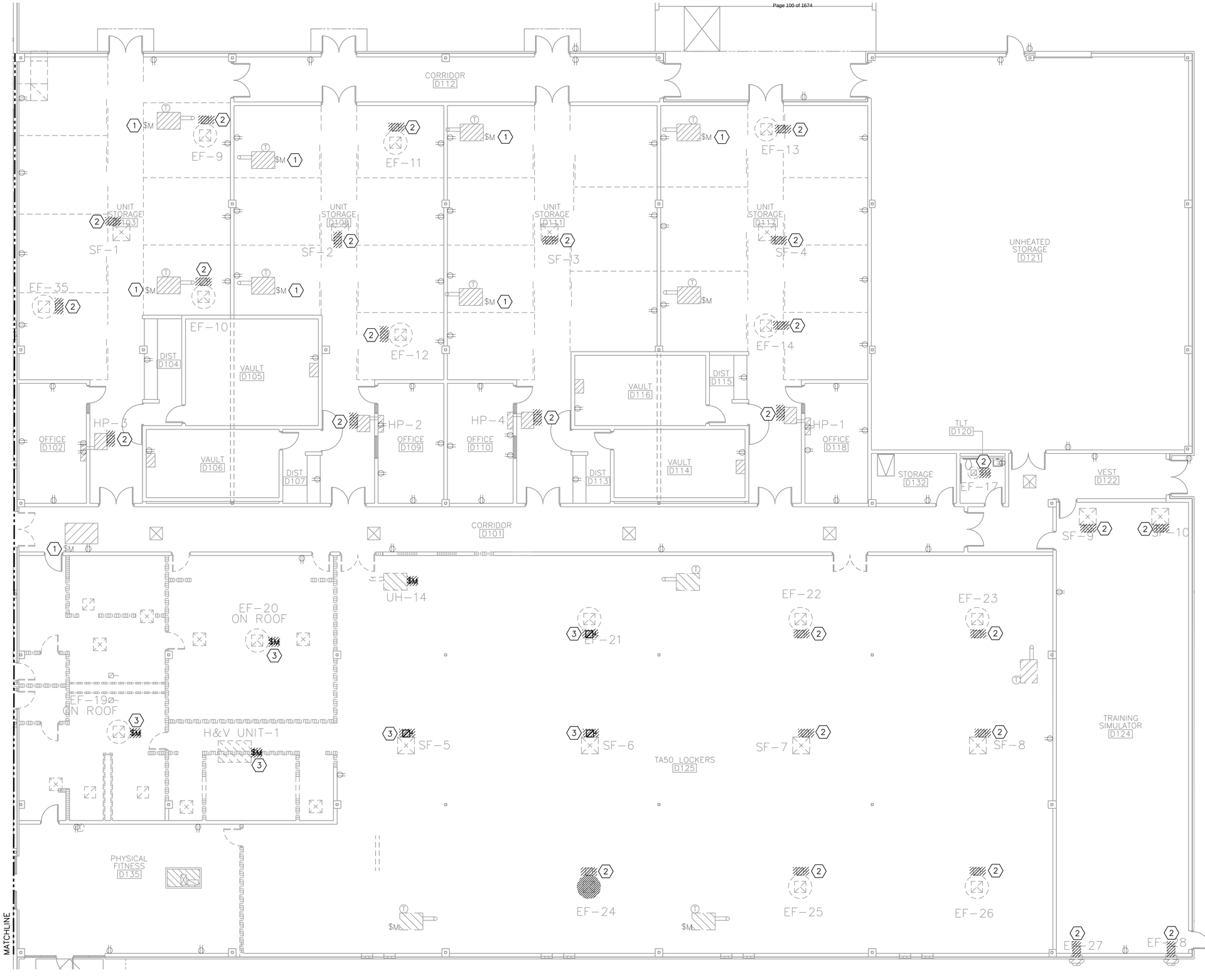
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL POWER DEMOLITION PLAN - AREA 'C'

E-8

SHT. 83 of 129



GENERAL NOTES

1. RETAIN THE RECEPTACLE CIRCUITS FOR REUSE DURING THE CONSTRUCTION PHASE OF THE PROJECT. LABEL CIRCUIT CONDUCTORS WITH THE ROOM NUMBER SERVED.
2. NOT ALL RECEPTACLES AND OTHER DEVICES ARE SHOWN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING RECEPTACLES AND DEVICES AND PROVIDING POWER FOR DEVICES TO REMAIN FOR A COMPLETE AND OPERATIONAL SYSTEM AT NO ADDITIONAL COST TO THE OWNER. THE CONTRACTOR SHALL PROVIDE ALL CONDUCTORS AND CONDUIT AS REQUIRED.
3. ALL EQUIPMENT AND DEVICES SHOWN HATCHED SHALL BE REMOVED.
4. THE ELECTRICAL DEMOLITION DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE PROVIDED TO CONVEY THE GENERAL SCOPE OF WORK. ALL EXISTING DEVICES SHALL BE FIELD VERIFIED PRIOR TO BEGINNING WORK OR SUBMITTING PRICES. IT IS THE INTENT OF THESE DOCUMENTS THAT ALL EXISTING ELECTRICAL RACEWAYS, CIRCUITRY, AND ELECTRICAL EQUIPMENT IN THIS AREA BE DEMOLISHED UNLESS OTHERWISE NOTED.
5. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, GEAR, DISCONNECTS, MOTOR STARTERS, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
6. ALL EXISTING CIRCUITS TO REMAIN SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.
7. ALL RECEPTACLES AND JUNCTION BOXES SHOWN HATCHED SHALL BE REMOVED. REMOVE ASSOCIATED WIRING BACK NEAREST JUNCTION BOX. REMOVE ALL SURFACE MOUNTED CONDUIT.
8. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN BUILDING EXTERIOR WALLS SHALL BE SEALED WATER TIGHT. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN INTERIOR WALLS SHALL BE PATCHED AND FIREPROOFED AS REQUIRED TO MAINTAIN THE INTEGRITY OF THE PARTITION.
9. GROUT AND SEAL ALL PENETRATIONS WHERE CONDUIT HAS BEEN REMOVED.

NOTES BY SYMBOL "⬡"

1. SWITCH AND ASSOCIATED CIRCUITRY SHALL REMAIN.

(4) 2. IF BID OPTION NO.4 IS SELECTED, REMOVE DISCONNECT SWITCH AND ASSOCIATED WIRING AND CONDUIT BACK TO SOURCE. RETAIN 120V CIRCUITRY FOR CONVENIENCE RECEPTACLES FOR REUSE WITH NEW RECEPTACLES.

IF OPTION IS NOT SELECTED, DISCONNECT SWITCH AND ALL ASSOCIATED WIRING AND CONDUIT SHALL REMAIN. RETAIN CONVENIENCE RECEPTACLE.

3. REMOVE DISCONNECT SWITCH AND ASSOCIATED CIRCUITRY BACK TO SOURCE.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/ HVLS FANS.

NORTH TRUE / NORTH PLAN

POWER DEMOLITION PLAN – AREA 'D'

1/8"=1'-0"

KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

STATE OF TEXAS · TERESA CASTILLON · 111323 · LICENSED PROFESSIONAL ENGINEER · 4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL POWER DEMOLITION PLAN - AREA 'D'

E-9

SHT. 84 of 129

GENERAL NOTES:

1. ALL LIGHT FIXTURES SHOWN DARK AND WITH A LETTER DESIGNATION ARE TO BE PROVIDED UNDER BASE BID. LIGHT FIXTURES SHOWN AT A LIGHT LINE WEIGHT AND WITH NO DESIGNATION ARE EXISTING TO REMAIN.
2. ALL LIGHTING CIRCUITRY SHALL BE #12, WITH A #12G., IN A ¾"C. UNLESS NOTED OTHERWISE, FOR LIGHTING CIRCUITS GREATER THAN 100' PROVIDE #10, WITH A #10G., IN A ¾"C. FOR LIGHTING CIRCUITS GREATER THAN 250' PROVIDE #8, WITH A #8G., IN A ¾"C. PROVIDE ALL CONDUCTORS AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL JUNCTION AND PULL BOXES IN ACCORDANCE WITH THE NEC.
4. CONDUIT SHALL NOT BE ROUTED ON THE OUTSIDE OF THE BUILDING FOR EXTERIOR LIGHTS.
5. ALL EXPOSED CONDUIT AND ASSOCIATED MOUNTING HARDWARE SHALL BE PAINTED TO MATCH THE SURFACE IT IS ATTACHED TO. FIELD VERIFY ALL REQUIREMENTS.
6. REFERENCE E-14 LIGHTING CONTROLS LEGEND FOR SWITCHES' AND SWITCH SENSOR'S.

NOTES BY SYMBOL "⬡"

(5) 1. IF BID OPTION NO. 5 IS SELECTED, PROVIDE LIGHT FIXTURES AND ASSOCIATED CIRCUITRY AS SHOWN IN THE CLASSROOM/CONFERENCE ROOM, WOMEN'S RESTROOM A137, AND MEN'S RESTROOM A135.

(6) 2. PROVIDE EXTERIOR LIGHT FIXTURE.

3. CONNECT BACK TO EXISTING CIRCUIT. PROVIDE ADDITIONAL WIRING AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.

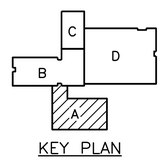
(6) 4. LIGHT FIXTURE SHALL BE MOUNTED IN THE GROUND IN THE SAME LOCATION WHERE THE EXISTING FIXTURES WERE PREVIOUSLY LOCATED.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN WING.
6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/ BUILDING SIGN.



LIGHTING PLAN – AREA 'A'
1/8"=1'-0"



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING PLAN - AREA 'A'

E-10

SHT. 85 of 129

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

GENERAL NOTES:

1. ALL LIGHT FIXTURES SHOWN DARK AND WITH A LETTER DESIGNATION ARE TO BE PROVIDED UNDER BASE BID. LIGHT FIXTURES SHOWN AT A LIGHT LINE WEIGHT AND WITH NO DESIGNATION ARE EXISTING TO REMAIN.
2. ALL LIGHTING CIRCUITRY SHALL BE #12, WITH A #12G., IN A ¾"C. UNLESS NOTED OTHERWISE, FOR LIGHTING CIRCUITS GREATER THAN 100' PROVIDE #10, WITH A #10G., IN A ¾"C. FOR LIGHTING CIRCUITS GREATER THAN 250' PROVIDE #8, WITH A #8G., IN A ¾"C. PROVIDE ALL CONDUCTORS AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL JUNCTION AND PULL BOXES IN ACCORDANCE WITH THE NEC.
4. CONDUIT SHALL NOT BE ROUTED ON THE OUTSIDE OF THE BUILDING FOR EXTERIOR LIGHTS.
5. ALL EXPOSED CONDUIT AND ASSOCIATED MOUNTING HARDWARE SHALL BE PAINTED TO MATCH THE SURFACE IT IS ATTACHED TO. FIELD VERIFY ALL REQUIREMENTS.
6. REFERENCE E-14 LIGHTING CONTROLS LEGEND FOR SWITCHES' AND SWITCH SENSOR'S.

NOTES BY SYMBOL "⬡"

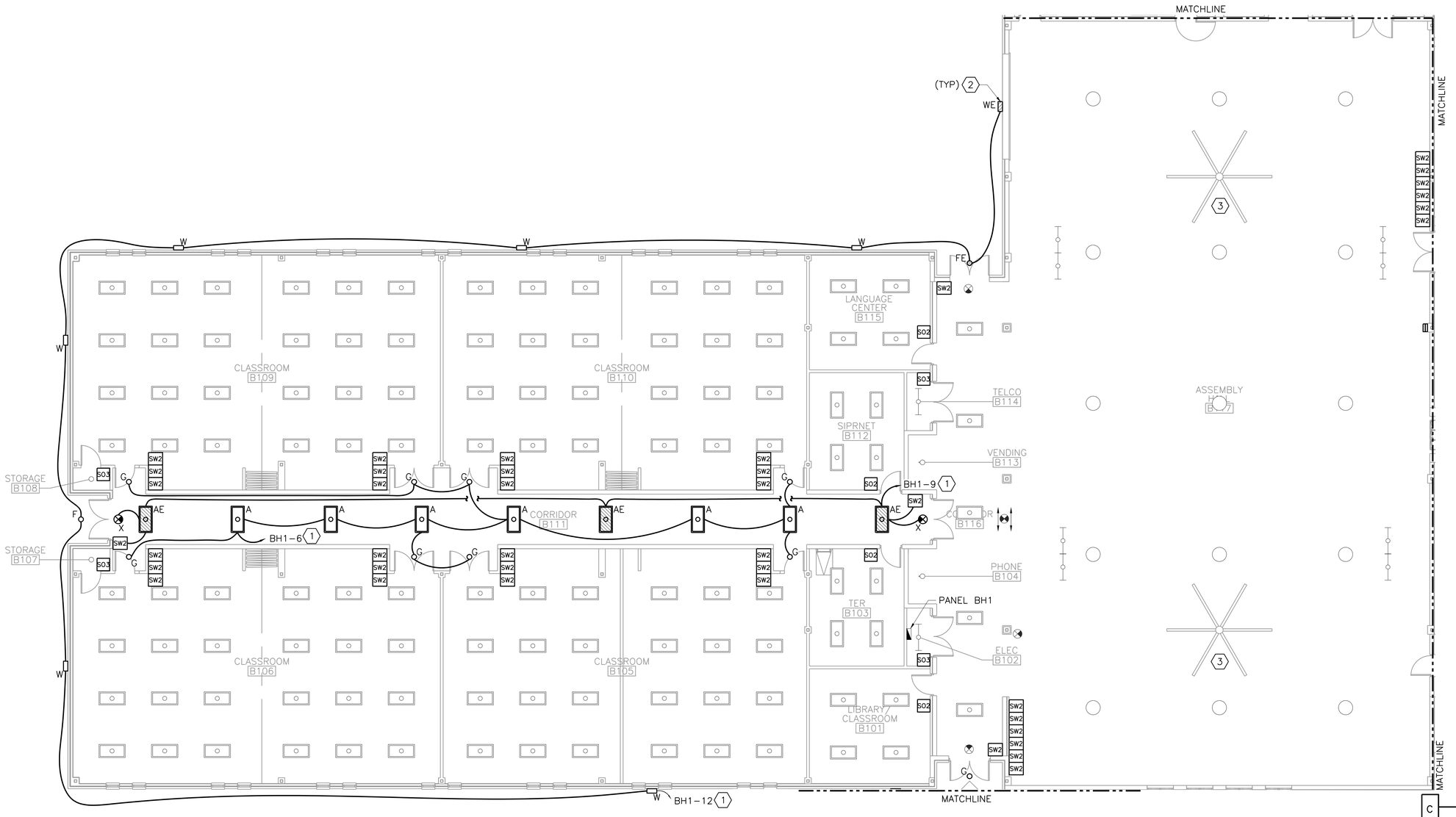
1. CONNECT BACK TO EXISTING CIRCUIT. PROVIDE ADDITIONAL WIRING AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.

(6) 2. PROVIDE EXTERIOR LIGHT FIXTURE.

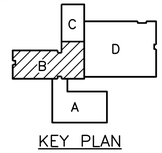
(4) 3. COORDINATE WITH MECHANICAL CONTRACTOR TO ENSURE THAT THE LOCATION OF HVLS FANS WILL NOT INTERFERE WITH EXISTING FIXTURES.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.
6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/ BUILDING SIGN.



LIGHTING PLAN – AREA 'B'
1/8"=1'-0"



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

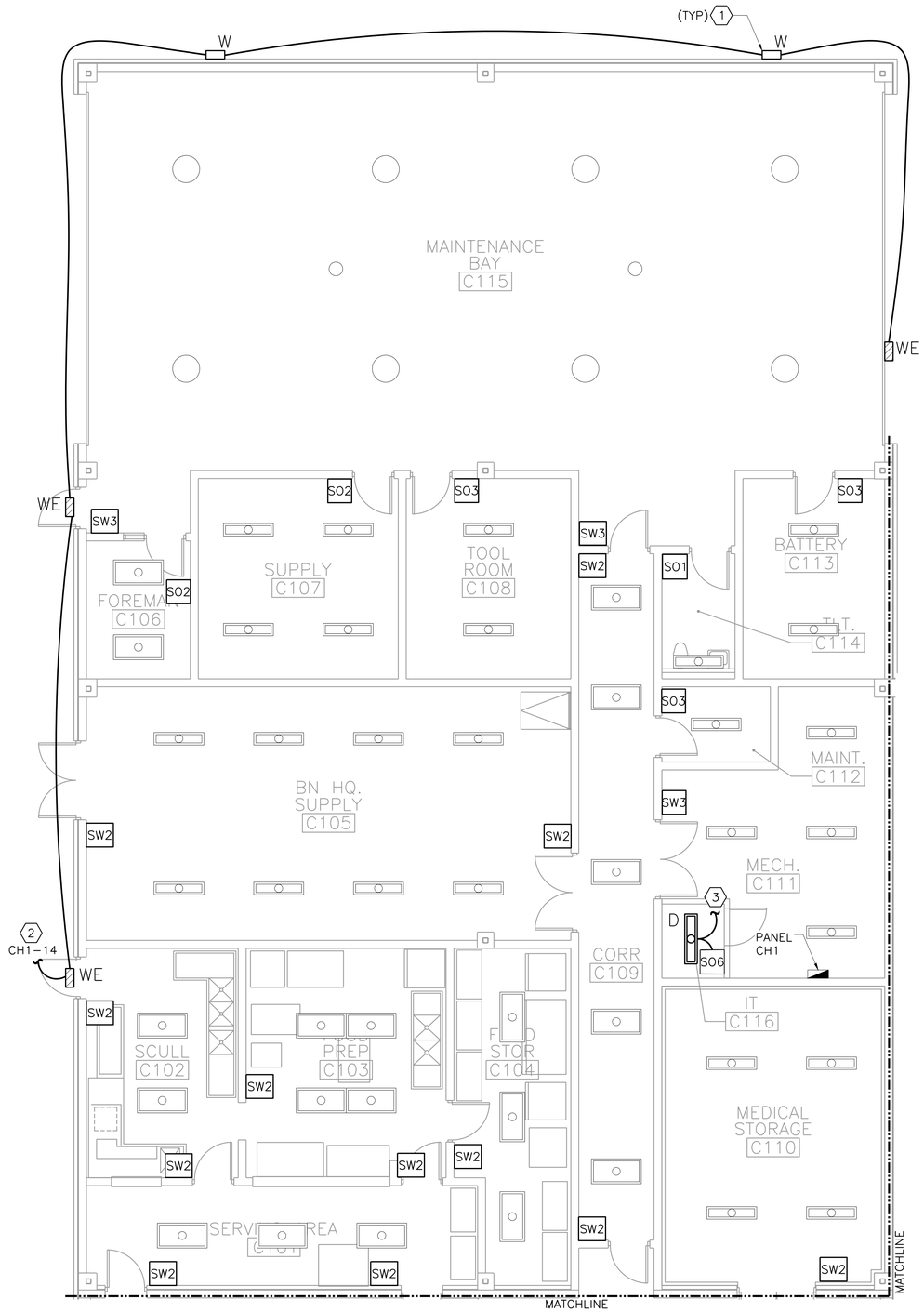
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING PLAN - AREA 'B'

E-11

SHT. 86 of 129



LIGHTING PLAN – AREA 'C'
3/16"=1'-0"

TRUE NORTH PLAN NORTH

GENERAL NOTES:

1. ALL LIGHT FIXTURES SHOWN DARK AND WITH A LETTER DESIGNATION ARE TO BE PROVIDED UNDER BASE BID. LIGHT FIXTURES SHOWN AT A LIGHT LINE WEIGHT AND WITH NO DESIGNATION ARE EXISTING TO REMAIN.
2. ALL LIGHTING CIRCUITRY SHALL BE #12, WITH A #12G., IN A ¾"C. UNLESS NOTED OTHERWISE, FOR LIGHTING CIRCUITS GREATER THAN 100' PROVIDE #10, WITH A #10G., IN A ¾"C. FOR LIGHTING CIRCUITS GREATER THAN 250' PROVIDE #8, WITH A #8G., IN A ¾"C. PROVIDE ALL CONDUCTORS AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL JUNCTION AND PULL BOXES IN ACCORDANCE WITH THE NEC.
4. EMERGENCY LIGHT FIXTURES SHALL BE WIRED WITH UNSWITCHED 'HOT' CONDUCTOR FROM PANELBOARD. CONNECT FIXTURE SO THAT EMERGENCY SIDE IS OPERATIONAL REGARDLESS OF TOGGLE SWITCH POSITION OR OCCUPANCY SENSOR MODE. EMERGENCY FIXTURES SHALL FUNCTION AS "NIGHT LIGHTS".
5. CONDUIT SHALL NOT BE ROUTED ON THE OUTSIDE OF THE BUILDING FOR EXTERIOR LIGHTS.
6. ALL EXPOSED CONDUIT AND ASSOCIATED MOUNTING HARDWARE SHALL BE PAINTED TO MATCH THE SURFACE IT IS ATTACHED TO. FIELD VERIFY ALL REQUIREMENTS.
7. REFERENCE E-14 LIGHTING CONTROLS LEGEND FOR SWITCHES' AND SWITCH SENSOR'S.

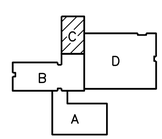
NOTES BY SYMBOL "⬡"

(6) 1. PROVIDE EXTERIOR LIGHT FIXTURE.

2. CONNECT BACK TO EXISTING CIRCUIT. PROVIDE ADDITIONAL WIRING AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.
3. CONNECT TO EXISTING LIGHTING CIRCUIT SERVING MECHANICAL ROOM. PROVIDE ADDITIONAL WIRING AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.

BID OPTIONS "◯"

6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/ BUILDING SIGN.



KEY PLAN

0 4' 8'
3/16"=1'-0"

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: JF
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481
CAMP MABRY P.O. BOX 5218
(512) 782-6131

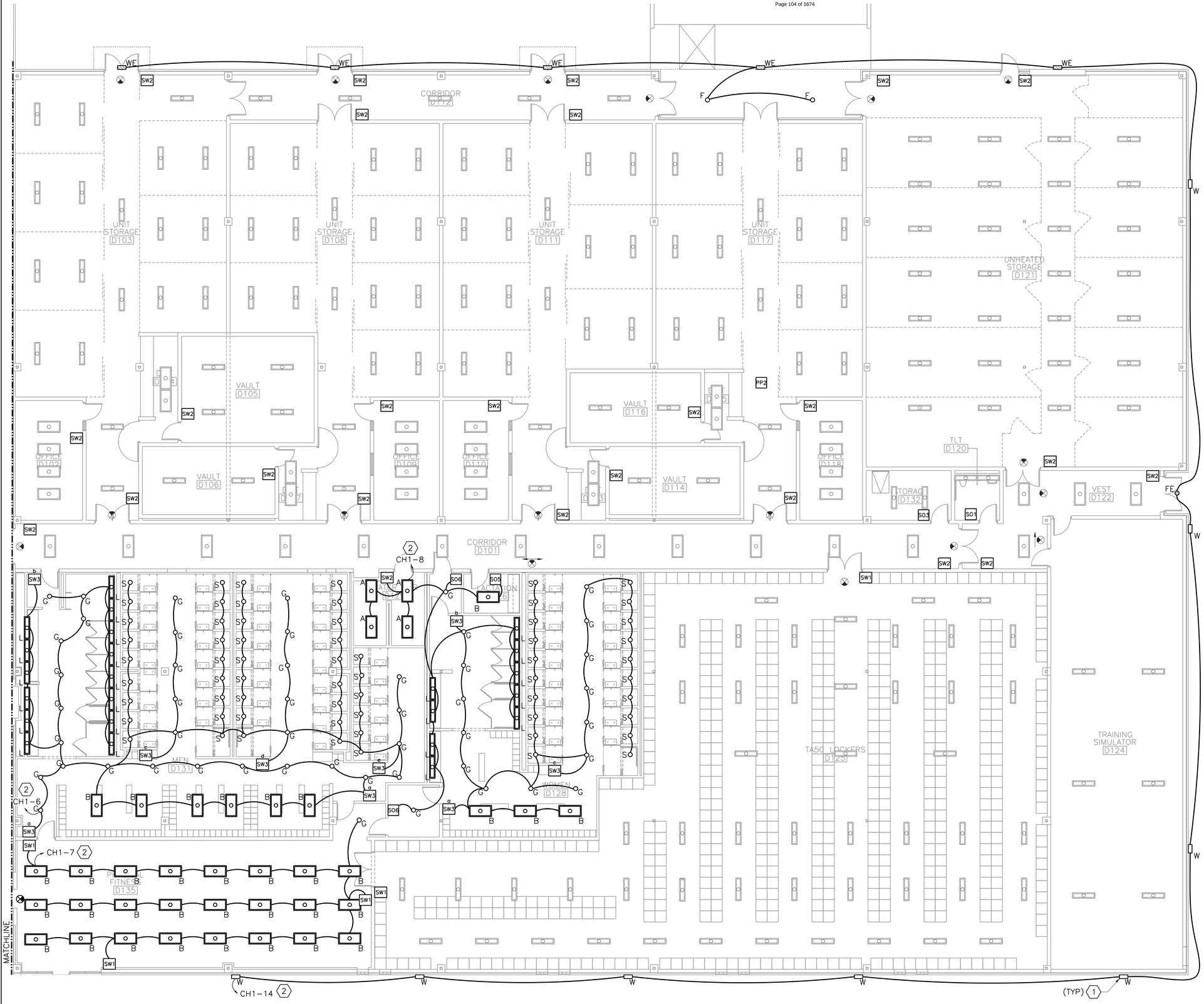
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING PLAN - AREA 'C'

E-12

SHT. 87 of 129



LIGHTING PLAN – AREA 'D'

1/8"=1'-0"

GENERAL NOTES:

1. ALL LIGHT FIXTURES SHOWN DARK AND WITH A LETTER DESIGNATION ARE TO BE PROVIDED UNDER BASE BID. LIGHT FIXTURES SHOWN AT A LIGHT LINE WEIGHT AND WITH NO DESIGNATION ARE EXISTING TO REMAIN.
2. ALL LIGHTING CIRCUITRY SHALL BE #12, WITH A #12G., IN A ¾"C. UNLESS NOTED OTHERWISE, FOR LIGHTING CIRCUITS GREATER THAN 100' PROVIDE #10, WITH A #10G., IN A ¾"C. FOR LIGHTING CIRCUITS GREATER THAN 250' PROVIDE #8, WITH A #8G., IN A ¾"C. PROVIDE ALL CONDUCTORS AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL JUNCTION AND PULL BOXES IN ACCORDANCE WITH THE NEC.
4. EMERGENCY LIGHT FIXTURES SHALL BE WIRED WITH UNSWITCHED 'HOT' CONDUCTOR FROM PANELBOARD. CONNECT FIXTURE SO THAT EMERGENCY SIDE IS OPERATIONAL REGARDLESS OF TOGGLE SWITCH POSITION OR OCCUPANCY SENSOR MODE. EMERGENCY FIXTURES SHALL FUNCTION AS "NIGHT LIGHTS".
5. CONDUIT SHALL NOT BE ROUTED ON THE OUTSIDE OF THE BUILDING FOR EXTERIOR LIGHTS.
6. ALL EXPOSED CONDUIT AND ASSOCIATED MOUNTING HARDWARE SHALL BE PAINTED TO MATCH THE SURFACE IT IS ATTACHED TO. FIELD VERIFY ALL REQUIREMENTS.
7. REFERENCE E-14 LIGHTING CONTROLS LEGEND FOR SWITCHES' AND SWITCH SENSOR'S.

NOTES BY SYMBOL "⬡"

(6) 1. PROVIDE EXTERIOR LIGHT FIXTURE.

2. CONNECT BACK TO EXISTING CIRCUIT BREAKER. PROVIDE ADDITIONAL WIRING AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.

BID OPTIONS "◯"

6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/ BUILDING SIGN.

KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING PLAN - AREA 'D'

E-13

SHT. 88 of 129

TERESA CASTILLON 111323 LICENSED PROFESSIONAL ENGINEER 4/20/18

GENERAL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL JUNCTION AND PULL BOXES IN ACCORDANCE WITH THE NEC.
2. CONTRACTOR SHALL ADJUST OCCUPANCY SENSORS IN ALL AREAS TO COORDINATE WITH ROOM CIRCULATION PATTERNS. ADJUST ALL TIMED EVENTS (FOR EXAMPLE, 'OFF' DELAY) WHEN ROOM IS UNOCCUPIED TO COORDINATE WITH OWNERS' REQUIREMENTS.
3. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL OCCUPANCY SENSORS/POWER PACKS AND ASSOCIATED POWER AND CONTROLS CABLING FOR A COMPLETE AND OPERATIONAL SYSTEM. INSTALL ALL DEVICES, BACKBOXES, CONDUIT, AND ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND SPECIFICATION 26 09 23 LIGHTING CONTROL DEVICES.
4. AT LOCATIONS WHERE ROOM LIGHT FIXTURES ARE CONTROLLED THROUGH THE USE OF OCCUPANCY SENSORS, PROVIDE THE NUMBER OF SENSORS AND LOCATE THE UNITS AS REQUIRED FOR COMPLETE ROOM COVERAGE. WHERE MORE THAN ONE SENSOR IS LOCATED IN A COMMON SPACE, CONNECT THE UNITS SUCH THAT DETECTION OF OCCUPANCY FROM EITHER UNIT WILL ENERGIZE THE ROOM LIGHTING. WHERE TOGGLE OR DIMMER SWITCHES ARE SHOWN IN CONJUNCTION WITH OCCUPANCY SENSORS, CONNECT THE SWITCH(ES) TO DE-ENERGIZE THE ROOM LIGHTING REGARDLESS OF OCCUPANCY.
5. THE OCCUPANCY SENSORS SHOWN ON THE PLANS IS CONCEPTUAL AND IS NOT INTENDED TO INDICATE THE NUMBER OF OCCUPANCY SENSORS REQUIRED FOR COMPLETE COVERAGE IN AN AREA. THE CONTRACTOR SHALL SUBMIT A PLAN SHOWING OCCUPANCY SENSOR LOCATIONS AND COVERAGE, POWER PACKS, ETC. AS AN OFFICIAL SUBMITTAL TO THE ENGINEER FOR APPROVAL.
6. [1] ALL OCCUPANCY SENSORS ASSOCIATED POWER PACKS, SWITCHES, AND WIRING ARE PART OF SECO OPTION NO. 1.
7. REFERENCE E-27 AND E-28 FOR CONTROL DIAGRAMS.

SECO OPTIONS "□"

1. PROVIDE OCCUPANCY SENSORS

NOTES BY SYMBOL "⬡"

1. FIELD VERIFY OPTIMAL LOCATION FOR PHOTOCELL. PHOTOCELL SHALL FACE NORTH.
2. VIA PHOTOCELL.

WIRE LEGEND

CAT5e
CAT5e
PRE-TERMINATED CAT5e CABLE

LIGHTING CONTROLS LEGEND

BG1
NBRG 8 KIT
BRIDGE, KIT

DP1
NPP16 D SA
POWER/RELAY PACK, OCCUPANCY CONTROLLED DIMMING, VACANCY (DEFAULT) OR AUTO-ON

DP3
NPP16 D
POWER/RELAY PACK, OCCUPANCY CONTROLLED DIMMING

OS1
NCM PDT 10
LOW VOLTAGE CEILING MOUNT SENSOR, PASSIVE DUAL TECHNOLOGY, LARGE MOTION / EXTENDED RANGE 360° LENS

OS2
NCM 10
LOW VOLTAGE CEILING MOUNT SENSOR, LARGE MOTION / EXTENDED RANGE 360° LENS

OS3
NCM 6
LOW VOLTAGE CEILING MOUNT SENSOR, HIGH BAY 360° LENS

OS4
NCM PDT 10 LT
LOW VOLTAGE CEILING MOUNT SENSOR, PASSIVE DUAL TECHNOLOGY, LARGE MOTION / EXTENDED RANGE 360° LENS, LOW TEMPERATURE / HIGH HUMIDITY

LIGHTING CONTROLS LEGEND

PC1
NCM ADCX
LOW VOLTAGE CEILING MOUNT SENSOR, PHOTOCONTROL W/ AUTO DIMMING; NO WIRES

PC2
LSA APS OL

PL1
ARP INTENC08 NLT
ACUITY RELAY PANEL, INCLUDE INT AND ENC, 8-SIZE, NLIGHT

PP1
NPP16
POWER/RELAY PACK

PP2
NPP16 SA
POWER/RELAY PACK, VACANCY (DEFAULT) OR AUTO-ON

PP3
NPP16 LT
POWER/RELAY PACK, LOW TEMPERATURE / HIGH HUMIDITY

PP4
NPP16 SA LT
POWER/RELAY PACK, VACANCY (DEFAULT) OR AUTO-ON, LOW TEMPERATURE / HIGH HUMIDITY

SC2
NECY MVOLT BAC ENC GFXK
NLIGHT ECLYPSE, 120-277 VAC, BACNET, 14 1/4"H X 14 1/4"W X 4"D METAL ENCLOSURE FOR ECLYPSE ENERGYSYTE OR NLIGHT ECLYPSE., NGWY2 GFX AND PS 150 POWER SUPPLY WITH CAT5 CABLE

SO1
WSX PDT XX
WALL SWITCH SENSOR, PASSIVE DUAL TECHNOLOGY

SO2
WSX PDT SA XX
WALL SWITCH SENSOR, PASSIVE DUAL TECHNOLOGY, VACANCY (DEFAULT) OR AUTO-ON

SO3
WSX SA XX
WALL SWITCH SENSOR, VACANCY (DEFAULT) OR AUTO-ON

SO4
WSX XX
WALL SWITCH SENSOR

SO5
WSX PDT D SA XX
WALL SWITCH SENSOR, PASSIVE DUAL TECHNOLOGY, OCCUPANCY CONTROLLED DIMMING, VACANCY (DEFAULT) OR AUTO-ON

SO6
NWSX LV XX
WALL SWITCH SENSOR, LOW VOLTAGE

SW1
NPODM DX XX
LOW VOLTAGE PUSH-BUTTON WALLPOD, RAISE/LOWER DIMMING WITHOUT WIRES

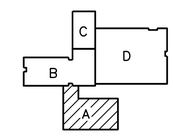
SW2
NPODM XX
LOW VOLTAGE PUSH-BUTTON WALLPOD

SW3
NPODM XX LT
LOW VOLTAGE PUSH-BUTTON WALLPOD, LOW TEMPERATURE / HIGH HUMIDITY

SW8
NPODM 4S DX XX
LOW VOLTAGE PUSH-BUTTON WALLPOD, 4 SCENE CONTROL, RAISE/LOWER DIMMING WITHOUT WIRES



LIGHTING CONTROLS PLAN – AREA 'A'
1/8"=1'-0"



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING CONTROLS PLAN - AREA 'A'

E-14

SHT. 89 of 129

GENERAL NOTES:

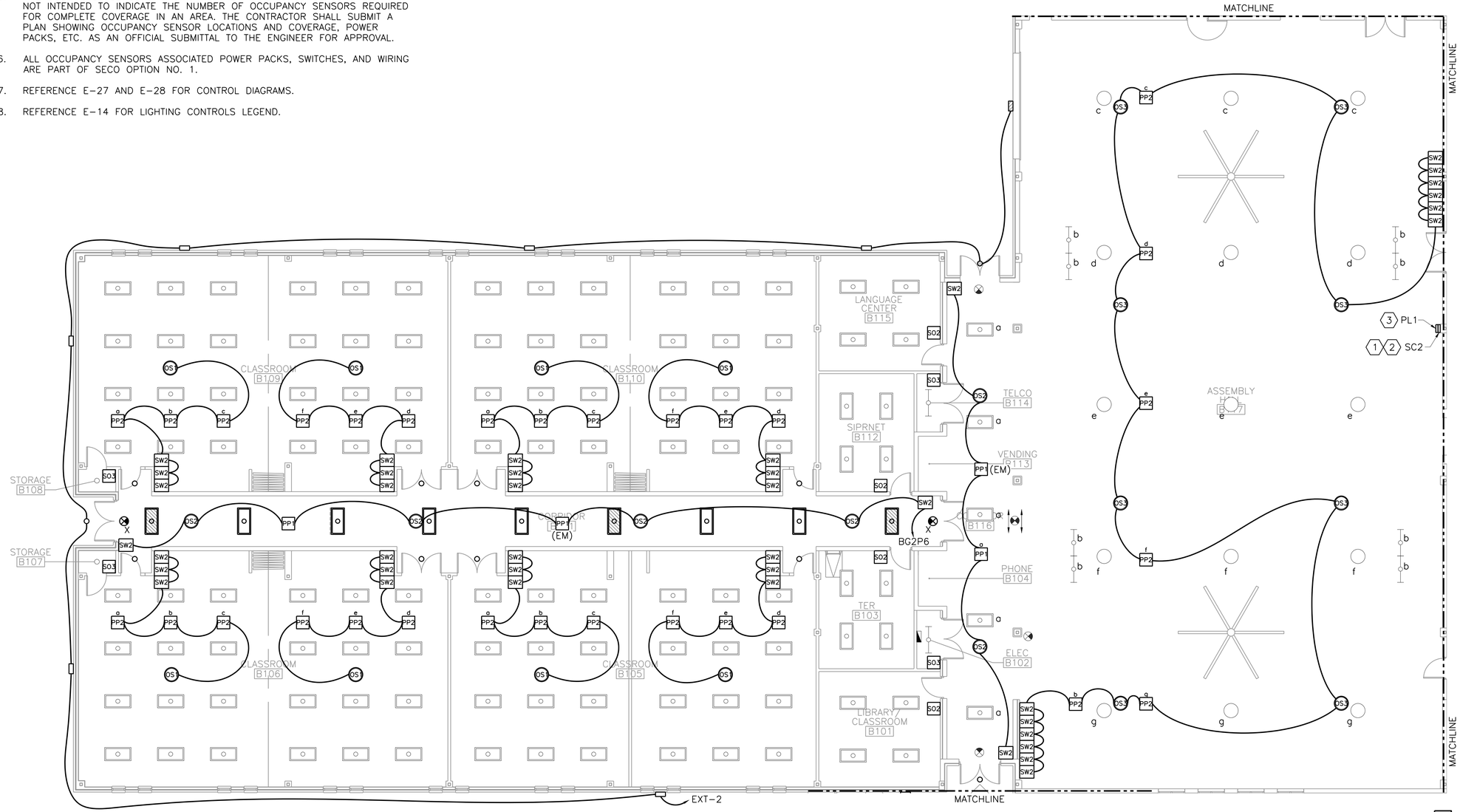
1. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL JUNCTION AND PULL BOXES IN ACCORDANCE WITH THE NEC.
2. CONTRACTOR SHALL ADJUST OCCUPANCY SENSORS IN ALL AREAS TO COORDINATE WITH ROOM CIRCULATION PATTERNS. ADJUST ALL TIMED EVENTS (FOR EXAMPLE, 'OFF' DELAY) WHEN ROOM IS UNOCCUPIED TO COORDINATE WITH OWNERS' REQUIREMENTS.
3. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL OCCUPANCY SENSORS/POWER PACKS AND ASSOCIATED POWER AND CONTROLS CABLING FOR A COMPLETE AND OPERATIONAL SYSTEM. INSTALL ALL DEVICES, BACKBOXES, CONDUIT, AND ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND SPECIFICATION 26 09 23 LIGHTING CONTROL DEVICES.
4. AT LOCATIONS WHERE ROOM LIGHT FIXTURES ARE CONTROLLED THROUGH THE USE OF OCCUPANCY SENSORS, PROVIDE THE NUMBER OF SENSORS AND LOCATE THE UNITS AS REQUIRED FOR COMPLETE ROOM COVERAGE. WHERE MORE THAN ONE SENSOR IS LOCATED IN A COMMON SPACE, CONNECT THE UNITS SUCH THAT DETECTION OF OCCUPANCY FROM EITHER UNIT WILL ENERGIZE THE ROOM LIGHTING. WHERE TOGGLE OR DIMMER SWITCHES ARE SHOWN IN CONJUNCTION WITH OCCUPANCY SENSORS, CONNECT THE SWITCH(ES) TO DE-ENERGIZE THE ROOM LIGHTING REGARDLESS OF OCCUPANCY.
5. THE OCCUPANCY SENSORS SHOWN ON THE PLANS IS CONCEPTUAL AND IS NOT INTENDED TO INDICATE THE NUMBER OF OCCUPANCY SENSORS REQUIRED FOR COMPLETE COVERAGE IN AN AREA. THE CONTRACTOR SHALL SUBMIT A PLAN SHOWING OCCUPANCY SENSOR LOCATIONS AND COVERAGE, POWER PACKS, ETC. AS AN OFFICIAL SUBMITTAL TO THE ENGINEER FOR APPROVAL.
6. [1] ALL OCCUPANCY SENSORS ASSOCIATED POWER PACKS, SWITCHES, AND WIRING ARE PART OF SECO OPTION NO. 1.
7. REFERENCE E-27 AND E-28 FOR CONTROL DIAGRAMS.
8. REFERENCE E-14 FOR LIGHTING CONTROLS LEGEND.

NOTES BY SYMBOL "⬡"

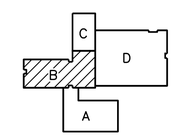
1. [1] PROVIDE NLIGHT ECLYPSE TIME-BASE CONTROLLER (NECY) FOR INTERIOR LIGHTING.
2. [2] IF SECO OPTION NO. 2 IS SELECTED, PROVIDE CONNECTION TO BUILDING AUTOMATION SYSTEM (BAS). RE: MECHANICAL SHEETS FOR ADDITIONAL INFORMATION
3. [1] PROVIDE NLIGHT ENABLED RELAY PANEL FOR EXTERIOR LIGHTS ARP INTENC08. RE: 1/E-28 FOR ADDITIONAL INFORMATION

SECO OPTIONS "□"

1. PROVIDE OCCUPANCY SENSORS.
2. PROVIDE DDC CONTROL SYSTEM.



LIGHTING CONTROLS PLAN – AREA 'B'
1/8"=1'-0"



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

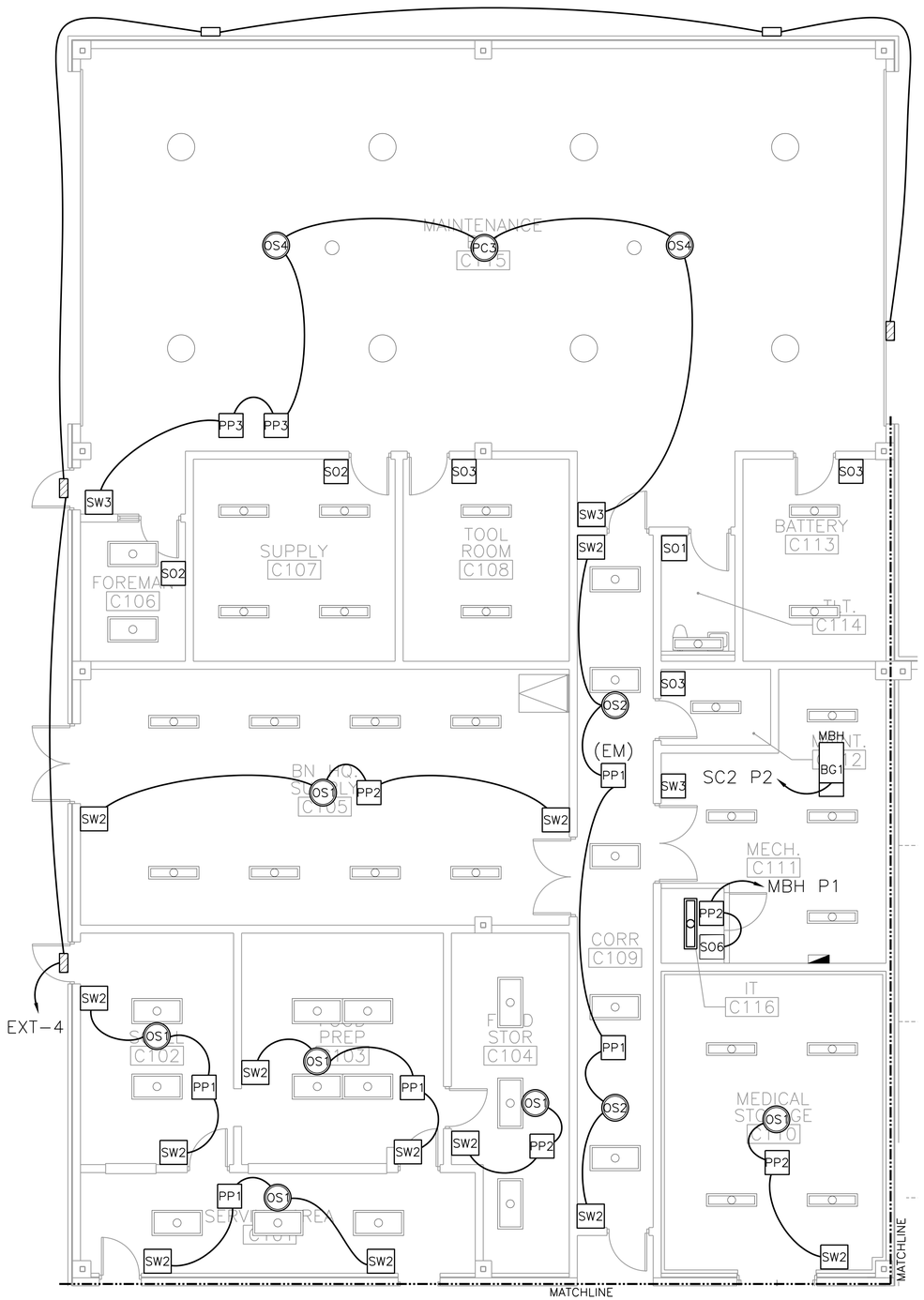
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING CONTROLS PLAN - AREA 'B'

E-15

SHT. 90 of 129



NORTH TRUE NORTH PLAN 1 –

LIGHTING CONTROLS PLAN – AREA 'C'

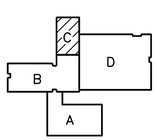
3/16"=1'-0"

GENERAL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL JUNCTION AND PULL BOXES IN ACCORDANCE WITH THE NEC.
2. CONTRACTOR SHALL ADJUST OCCUPANCY SENSORS IN ALL AREAS TO COORDINATE WITH ROOM CIRCULATION PATTERNS. ADJUST ALL TIMED EVENTS (FOR EXAMPLE, 'OFF' DELAY) WHEN ROOM IS UNOCCUPIED TO COORDINATE WITH OWNERS' REQUIREMENTS.
3. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL OCCUPANCY SENSORS/POWER PACKS AND ASSOCIATED POWER AND CONTROLS CABLING FOR A COMPLETE AND OPERATIONAL SYSTEM. INSTALL ALL DEVICES, BACKBOXES, CONDUIT, AND ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND SPECIFICATION 26 09 23 LIGHTING CONTROL DEVICES.
4. AT LOCATIONS WHERE ROOM LIGHT FIXTURES ARE CONTROLLED THROUGH THE USE OF OCCUPANCY SENSORS, PROVIDE THE NUMBER OF SENSORS AND LOCATE THE UNITS AS REQUIRED FOR COMPLETE ROOM COVERAGE. WHERE MORE THAN ONE SENSOR IS LOCATED IN A COMMON SPACE, CONNECT THE UNITS SUCH THAT DETECTION OF OCCUPANCY FROM EITHER UNIT WILL ENERGIZE THE ROOM LIGHTING. WHERE TOGGLE OR DIMMER SWITCHES ARE SHOWN IN CONJUNCTION WITH OCCUPANCY SENSORS, CONNECT THE SWITCH(ES) TO DE-ENERGIZE THE ROOM LIGHTING REGARDLESS OF OCCUPANCY.
5. THE OCCUPANCY SENSORS SHOWN ON THE PLANS IS CONCEPTUAL AND IS NOT INTENDED TO INDICATE THE NUMBER OF OCCUPANCY SENSORS REQUIRED FOR COMPLETE COVERAGE IN AN AREA. THE CONTRACTOR SHALL SUBMIT A PLAN SHOWING OCCUPANCY SENSOR LOCATIONS AND COVERAGE, POWER PACKS, ETC. AS AN OFFICIAL SUBMITTAL TO THE ENGINEER FOR APPROVAL.
6. [1] ALL OCCUPANCY SENSORS ASSOCIATED POWER PACKS, SWITCHES, AND WIRING ARE PART OF SECO OPTION NO. 1.
7. REFERENCE E-27 AND E-28 FOR CONTROL DIAGRAMS.
8. REFERENCE E-14 FOR LIGHTING CONTROLS LEGEND.

SECO OPTIONS "□"

1. PROVIDE OCCUPANCY SENSORS.



KEY PLAN

0 4' 8'
3/16"=1'-0"

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

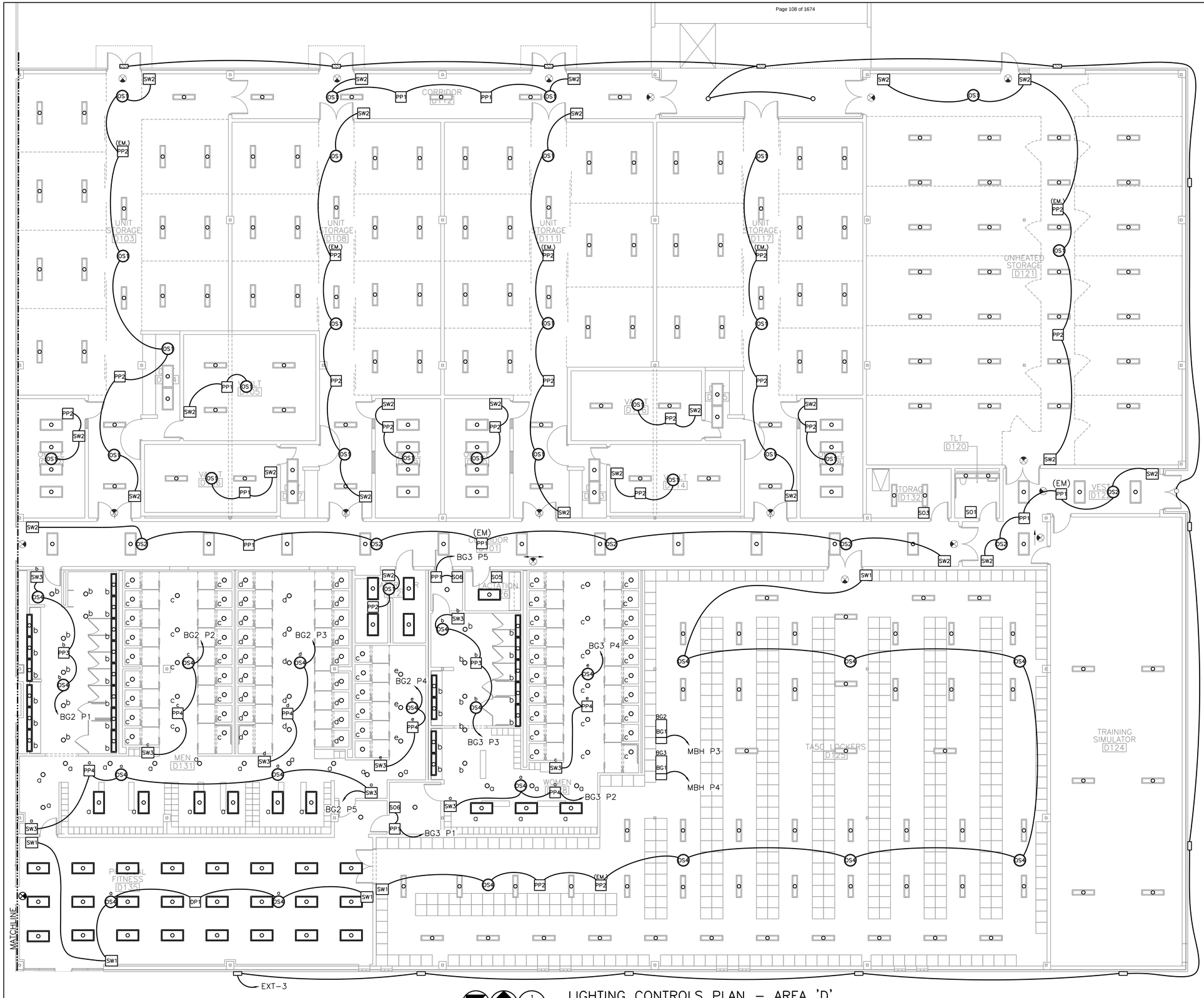
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING CONTROLS PLAN - AREA 'C'

E-16

SHT. 91 of 129



LIGHTING CONTROLS PLAN – AREA 'D'

1/8"=1'-0"

GENERAL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL JUNCTION AND PULL BOXES IN ACCORDANCE WITH THE NEC.
2. CONTRACTOR SHALL ADJUST OCCUPANCY SENSORS IN ALL AREAS TO COORDINATE WITH ROOM CIRCULATION PATTERNS. ADJUST ALL TIMED EVENTS (FOR EXAMPLE, 'OFF' DELAY) WHEN ROOM IS UNOCCUPIED TO COORDINATE WITH OWNERS' REQUIREMENTS.
3. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL OCCUPANCY SENSORS/POWER PACKS AND ASSOCIATED POWER AND CONTROLS CABLING FOR A COMPLETE AND OPERATIONAL SYSTEM. INSTALL ALL DEVICES, BACKBOXES, CONDUIT, AND ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND SPECIFICATION 26 09 23 LIGHTING CONTROL DEVICES.
4. AT LOCATIONS WHERE ROOM LIGHT FIXTURES ARE CONTROLLED THROUGH THE USE OF OCCUPANCY SENSORS, PROVIDE THE NUMBER OF SENSORS AND LOCATE THE UNITS AS REQUIRED FOR COMPLETE ROOM COVERAGE. WHERE MORE THAN ONE SENSOR IS LOCATED IN A COMMON SPACE, CONNECT THE UNITS SUCH THAT DETECTION OF OCCUPANCY FROM EITHER UNIT WILL ENERGIZE THE ROOM LIGHTING. WHERE TOGGLE OR DIMMER SWITCHES ARE SHOWN IN CONJUNCTION WITH OCCUPANCY SENSORS, CONNECT THE SWITCH(ES) TO DE-ENERGIZE THE ROOM LIGHTING REGARDLESS OF OCCUPANCY.
5. THE OCCUPANCY SENSORS SHOWN ON THE PLANS IS CONCEPTUAL AND IS NOT INTENDED TO INDICATE THE NUMBER OF OCCUPANCY SENSORS REQUIRED FOR COMPLETE COVERAGE IN AN AREA. THE CONTRACTOR SHALL SUBMIT A PLAN SHOWING OCCUPANCY SENSOR LOCATIONS AND COVERAGE, POWER PACKS, ETC. AS AN OFFICIAL SUBMITTAL TO THE ENGINEER FOR APPROVAL.
6. ALL OCCUPANCY SENSORS ASSOCIATED POWER PACKS, SWITCHES, AND WIRING ARE PART OF SECO OPTION NO. 1.
7. REFERENCE E-27 AND E-28 FOR CONTROL DIAGRAMS.
8. REFERENCE E-14 FOR LIGHTING CONTROLS LEGEND.

SECO OPTIONS "□"

1. PROVIDE OCCUPANCY SENSORS

KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING CONTROLS PLAN - AREA 'D'

E-17

SHT. 92 of 129

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

GENERAL NOTES:

1. ALL POWER CIRCUITRY SHALL BE MINIMUM 2#12, #12G., 3/4"C. UNLESS NOTED OTHERWISE. FOR POWER CIRCUITS GREATER THAN 100' PROVIDE 2#10, #10G., 3/4"C.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL PULL BOXES AS PER THE NATIONAL ELECTRIC CODE.
3. EXISTING CONDUITS AND BACKBOXES IN EXISTING MASONRY WALLS MAY BE RE-USED ONLY WITH EXPLICIT DIRECTION FROM THE ELECTRICAL ENGINEER OR OWNER'S REPRESENTATIVE. PERMISSION MUST BE IN WRITING FROM THE ENGINEER/REPRESENTATIVE.
4. COORDINATE LOCATION OF JUNCTION BOXES AND OUTLETS THAT SERVE EQUIPMENT SUPPLIED BY OTHERS PRIOR TO ROUGH-IN. EXAMPLES OF EQUIPMENT INCLUDE HAND DRYERS, U.C. REFRIGERATOR, WATER COOLER, ICE MAKER, ETC. CONTRACTOR SHALL INSTALL ALL ELECTRICAL DEVICES, CONDUIT, WIRE AND TERMINATIONS IN ACCORDANCE WITH EQUIPMENT SUPPLIER'S RECOMMENDATIONS.

(3) 5. ALL ELECTRICAL WORK IN SERVER ROOM A134 IS BID OPTION NO. 3.

NOTES BY SYMBOL "⬡"

(5) 1. IF BID OPTION NO. 2 IS SELECTED, PROVIDE RECEPTACLES AND ASSOCIATED CIRCUITRY AS SHOWN INSIDE AND OUTSIDE OF CONFERENCE ROOM. IF BID OPTION NO. 2 IS NOT SELECTED, EXISTING RECEPTACLES SHALL REMAIN AS THEY ARE.

2. PROVIDE NEMA L6-30R RECEPTACLE MOUNTED TO RACK. RE: TECHNOLOGY PLANS

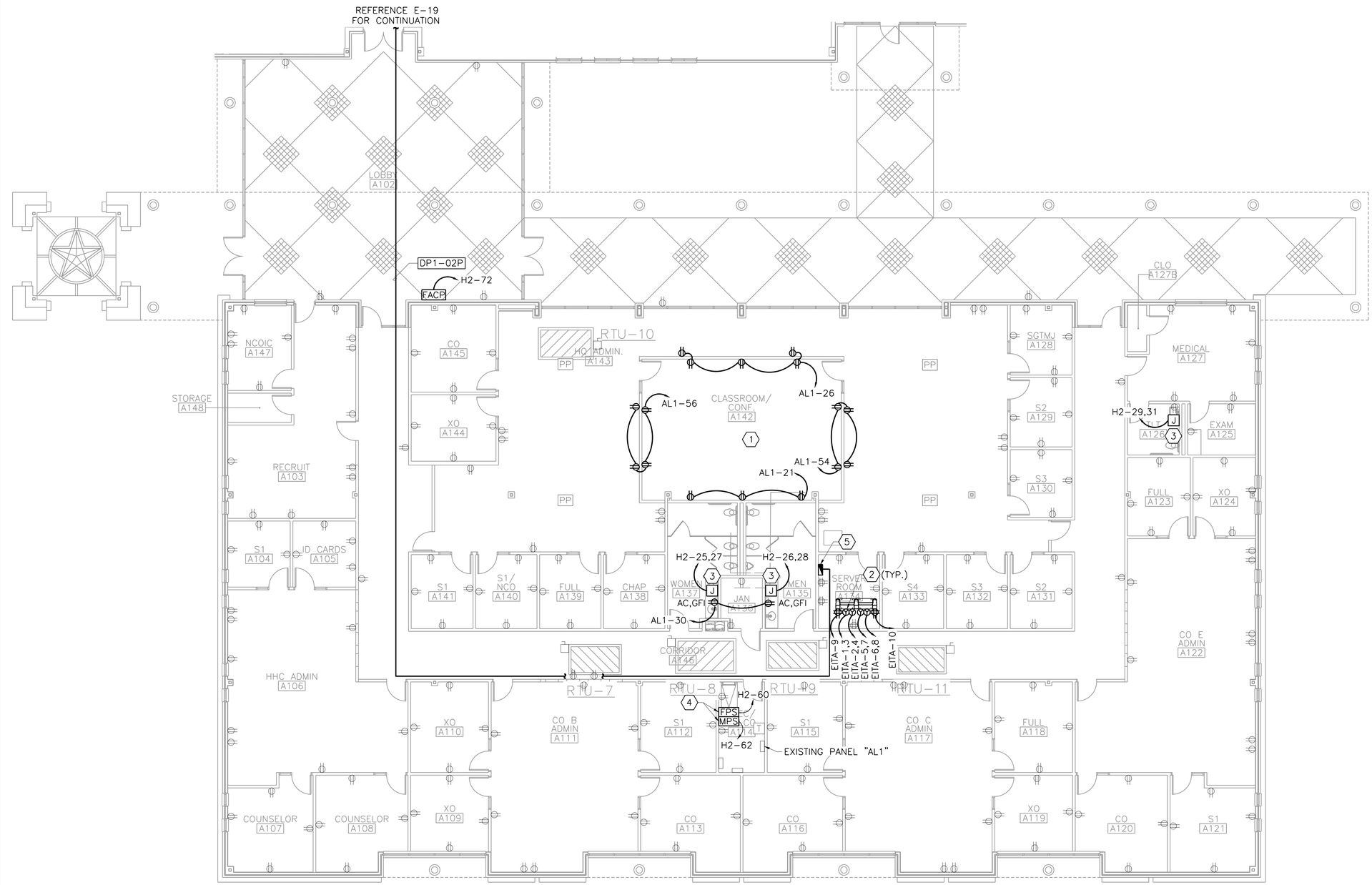
(5) 3. PROVIDE JUNCTION BOX FOR ELECTRICAL WATER HEATER. COORDINATE FINAL LOCATION WITH PLUMBING CONTRACTOR.

4. PROVIDE CIRCUITRY FOR FIRE ALARM AND MASS NOTIFICATION POWER SUPPLIES. COORDINATE WITH FIRE ALARM CONTRACTOR. RE: FIRE ALARM SHEETS.

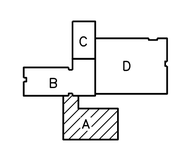
(3) 5. PROVIDE 208Y/120V, 3ø, 4W, 100A PANEL EITA. COORDINATE LOCATION WITH TELECOMM CONTRACTOR.

BID OPTIONS "◯"

3. FULL IT SYSTEM INCLUDING UPGRADES.
5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN WING.



NORTH TRUE / NORTH PLAN — 1/— POWER PLAN – AREA 'A'
1/8"=1'-0"



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS. 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL POWER PLAN - AREA 'A'

E-18

SHT. 93 of 129

GENERAL NOTES:

1. ALL POWER CIRCUITRY SHALL BE MINIMUM 2#12, #12G., 3/4"C. UNLESS NOTED OTHERWISE. FOR POWER CIRCUITS GREATER THAN 100' PROVIDE 2#10, #10G., 3/4"C.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL PULL BOXES AS PER THE NATIONAL ELECTRIC CODE.
3. EXISTING CONDUITS AND BACKBOXES IN EXISTING MASONRY WALLS MAY BE RE-USED ONLY WITH EXPLICIT DIRECTION FROM THE ELECTRICAL ENGINEER OR OWNER'S REPRESENTATIVE. PERMISSION MUST BE IN WRITING FROM THE ENGINEER/REPRESENTATIVE.
4. COORDINATE LOCATION OF JUNCTION BOXES AND OUTLETS THAT SERVE EQUIPMENT SUPPLIED BY OTHERS PRIOR TO ROUGH-IN. EXAMPLES OF EQUIPMENT INCLUDE HAND DRYERS, U.C. REFRIGERATOR, WATER COOLER, ICE MAKER, ETC. CONTRACTOR SHALL INSTALL ALL ELECTRICAL DEVICES, CONDUIT, WIRE AND TERMINATIONS IN ACCORDANCE WITH EQUIPMENT SUPPLIER'S RECOMMENDATIONS.

NOTES BY SYMBOL "⬡"

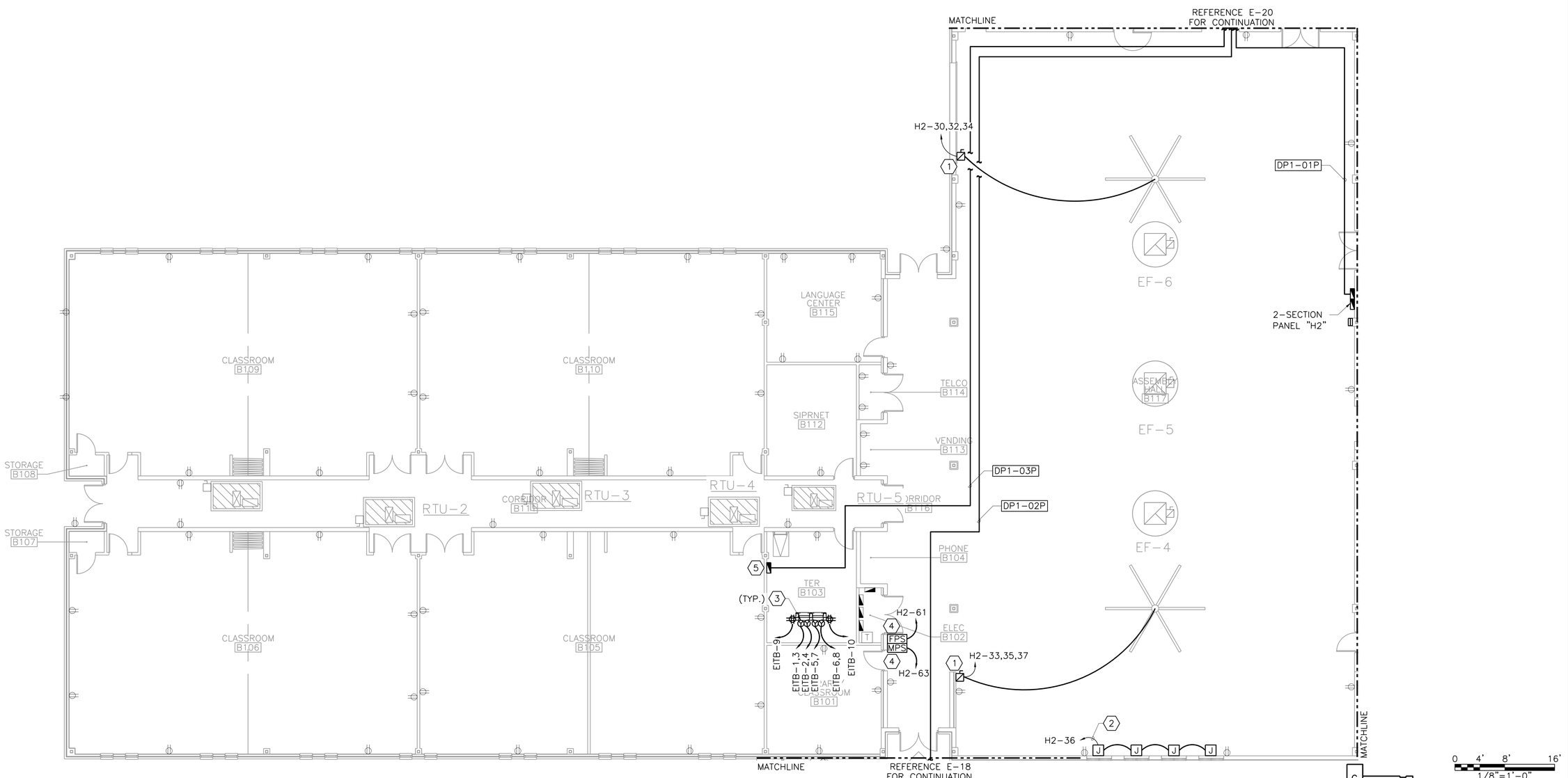
(4) 1. PROVIDE 30A/3P/10A FUSED DISCONNECT SWITCH FOR HVLS FAN. PROVIDE 3 #12, #12G., ¾"C.

2. PROVIDE 2 #10, #10G., ¾"C.
3. PROVIDE NEMA L6-30R RECEPTACLE MOUNTED TO RACK. RE: TECHNOLOGY PLANS.
4. PROVIDE CIRCUITRY FOR FIRE ALARM AND MASS NOTIFICATION POWER SUPPLIES. COORDINATE WITH FIRE ALARM CONTRACTOR. RE: FIRE ALARM SHEETS.

(3) 5. PROVIDE 208Y/120V, 3ø, 4W, 100A PANEL EITB. COORDINATE LOCATION WITH TELECOMM CONTRACTOR.

BID OPTIONS "◯"

3. FULL IT SYSTEM INCLUDING UPGRADES.
4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.



NORTH TRUE NORTH PLAN — 1 — POWER PLAN – AREA 'B'
1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

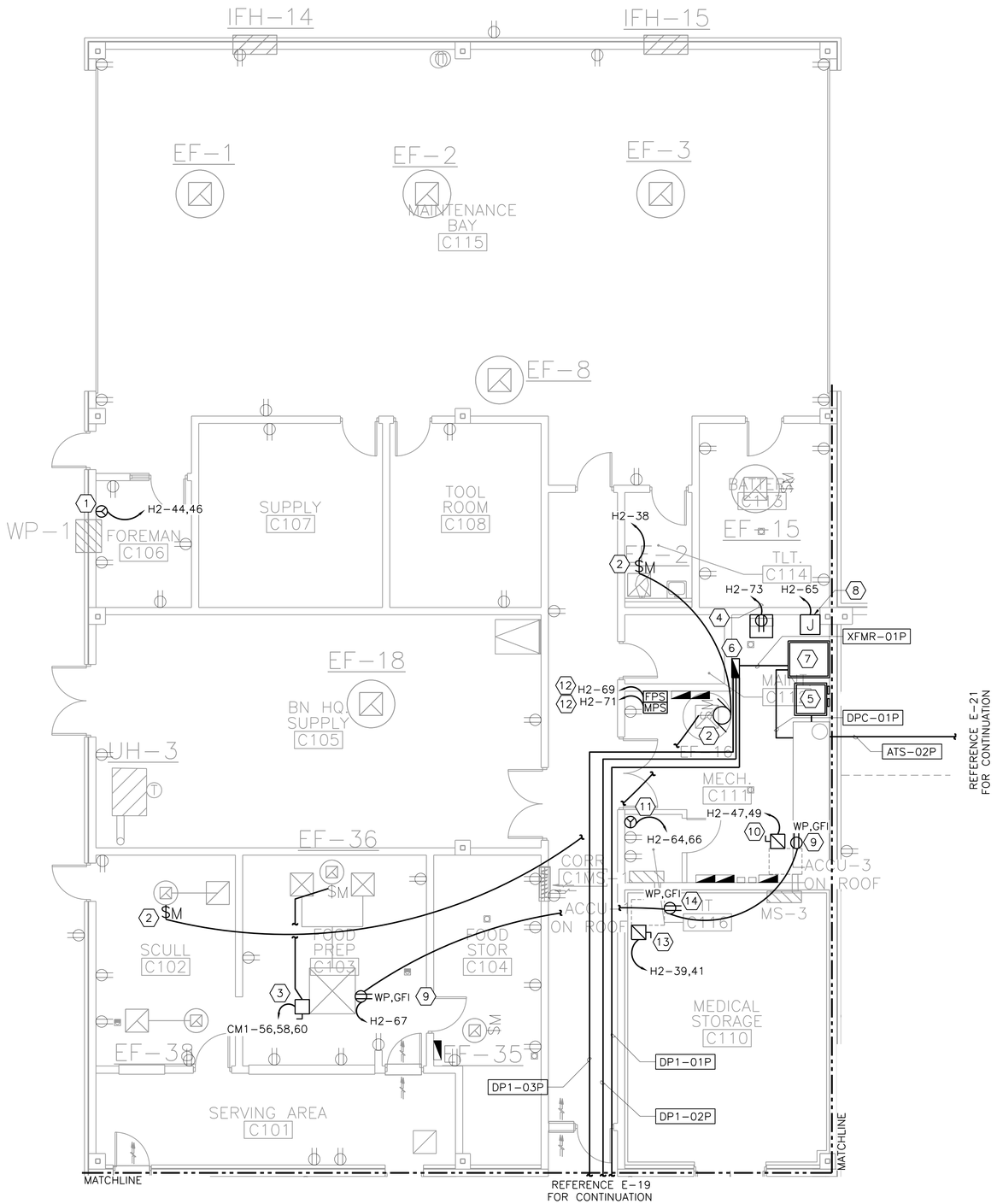
TXARNG CFMO

ELECTRICAL POWER PLAN - AREA 'B'

E-19

SHT. 94 of 129

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18



NORTH TRUE NORTH — 1 — POWER PLAN – AREA 'C'

3/16"=1'-0"

GENERAL NOTES:

1. ALL POWER CIRCUITRY SHALL BE MINIMUM 2#12, #12G., 3/4"C. UNLESS NOTED OTHERWISE. FOR POWER CIRCUITS GREATER THAN 100' PROVIDE 2#10, #10G., 3/4"C.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL PULL BOXES AS PER THE NATIONAL ELECTRIC CODE.
3. EXISTING CONDUITS AND BACKBOXES IN EXISTING MASONRY WALLS MAY BE RE-USED ONLY WITH EXPLICIT DIRECTION FROM THE ELECTRICAL ENGINEER OR OWNER'S REPRESENTATIVE. PERMISSION MUST BE IN WRITING FROM THE ENGINEER/REPRESENTATIVE.
4. COORDINATE LOCATION OF JUNCTION BOXES AND OUTLETS THAT SERVE EQUIPMENT SUPPLIED BY OTHERS PRIOR TO ROUGH-IN. EXAMPLES OF EQUIPMENT INCLUDE HAND DRYERS, U.C. REFRIGERATOR, WATER COOLER, ICE MAKER, ETC. CONTRACTOR SHALL INSTALL ALL ELECTRICAL DEVICES, CONDUIT, WIRE AND TERMINATIONS IN ACCORDANCE WITH EQUIPMENT SUPPLIER'S RECOMMENDATIONS.

NOTES BY SYMBOL "⬡"

(4) 1. PROVIDE NEMA 6-20R RECEPTACLE. COORDINATE FINAL LOCATION WITH LOCATION OF WALL UNIT. PROVIDE 2#10, #10G, ¾"C.

(4) 2. PROVIDE MOTOR RATED SWITCH FOR FAN.

(4) 3. PROVIDE 30A/2P/15A FUSED DISCONNECT SWITCH IN NEMA 3R ENCLOSURE. PROVIDE 2 #12, #12G., ¾"C. INTERLOCK WITH EF-36.

[2] 4. PROVIDE 2 #12, #12G., ¾"C. FOR BAS PANEL.

5. REINSTALL EXISTING TRANSFORMER "CT1" IN THIS LOCATION. PROVIDE ALL WIRING AND CONDUIT AS REQUIRED BACK TO PANELS FOR A COMPLETE AND OPERATIONAL SYSTEM. PROVIDE CONCRETE PAD.

6. PROVIDE 480Y/277V, 3PH, 4W DISTRIBUTION PANEL "DPH1".

7. PROVIDE 480-208Y/120V, 3PH, 4W 225KVA TRANSFORMER ON CONCRETE PAD.

8. PROVIDE JUNCTION BOX FOR CONNECTION TO FLOW METER. COORDINATE WITH PLUMBING.

9. PROVIDE WP,GFI CONVENIENCE RECEPTACLE ON HVAC UNIT LOCATED ON ROOF.

(4) 10. PROVIDE 30A/2P/15A FUSED DISCONNECT SWITCH IN NEMA 3R ENCLOSURE. PROVIDE 2 #12, #12G., ¾"C.

11. PROVIDE NEMA L6-30R RECEPTACLE. COORDINATE FINAL LOCATION WITH TELECOMM. PROVIDE 2#10, #10G., 3/4"C.

12. PROVIDE CIRCUITRY FOR FIRE ALARM AND MASS NOTIFICATION ALARM AUXILIARY POWER SUPPLIES. COORDINATE WITH FIRE ALARM CONTRACTOR. RE: FIRE ALARM DRAWINGS

13. PROVIDE 30A/2P/15A FUSED DISCONNECT SWITCH IN NEMA 3R ENCLOSURE. PROVIDE 2 #10, #10G., 1"C.

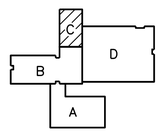
14. PROVIDE CONVENIENCE RECEPTACLE AND CONNECT TO NEAREST EXISTING 120V CIRCUIT ON ROOF.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FAN.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.



KEY PLAN

0 4' 8'

3/16"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

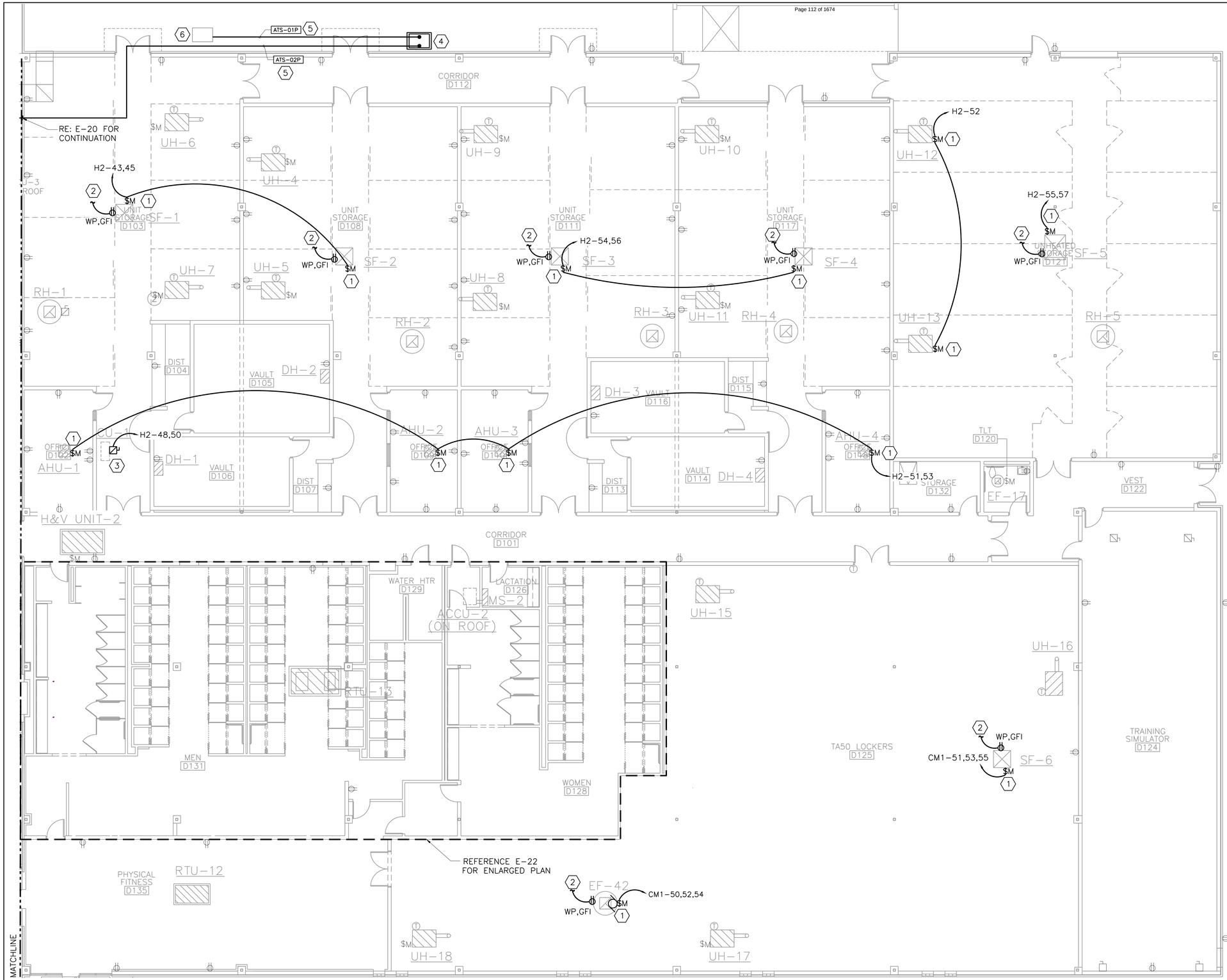
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

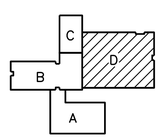
ELECTRICAL POWER PLAN - AREA 'C'

E-20

SHT. 95 of 129



POWER PLAN – AREA 'D'
1/8"=1'-0"



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

GENERAL NOTES:

1. ALL POWER CIRCUITRY SHALL BE MINIMUM 2#12, #12G., 3/4"C. UNLESS NOTED OTHERWISE. FOR POWER CIRCUITS GREATER THAN 100' PROVIDE 2#10, #10G., 3/4"C.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL PULL BOXES AS PER THE NATIONAL ELECTRIC CODE.
3. EXISTING CONDUITS AND BACKBOXES IN EXISTING MASONRY WALLS MAY BE RE-USED ONLY WITH EXPLICIT DIRECTION FROM THE ELECTRICAL ENGINEER OR OWNER'S REPRESENTATIVE. PERMISSION MUST BE IN WRITING FROM THE ENGINEER/REPRESENTATIVE.
4. COORDINATE LOCATION OF JUNCTION BOXES AND OUTLETS THAT SERVE EQUIPMENT SUPPLIED BY OTHERS PRIOR TO ROUGH-IN. EXAMPLES OF EQUIPMENT INCLUDE HAND DRYERS, U.C. REFRIGERATOR, WATER COOLER, ICE MAKER, ETC. CONTRACTOR SHALL INSTALL ALL ELECTRICAL DEVICES, CONDUIT, WIRE AND TERMINATIONS IN ACCORDANCE WITH EQUIPMENT SUPPLIER'S RECOMMENDATIONS.

NOTES BY SYMBOL "⬡"

(4) 1. PROVIDE MOTOR RATED SNAP SWITCH.

(4) 2. PROVIDE CONVENIENCE RECEPTACLE. CONNECT BACK TO EXISTING 120V CIRCUIT. FIELD VERIFY EXISTING CONDITIONS AND REQUIREMENTS.

(4) 3. PROVIDE 60A/3P/35A FUSED DISCONNECT IN NEMA 3R ENCLOSURE. PROVIDE 2#8, #10G., 3/4"C.

(8) 4. PROVIDE AUTOMATIC TRANSFER SWITCH. RE: E-23 FOR ADDITIONAL INFORMATION

(8) 5. ROUTE CONDUIT MOUNTED TO THE EXTERIOR WALL.

6. EXISTING UTILITY TRANSFORMER. COORDINATE WITH LOCAL UTILITY REPRESENTATIVE FOR CONNECTION TO EXISTING TRANSFORMER.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FAN.
8. ELECTRICAL GENERATOR PROVISIONS.

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED PROFESSIONAL ENGINEER
4/20/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL POWER PLAN - AREA 'D'

E-21

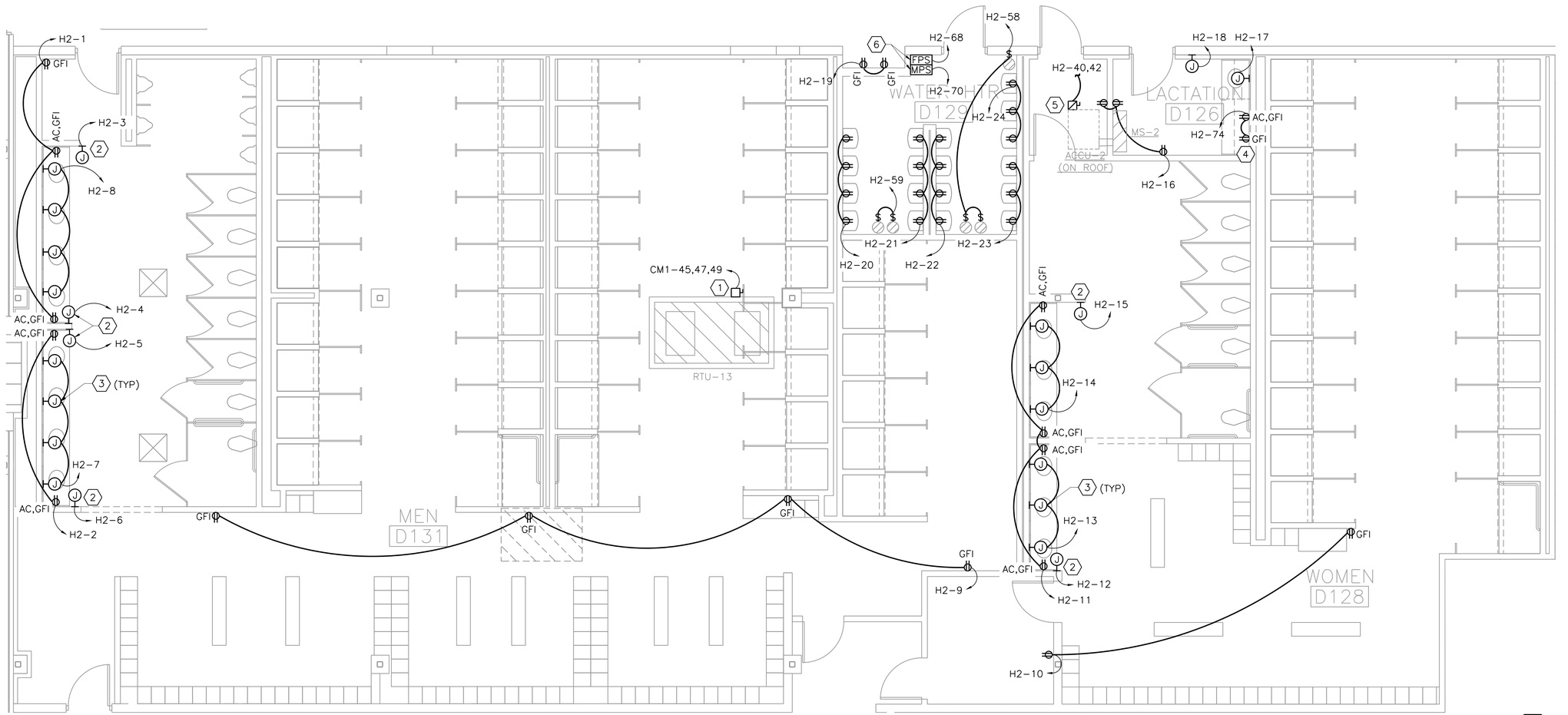
SHT. 96 of 129

GENERAL NOTES:

1. ALL POWER CIRCUITRY SHALL BE MINIMUM 2#12, #12G., 3/4"C. UNLESS NOTED OTHERWISE. FOR POWER CIRCUITS GREATER THAN 100' PROVIDE 2#10, #10G., 3/4"C.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL PULL BOXES AS PER THE NATIONAL ELECTRIC CODE.
3. EXISTING CONDUITS AND BACKBOXES IN EXISTING MASONRY WALLS MAY BE RE-USED ONLY WITH EXPLICIT DIRECTION FROM THE ELECTRICAL ENGINEER OR OWNER'S REPRESENTATIVE. PERMISSION MUST BE IN WRITING FROM THE ENGINEER/REPRESENTATIVE.
4. COORDINATE LOCATION OF JUNCTION BOXES AND OUTLETS THAT SERVE EQUIPMENT SUPPLIED BY OTHERS PRIOR TO ROUGH-IN. EXAMPLES OF EQUIPMENT INCLUDE HAND DRYERS, U.C. REFRIGERATOR, WATER COOLER, ICE MAKER, ETC. CONTRACTOR SHALL INSTALL ALL ELECTRICAL DEVICES, CONDUIT, WIRE AND TERMINATIONS IN ACCORDANCE WITH EQUIPMENT SUPPLIER'S RECOMMENDATIONS.

NOTES BY SYMBOL "⬡"

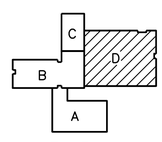
1. PROVIDE 60A/3P/60AF DISCONNECT SWITCH IN NEMA 3R ENCLOSURE. PROVIDE 3 #4, #10G., 1"C.
2. PROVIDE JUNCTION BOX AND MAKE FINAL CONNECTION TO HAND DRYER. PROVIDE 2 #8, #10G., 1"C.
3. PROVIDE JUNCTION BOX FOR ELECTRONIC FAUCET AND MAKE FINAL CONNECTION. PROVIDE 2 #8, #10G., 1"C.
4. PROVIDE RECEPTACLE BELOW THE COUNTER FOR MINI REFRIGERATOR.
5. PROVIDE A 30A/2P/15A FUSED DISCONNECT SWITCH IN A NEMA 3R ENCLOSURE. PROVIDE 2#12, #12G., 3/4"C.
6. PROVIDE CIRCUITRY FOR FIRE ALARM AND MASS NOTIFICATION POWER SUPPLIES. COORDINATE WITH FIRE ALARM CONTRACTOR. RE: FIRE ALARM SHEETS.



NORTH TRUE / NORTH PLAN 1 –

ENLARGED POWER PLAN – AREA 'D'

1/4"=1'-0"



KEY PLAN

0 1' 2' 4' 8'

1/4"=1'-0"

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL ENLARGED POWER PLAN - AREA 'D'

E-22

SHT. 97 of 129

NOTES BY SYMBOL "⬡"

(8) 1. PROVIDE 1200A, 480Y/277V, 4 POLE, OPEN TRANSITION AUTOMATIC TRANSFER SWITCH IN NEMA 3R CONFIGURATION. NORMAL AND EMERGENCY POWER SHALL HAVE 1200A ADJUSTABLE TRIP BREAKER WITH AR ENERGY REDUCTION MODE. ARC ENERGY REDUCTION SHALL BE ENGAGED WITH A KEY SWITCH AND INDICATOR LIGHT SHALL ILLUMINATE WHEN KEY SWITCH IS ENGAGED.

(8) 2. PROVIDE PORTABLE GENERATOR CONNECTION WITH CAMLOCK CONNECTORS AND PHASE ROTATION INDICATION/ALARM.

3. COORDINATE CIRCUIT BREAKER SIZE REQUIREMENTS WITH THE SPD MANUFACTURER.

(8) 4. PROVIDE WIRING AND CONDUIT AS SHOWN.

5. REMOVE EXISTING CIRCUIT BREAKER/HANDLE AND PROVIDE NEW CIRCUIT BREAKER/HANDLE.

6. SPARE CIRCUIT BREAKER IS BROKEN AND INOPERABLE. REMOVE AND LEAVE AS SPACE ONLY.

(2) (1) 7. EXISTING PANELBOARD IS GE A SERIES CAT. NO AQF3244CBXAXB4, 208Y/120V, 400A MCB, 3PH, 4W.

(2) (1) 8. FIELD VERIFY RECEPTACLE INFORMATION.

9. PROVIDE SQUARE D METER PM8000 SERIES (METSEPM8244) DIN RAIL MOUNTED METER WITH REMOTE DISPLAY AND (METSEPM89M2600) I/O MODULE, 6 INPUTS/COUNTERS.

[2] 10. BACNET CONTROLLER IN MECH. RM.

[2] 11. SUPPLY CAT6E CABLE IN ¾" CONDUIT.

(3) 12. PROVIDE DEDICATED PANEL IN SERVER ROOM.

GENERAL NOTES:

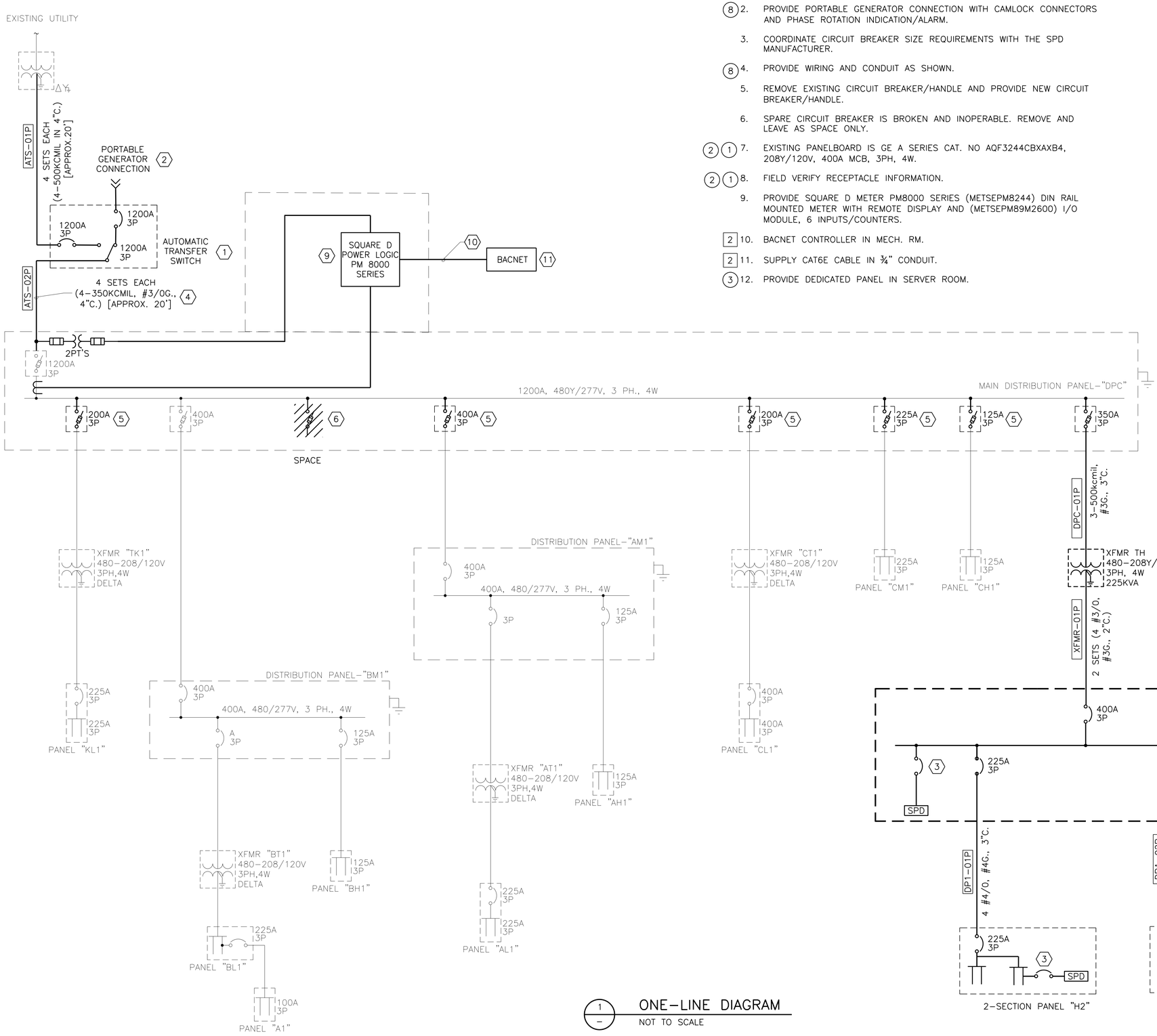
1. ITEMS SHOWN AT A LIGHT LINE WEIGHT ARE EXISTING TO REMAIN. ITEMS SHOWN AT A DARK LINE WEIGHT ARE TO BE PROVIDED.
2. AIC RATING OF NEW CIRCUIT BREAKERS SHALL MATCH AIC RATING OF EXISTING PANEL.

BID OPTIONS "◯"

1. TEMPORARY RESTROOM BUILDING.
2. TEMPORARY SHOWER BUILDING.
3. FULL IT SYSTEM INCLUDING UPGRADES.
4. ELECTRICAL GENERATOR PROVISIONS

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.



1 — ONE-LINE DIAGRAM
NOT TO SCALE

2 — MODULAR BUILDINGS (1)(2) ONE-LINE DIAGRAM
NOT TO SCALE

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HW
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL ONE-LINE DIAGRAMS

E-23

SHT. 98 of 129

PANEL NO. CM1 SECTION 2 (EXIST.

SERVICE VOLTAGE 480Y/277 VOLTS
A.I.C. 65,000
MAIN 225 AMPS MLO
BUS RATING 225 AMPS
NEUTRAL BUS 225 AMPS
LOCATION MECH/ELEC RM
FEED FROM

DESCRIPTION	BREAKER POLE	BREAKER AMP	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	CKT NO	BUSS CONN	CKT NO	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	BREAKER POLE	BREAKER AMP	DESCRIPTION
EXISTING LOAD	1	20	1000			43		44	1000			1	20	EXISTING LOAD
RTU-13	3		11928			45		46		1000		1	20	EXISTING LOAD
				11928		47		48			1000	1	20	EXISTING LOAD
		60			11928	49		50	443.41			3		
SF-6	3		1454.9			51		52		443.41				EF-42
				1454.9		53		54			443.41		20	
		20			1454.9	55		56	831.38			3		
SPACE						57		58		831.38				SF-11
SPACE						59		60			831.38		20	
SPACE						61		62						SHUNT TRIP SPACE FOR SF-11
SPACE						63		64						SPACE
SPACE						65		66						SPACE
SPACE						67		68						SPACE
SPACE						69		70						SPACE
SPACE						71		72						SPACE
SPACE						73		74						SPACE
SPACE						75		76						SPACE
SPACE						77		78						SPACE
SPACE						79		80						SPACE
SPACE						81		82						SPACE
SPACE						83		84						SPACE
CONNECTED BUS A 3,275 VA			1000	0	0				2274.8	2274.8	2274.8			DEMAND KVA: 9.8
CONNECTED BUS B 2,275 VA						TOTAL:	7824.368183	VA						DEMAND AMPS: 11.8
CONNECTED BUS C 2,275 VA			NOTE: ** INDICATES ITEMS UNDER THIS CONTRACT											NOTE: * INDICATES GFI BREAKER

PANEL NO. CH1 (EXISTING)

SERVICE VOLTAGE 480Y/277 VOLTS
A.I.C. 65,000
MAIN 100 AMPS MLO
BUS RATING 100 AMPS
NEUTRAL BUS 100 AMPS
LOCATION MECH/ELEC ROOM C110
FEED FROM

DESCRIPTION	BREAKER POLE	BREAKER AMP	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	CKT NO	BUSS CONN	CKT NO	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	BREAKER POLE	BREAKER AMP	DESCRIPTION
EXISTING LOAD	1	20	1000			1		2	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		3		4		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	5		6			3704	1	20	MEN'S RESTROOM/SHOWER LIGHTS
FITNESS ROOM LIGHTS	1	20	1152			7		8	1852			1	20	WOMEN'S RESTROOM/SHOWER, LACTATION, WATER HEATER RM
EXISTING LOAD	1	20		1000		9		10		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	11		12			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			13		14	739			1	20	EXTERIOR LIGHTS
EXISTING LOAD	1	20		1000		15		16		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	17		18			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			19		20	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		21		22		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	23		24			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			25		26	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		27		28		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	29		30			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			31		32	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		33		34		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	35		36			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			37		38	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		39		40		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	41		42			1000	1	20	EXISTING LOAD
CONNECTED BUS A 14,743 VA			7152	7000	7000				7591	7000	9704			DEMAND KVA: 45.4
CONNECTED BUS B 14,000 VA						TOTAL:	45447	VA						DEMAND AMPS: 54.7
CONNECTED BUS C 16,704 VA			NOTE: ** INDICATES ITEMS UNDER THIS CONTRACT											NOTE: * INDICATES GFI BREAKER

PANEL NO. H2

SERVICE VOLTAGE 208Y/120 VOLTS
A.I.C. 25,000
MAIN 225 AMPS MCB
BUS RATING 225 AMPS
NEUTRAL BUS 225 AMPS
LOCATION
FEED FROM

DESCRIPTION	BREAKER POLE	BREAKER AMP	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	CKT NO	BUSS CONN	CKT NO	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	BREAKER POLE	BREAKER AMP	DESCRIPTION
MEN'S D131- RECEPTACLES	1	20	540			1		2	360			1	20	MEN'S D131- RECEPTACLES
MEN'S D131 HAND DRYER	1	20		1400		3		4		1400		1	20	MEN'S D131 HAND DRYER
MEN'S D131 HAND DRYER	1	30			1400	5		6			1400	1	15	MEN'S D131 HAND DRYER
MEN'S D131 SINK SENSORS	1	20	500			7		8	500			1	20	MEN'S D131 SINK SENSORS
MEN'S D131 CONV. RECEPTACLE	1	20		720		9		10		360		1	20	WOMEN'S D128 CONV. RECEPTACLES
WOMEN'S D128 ABOVE COUNTER RECEPTACLES	1	20			720	11		12			1400	1	20	WOMEN'S D128 HAND DRYER
WOMEN'S D128 ABOVE SINK SENSORS	1	20	500			13		14	500			1	20	WOMEN'S D128 ABOVE SINK SENSORS
WOMEN'S D128 HAND DRYER	1	20		1400		15		16		540		1	20	LACTATION GENERAL RECEPTACLES
LACTATION SINK SENSOR	1	15			500	17		18			1400	1	15	LACTATION HAND DRYER
WATER FOUNTAIN RECEPTACLES	1	20	600			19		20	1400			1	20	TANKLESS WATER HEATERS
TANKLESS WATER HEATERS	1	20		1400		21		22		1400		1	20	TANKLESS WATER HEATERS
TANKLESS WATER HEATERS	1	20			1050	23		24			1050	1	20	TANKLESS WATER HEATERS
ADMIN WING-WOMEN'S A137 SINK WATER HEATER	2		2050			25		26	2050			2		ADMIN WING-MEN'S A135 SINK WATER HEATER
		25		2050		27		28		2050			25	
ADMIN WING-TLT A126 SINK WATER HEATER	2				2050	29		30			792.59	3		HVLS-1
		25	2050			31		32	792.59					
HVLS-2	3			792.59		33		34		792.59			20	
					792.59	35		36			140	1	20	ASSEMBLY HALL MOTORIZED LOUVERS
		20	792.59			37		38	300			1	20	EF-16, EF-37
ACCU-1	2			728		39		40		728		2		ACCU-2
		20			728	41		42			728		20	
SF-1, SF-2	2		637			43		44	2050			2		WP-1
		20		637		45		46		2050			20	
ACCU-3	2				728	47		48			2075	2		CU-1
		15	728			49		50	2075				35	
AHU-1, 2, 3, 4	2			1310.4		51		52		600		1	20	UH-12, UH-13
		20			1310.4	53		54			637	2		SF-3, SF-4
SF-5	2		1300			55		56	637				20	
		20		1300		57		58	780			1	20	CIRCULATION PUMPS
CIRCULATION PUMPS	1	20			480	59		60		500		1	20	AREA A FPS
AREA B FPS	1	20	500			61		62			500	1	20	AREA A MPS
AREA B MPS	1	20		500		63		64	2882.1			2		TELECOMM L630R
FLOWMETER	1	20			500	65		66		2882.1			30	
HVAC RECEPTACLES	1	20	540			67		68			500	1	20	AREA D FPS
AREA C FPS	1	20		500		69		70	500			1	20	AREA D MPS
AREA C MPS	1	20			500	71		72		500		1	20	FACP
BAS CONTROL PANEL	1	20	500			73		74			1920	1	20	MINI FRIDGE
SPARE	1	20				75		76				1	20	SPARE
SPARE	1	20				77		78				1	20	SPARE
SPARE	1	20				79		80				3		SPD
SPARE	1	20				81		82						
SPARE	1	20				83		84					20	
CONNECTED BUS A 21,902 VA			11238	12738	10759				10665	9920.6	9622.6			DEMAND KVA: 68.6
CONNECTED BUS B 22,659 VA						TOTAL:	64942.3187	VA						DEMAND AMPS: 190.5
CONNECTED BUS C 20,382 VA														NOTE: * INDICATES GFI BREAKER

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL SCHEDULES I

E-24

SHT. 99 of 129

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18
Teresa Castillón

PANEL NO. BH1 (EXISTING)

MAIN 100 AMPS MLO — LOCATION ELEC RM B104
SERVICE VOLTAGE 480Y/277 VOLTS — BUS RATING 100 AMPS
A.I.C. FIELD VERIFY — NEUTRAL BUS 100 AMPS — FEED FROM

DESCRIPTION	BREAKER POLE	BREAKER AMP	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	CKT NO	BUSS CONN	CKT NO	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	BREAKER POLE	BREAKER AMP	DESCRIPTION
EXISTING LOAD	1	20	1000			1		2	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		3		4		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	5		6			288	1	20	CORRIDOR B111 LIGHTS
EXISTING LOAD	1	20	1000			7		8	1000			1	20	EXISTING LOAD
CORRIDOR B111 EMERGENCY LIGHTS	1	20		144		9		10		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	11		12			427	1	20	EXTERIOR LIGHTS
EXISTING LOAD	1	20	1000			13		14	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		15		16		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	17		18			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			19		20	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		21		22		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	23		24			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			25		26	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		27		28		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	29		30			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			31		32	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		33		34		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	35		36			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			37		38	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		39		40		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	41		42			1000	1	20	EXISTING LOAD
CONNECTED BUS A 14,000 VA			7000	6144	7000				7000	7000	5715			DEMAND KVA: 39.9
CONNECTED BUS B 13,144 VA				TOTAL:		39859		VA						DEMAND AMPS: 47.9
CONNECTED BUS C 12,715 VA			NOTE: ** INDICATES ITEMS UNDER THIS CONTRACT									NOTE: * INDICATES GFI BREAKER		

PANEL NO. AH1 (EXISTING)

MAIN 100 AMPS MLO — LOCATION ELEC/TELCO 114
SERVICE VOLTAGE 480Y/277 VOLTS — BUS RATING 100 AMPS
A.I.C. FIELD VERIFY — NEUTRAL BUS 100 AMPS — FEED FROM

DESCRIPTION	BREAKER POLE	BREAKER AMP	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	CKT NO	BUSS CONN	CKT NO	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	BREAKER POLE	BREAKER AMP	DESCRIPTION
EXISTING LOAD	1	20	1000			1		2	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		3		4		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	5		6			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			7		8	744			1	20	CONFERENCE ROOM LIGHTS
EXISTING LOAD	1	20		1000		9		10		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	11		12			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			13		14	400			1	20	EXTERIOR LIGHTS
EXISTING LOAD	1	20		1000		15		16		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	17		18			256	1	20	LOBBY LIGHTS
EXISTING LOAD	1	20	1000			19		20	75			1	20	EXTERIOR GROUND MOUNTED LIGHTS
EXISTING LOAD	1	20		1000		21		22		525		1	20	BREEZEWAY LIGHTS
EXISTING LOAD	1	20			1000	23		24			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			25		26	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		27		28		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	29		30			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			31		32	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		33		34		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	35		36			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			37		38	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		39		40		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	41		42			1000	1	20	EXISTING LOAD
CONNECTED BUS A 12,219 VA			7000	7000	7000				5219	6525	6256			DEMAND KVA: 39.0
CONNECTED BUS B 13,525 VA				TOTAL:		39000		VA						DEMAND AMPS: 46.9
CONNECTED BUS C 13,256 VA			NOTE: ** INDICATES ITEMS UNDER THIS CONTRACT									NOTE: * INDICATES GFI BREAKER		

PANEL NO. AL1 (EXISTING)

MAIN 225 AMPS MCB — LOCATION ELEC TELCO. ROOM A114
SERVICE VOLTAGE 208Y/120 VOLTS — BUS RATING 225 AMPS
A.I.C. 65,000 — NEUTRAL BUS 225 AMPS — FEED FROM

DESCRIPTION	BREAKER POLE	BREAKER AMP	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	CKT NO	BUSS CONN	CKT NO	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	BREAKER POLE	BREAKER AMP	DESCRIPTION
EXISTING LOAD	1	20	1000			1		2	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		3		4		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	5		6			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			7		8	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		9		10		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	11		12			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			13		14	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		15		16		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	17		18			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			19		20	1000			1	20	EXISTING LOAD
CONFERENCE ROOM RECEPTACLES	1	20		540		21		22		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	23		24			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			25		26	900			1	20	CONFERENCE ROOM RECEPTACLES
EXISTING LOAD	1	20		1000		27		28		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	29		30			360	1	20	RESTROOM RECEPTACLES
EXISTING LOAD	1	20	1000			31		32	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		33		34		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	35		36			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	1000			37		38	1000			1	20	EXISTING LOAD
EXISTING LOAD	1	20		1000		39		40		1000		1	20	EXISTING LOAD
EXISTING LOAD	1	20			1000	41		42			1000	1	20	EXISTING LOAD
EXISTING LOAD	1	20	500			43		44	500			1	20	EXISTING LOAD
EXISTING LOAD	1	20		500		45		46		500		1	20	EXISTING LOAD
EXISTING LOAD	1	20			500	47		48			500	1	20	EXISTING LOAD
EXISTING LOAD	1	20	500			49		50	500			1	20	EXISTING LOAD
EXISTING LOAD	1	20		500		51		52		500		1	20	EXISTING LOAD
EXISTING LOAD	1	20			500	53		54			720	1	20	CONFERENCE ROOM RECEPTACLES
EXISTING LOAD	1	20	500			55		56	720			1	20	CONFERENCE ROOM RECEPTACLES
EXISTING LOAD	1	20		500		57		58		500		1	20	EXISTING LOAD
EXISTING LOAD	1	20			500	59		60			500	1	20	EXISTING LOAD
EXISTING LOAD	1	20	500			61		62	500			1	20	EXISTING LOAD
EXISTING LOAD	1	20		500		63		64		500		1	20	EXISTING LOAD
EXISTING LOAD	1	20			500	65		66			500	1	20	EXISTING LOAD
EXISTING LOAD	1	20	500			67		68	500			1	20	EXISTING LOAD
EXISTING LOAD	1	20		500		69		70		500		1	20	EXISTING LOAD
EXISTING LOAD	1	20			500	71		72			500	1	20	EXISTING LOAD
EXISTING LOAD	1	20	500			73		74	500			1	20	EXISTING LOAD
EXISTING LOAD	1	20		500		75		76		500		1	20	EXISTING LOAD
EXISTING LOAD	1	20			500	77		78			500	1	20	EXISTING LOAD
EXISTING LOAD	1	20	500			79		80	500			1	20	EXISTING LOAD
EXISTING LOAD	1	20		500		81		82		500		1	20	EXISTING LOAD
EXISTING LOAD	1	20			500	83		84			500	1	20	EXISTING LOAD
CONNECTED BUS A 21,120 VA			10500	10040	10500				10620	10500	10080			DEMAND KVA: 62.2
CONNECTED BUS B 20,540 VA				TOTAL:		62240		VA						DEMAND AMPS: 172.8
CONNECTED BUS C 20,580 VA			NOTE: ** INDICATES ITEMS UNDER THIS CONTRACT									NOTE: * INDICATES GFI BREAKER		

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL SCHEDULES II

E-25

SHT. 100 of 129

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

PANEL NO. EITA — MAIN 100 AMPS MCB — LOCATION SERVER ROOM A134
SERVICE VOLTAGE 208Y/120 VOLTS — BUS RATING 100 AMPS
A.I.C. 65,000 — NEUTRAL BUS 100 AMPS — FEED FROM

DESCRIPTION	BREAKER POLE	BREAKER AMP	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	CKT NO	BUSS CONN	CKT NO	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	BREAKER POLE	BREAKER AMP	DESCRIPTION
L6-30R	2	30	2496			1		2	2496			2	30	L6-30R
				2496		3		4		2496				
L6-30R	2	30			2496	5		6			2496	2	30	L6-30R
			2496			7		8	2496					
SERVER ROOM QUAD	1	20		360		9		10		360		1	20	SERVER ROOM QUAD
SPACE						11		12						SPACE
SPACE						13		14						SPACE
SPACE						15		16						SPACE
SPACE						17		18						SPACE
SPACE						19		20				3		SPD
SPACE						21		22						
SPACE						23		24					20	

CONNECTED BUS A 9,984 VA — 4992 2856 2496 — 4992 2856 2496 — DEMAND KVA: 20.7
CONNECTED BUS B 5,712 VA — TOTAL: 20688 VA — DEMAND AMPS: 57.4
CONNECTED BUS C 4,992 VA — NOTE: * INDICATES GFI BREAKER

PANEL NO. EITB — MAIN 100 AMPS MCB — LOCATION TER B103
SERVICE VOLTAGE 208Y/120 VOLTS — BUS RATING 100 AMPS
A.I.C. 65,000 — NEUTRAL BUS 100 AMPS — FEED FROM

DESCRIPTION	BREAKER POLE	BREAKER AMP	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	CKT NO	BUSS CONN	CKT NO	VOLT AMPS A	VOLT AMPS B	VOLT AMPS C	BREAKER POLE	BREAKER AMP	DESCRIPTION
L6-30R	2	30	2496			1		2	2496			2	30	L6-30R
				2496		3		4		2496				
L6-30R	2	30			2496	5		6			2496	2	30	L6-30R
			2496			7		8	2496					
SERVER ROOM QUAD	1	20		360		9		10		360		1	20	SERVER ROOM QUAD
SPACE						11		12						SPACE
SPACE						13		14						SPACE
SPACE						15		16						SPACE
SPACE						17		18						SPACE
SPACE						19		20				3		SPD
SPACE						21		22						
SPACE						23		24					20	

CONNECTED BUS A 9,984 VA — 4992 2856 2496 — 4992 2856 2496 — DEMAND KVA: 20.7
CONNECTED BUS B 5,712 VA — TOTAL: 20688 VA — DEMAND AMPS: 57.4
CONNECTED BUS C 4,992 VA — NOTE: * INDICATES GFI BREAKER

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER	CATALOG NO.	VOLT.	DESCRIPTION	LAMPS	INPUT WATTS
A	LITHONIA	2GTL4-40L-GZ10-LP835-USPOM	277	2'x4' LED TROFFER WITH .125" ACRYLIC FLAT LENS, REGRESSED ALUMINUM DOOR, 4000 LUMENS, 3500K CCT, AND ELECTRONIC DRIVER.	LED	32
AE	LITHONIA	2GTL4-40L-GZ10-LP835-EL14-USPOM	277	SIMILAR TO TYPE "A" EXCEPT WITH A 1400 NOMINAL LUMEN EMERGENCY BATTERY PACK.	LED	32
B	LITHONIA	2AVL4-40L--MDR-MVOLT-EZ1-LP835-USPOM	277	2'x4' DIRECT/INDIRECT LED TROFFER WITH A METAL DIFFUSER, COLD ROLLED STEEL REFLECTOR ASSEMBLY, 4000 LUMENS, 3500K CCT, 82 CRI, ELECTRONIC DIMMING DRIVER, AND WHITE FINISH.	LED	48
BE	LITHONIA	2AVL4-40L--MDR-MVOLT-EZ1-LP835-EL14L-USPOM	277	SIMILAR TO TYPE "C" EXCEPT WITH A 1400 NOMINAL LUMEN EMERGENCY BATTERY PACK.	LED	48
C	LITHONIA	DSXF1LED-P2-4000K-HMF-277-THK-DBLXD-USPOM	277	D-SERIES SIZE 1 LED FLOO LUMINAIRE. PROVIDE HYDREL WMSA-78C BLACK WALL MOUNT SPLICE FOR MOUNTING.	LED	25
CE	LITHONIA	DSXF1LED-P2-4000K-HMF-277-THK-DBLXD-USPOM, POWER SENTRY EAC ISSM MICRO INVERTER	277	D-SERIES SIZE 1 LED FLOO LUMINAIRE. PROVIDE HYDREL WMSA-78C BLACK WALL MOUNT SPLICE FOR MOUNTING. PROVIDE 20W MICRO-INVERTER.	LED	25
D	LITHONIA	ZL1F-L48-4500LM-MDD-MVOLT-35K-90CRI-WH-USPOM	277	4' LED STRIP LIGHT WITH STEEL HOUSING, WHITE FINISH, 4500 UMENS, 3500K CCT, 90CRI, FROSTED LENS, AND ELECTRONIC DRIVER.	LED	25
F	BEGA USA	33136 BRZ K4	277	SURFACE CANOPY MOUNTED LED LUMINAIRE, ONE PIECE DIE-CAST ALUMINIUM, 4000K, 85CRI, DARK BRONZE. IP65 RATED.	LED	25
FE	BEGA USA	33137 BRZ K4 WITH REMOTE BATTERY	277	SURFACE CANOPY MOUNTED LED LUMINAIRE, ONE PIECE DIE-CAST ALUMINIUM, 4000K, 85CRI, DARK BRONZE. IP65 RATED, WITH REMOTE MOUNTED BATTERY PACK, POWER SENTRY PS1555CP. BATTERY PACK MAY BE MOUNTED ABOVE THE CEILING INSIDE THE BUILDING.	LED	25
G	LITHONIA	EVO-35/35-6-AR-WD-LSS-MVOLT-EZ1-USPOM	277	6" DOWN LIGHT WITH CLEAR TRIM, SEMISPECULAR FINISH, 3500K CRI, 3500 LUMENS, 85 CRI, AND ELECTRONIC DRIVER.	LED	28
GE	LITHONIA	EVO-35/35-6-AR-WD-LSS-MVOLT-EZ1-EL-USPOM	277	SIMILAR TO TYPE "G" EXCEPT WITH AN EMERGENCY BATTERY PACK.	LED	28
H	LITHONIA	DSXF2-P2-40K-FL-MVOLT-IS-DDBXD-FV-USPOM	277	D-SERIES SIZE 2 LED FLOO LUMINAIRE. PROVIDE STANCHION FOR MOUNTING TO THE GROUND	LED	25
L	MARK LIGHTING	SL4L LOP (X)FT FLP FL 80CRI 35K 600LMF WW MIN1 NODIM 120 NLIGHT DPL USPOM	277	4 INCH DIRECT LEF TROFFER WITH A FLUSH 90% TRANSMISSIVE SATIN DIFFUSER, ALUMINUM EXTRUDED HOUSING, 600 LUMENS PER FOOT, 3500K CCT, 82 CRI, ELECTRONIC DIMMING DRIVER, AND WHITE FINISH, CONTRACTOR TO PROVIDE WALL TO WALL WITHIN 1 INCH.	LED	24
S	GOTHAM	EVO-35/25-6-DFR-MVOLT-EZ1-USPOM	277	6" SHOWER LIGHT WITH NON-CONDUCTIVE HOUSING, WHITE FLANGE, REGRESSED LENS, 3500K CRI, 2500 LUMENS, 85 CRI, AND ELECTRONIC DRIVER.	LED	42
X	LITHONIA	LE-S-1-R-EL N-SD-USPOM	277	EXIT LIGHT WITH DIE-CAST ALUMINUM HOUSING, BRUSHED ALUMINUM FINISH, RED LEDS, AND NI-CAD BATTERY BACK-UP.	LED	14
W	LITHONIA	WST LED-P2-40K-VF277-VG-DDBXD-USPOM	277	OUTDOOR TRAPEZOIDAL WALLPACK FIXTURE WITH DIE-CAST ALUMINUM HOUSING, 20LEDS, 4000 LUMENS, 4000K CCT, VANDAL GUARD, AND DARK BRONZE FINISH	LED	53
WE	LITHONIA	WST LED-P2-40K-VF277-E7WC VG-DDBXD-USPOM	277	SIMILAR TO TYPE "W" EXCEPT WITH AN EMERGENCY BATTERY PACK.	LED	53

LIGHTING FIXTURE SCHEDULE NOTES:

1. LIGHT FIXTURES PROVIDED SHALL BE APPROVED EQUAL TO THE FIXTURE INDICATED IN THE SCHEDULE ABOVE.
2. FIXTURE MODEL NUMBERS ARE USED TO ESTABLISH MINIMUM QUALITY AND PERFORMANCE STANDARDS AND NOT TO ESTABLISH MOUNTING TYPE. MOUNTING REQUIREMENTS MAY VARY FOR THE SAME TYPE OF FIXTURE THROUGHOUT THE PROJECT. CONTRACTOR SHALL VERIFY INSTALLATION LOCATION AND PROVIDE APPROPRIATE MOUNTING HARDWARE FIXTURE TYPE DESIGN FOR EACH LOCATION.
3. FOR FIXTURE TYPE "FE" THE CONTRACTOR SHALL PROVIDE A NEMA 12 BOX FOR THE REMOTE BALLAST. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL MOUTNING HARDWARE AS REQUIRED.
4. THE CONTRACTOR SHALL WIRE ALL EMERGENCY BATTERY PACKS TO THE UNSWITCHED SIDE OF THE CIRCUIT IN WHICH IT IS CONNECTED. THE CONTRACTOR SHALL PROVIDE ALL CONDUCTORS AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.

LUMINAIRE CONTROL FUNCTIONS PROGRAMMED BY AUTHORISED FACTORY TECHNICIAN

	SPACE DESCRIPTION		A: OCCUPANCY SENSOR CONTROL (O) / TIME SWITCH CONTROL (T) / PHOTOCELL SWITCH CONTROL (P) / OCCUPANCY SENSOR PROGRAMMABLE CONTROL (OP)	B: AUTOMATICALLY TURN OFF LIGHTS WITHIN 30 MINUTES OF ALL OCCUPANTS LEAVING THE SPACE	C: AUTOMATICALLY TURN ON THE LIGHT TO NOT MORE THAN 50% WHEN OCCUPANT ENTERS THE SPACE	D: OCCUPANTS CAN MANUALLY TURN OFF THE LIGHT	E: AUTOMATICALLY TURN OFF LIGHTS AS A FUNCTION OF AVAILABLE DAYLIGHT	F: AUTOMATICALLY REDUCE THE CONNECTED LIGHTING POWER BY NOT LESS THAN 30% FROM NOT LATER THAN MIDNIGHT TO 6AM, FROM ONE HOUR AFTER BUSINESS CLOSING TO ONE HOUR BEFORE BUSINESS OPENING OR DURING ANY PERIOD WHEN ACTIVITY HAS NOT BEEN DETECTED FOR A TIME LONGER THAN 15 MINUTES	G: TIME BASED CONTROL WITH MANUAL OVERRIDE NOT OVER 2 HOUR CONTROLLING LESS THAN 5000 SQFT.	H: LOAD SHEDDING	I: DAYLIGHT HARVESTING	
1	CLASSROOM/LECTURE/TRAINING ROOM	OP	●	●	●							1
2	CONFERENCE/MEETING/MULTIPURPOSE ROOM	OP	●	●	●							2
3	COPY/PRINT ROOM	OP	●	●	●							3
4	LOBBY	OP	●	●	●				●			4
5	OFFICE	OP	●	●	●							5
6	RESTROOM	OP	●	●	●							6
7	JANITORIAL CLOSET/STORAGE/LOCKER ROOM	OP	●	●	●							7
8	ANY SPACES 300 SQFT. OR LESS ENCLOSED BY FLOOR TO CEILING PARTITION	OP	●	●	●							8
9	CORRIDOR	T						●				9
10	REMAINING AREAS WITH NO OCCUPANCY SENSOR	T						●				10
11	EXTERIOR AREAS	O/T/P				●	●					11
			A	B	C	D	E	F	G	H		

1 — SEQUENCE OF OPERATIONS FOR LIGHTING SWITCHING / CONTROL
NOT TO SCALE

STATE OF TEXAS — TERESA CASTILLÓN — 111323 — LICENSED PROFESSIONAL ENGINEER — 4/20/18

PROJECT ARCHITECT: HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: JF
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

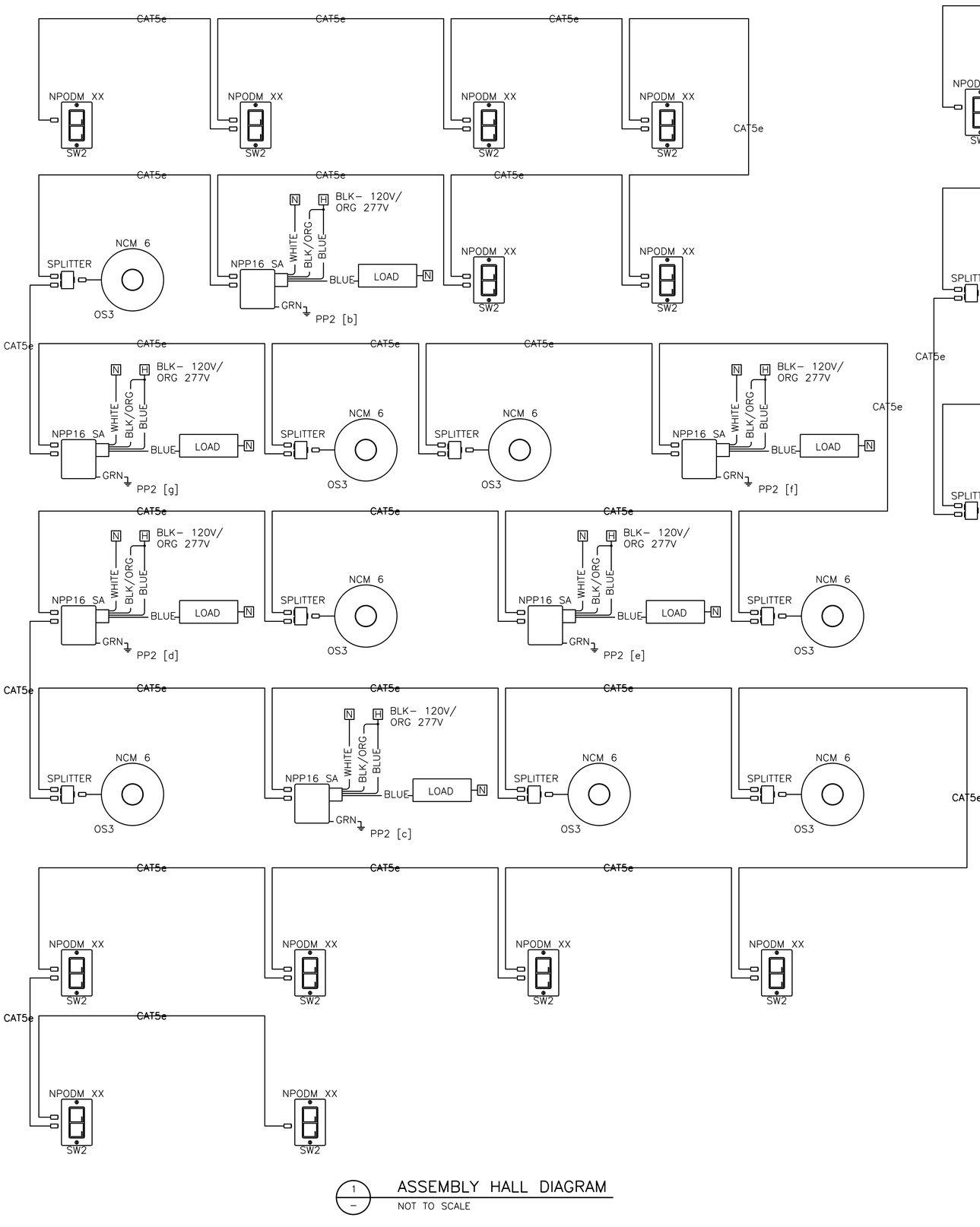
TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

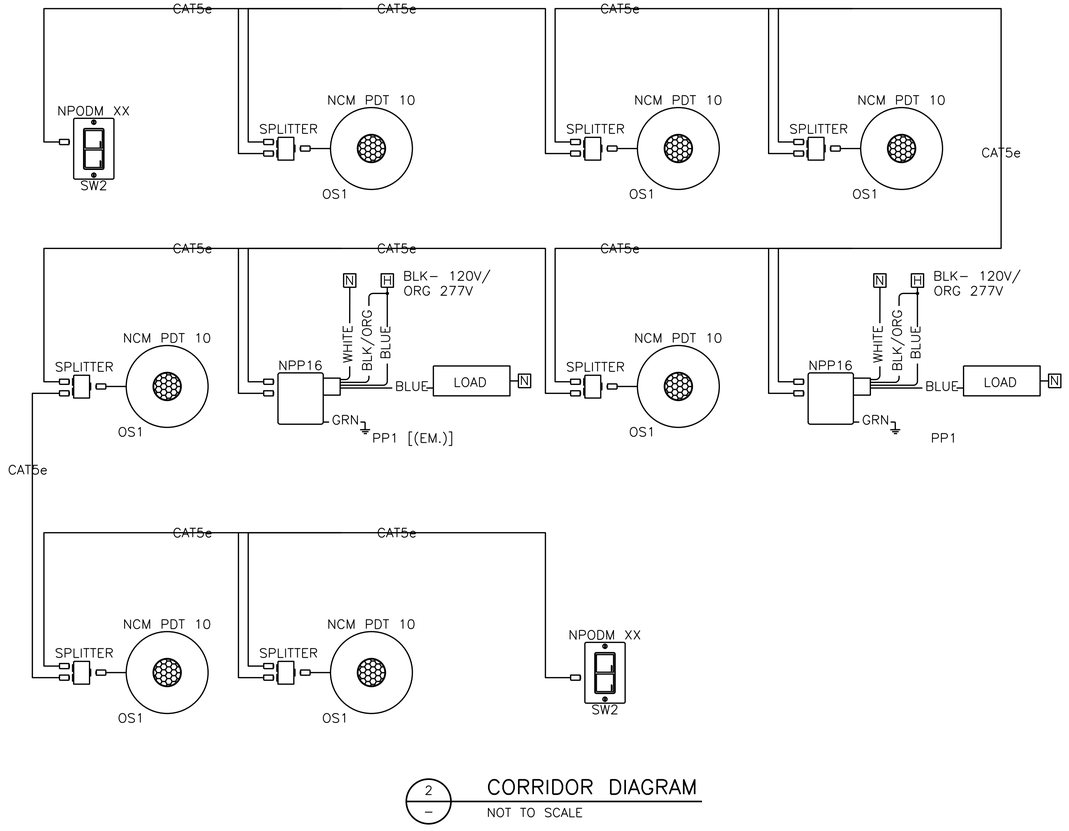
ELECTRICAL SCHEDULES III

E-26

SHT. 101 of 129



1 — ASSEMBLY HALL DIAGRAM
NOT TO SCALE



2 — CORRIDOR DIAGRAM
NOT TO SCALE

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: JF
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

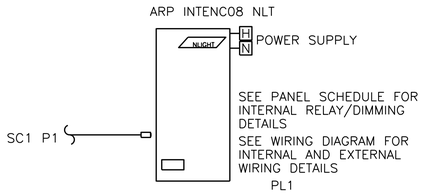
TXARNG CFMO

ELECTRICAL LIGHTING CONTROL DIAGRAMS I

E-27

SHT. 102 of 129

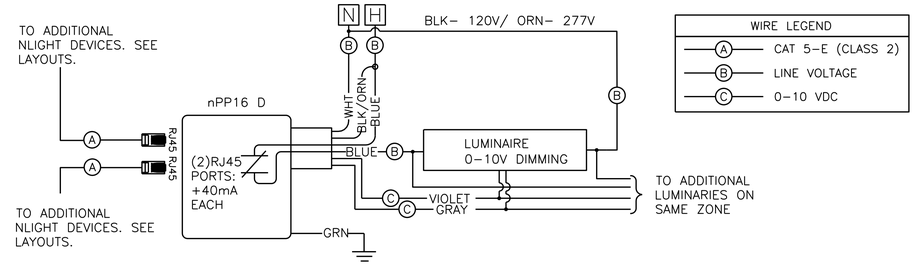
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18



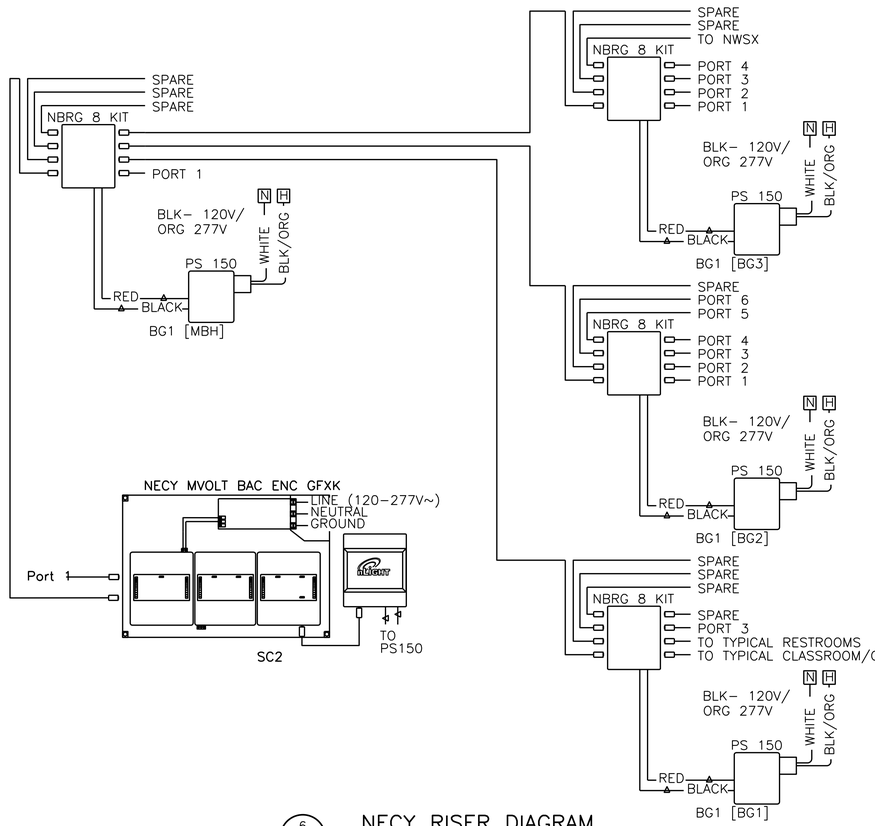
PANEL ARP1 LOAD SCHEDULE- 120/277V

Area	Zone Name	Breaker #	Voltage	Output#	Fixture Designation	Load Type	Fixture Watts
LOBBY	LOBB-1		277	1	D	0-10V	25
BREEZEWAY	BZW-1		277	2	C	NON-DIM	25
TOWER/ENTRY	TWR-1		277	3	C	NON-DIM	25
EXTERIOR	EXT-1		277	4	F	NON-DIM	26
EXTERIOR	EXT-2		277	5	W/F	NON-DIM	53/26
EXTERIOR	EXT-3		277	6	W/F	NON-DIM	53/26
EXTERIOR	EXT-4		277	7	W/F	NON-DIM	53/27
SPARE				8			

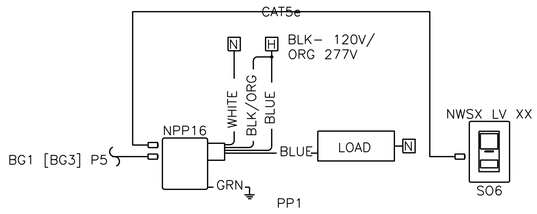
1 — PANEL 'ARP' RISER DIAGRAM
NOT TO SCALE



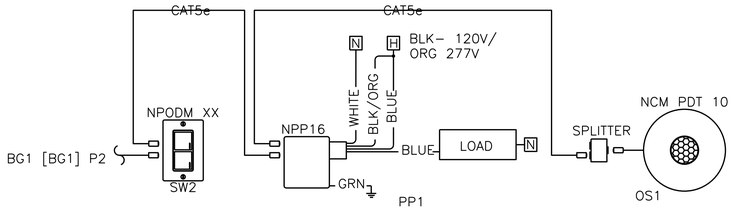
2 — TYPICAL WIRING DIAGRAM: POWER RELAY PACK NPP16D (DIMMING)
NOT TO SCALE



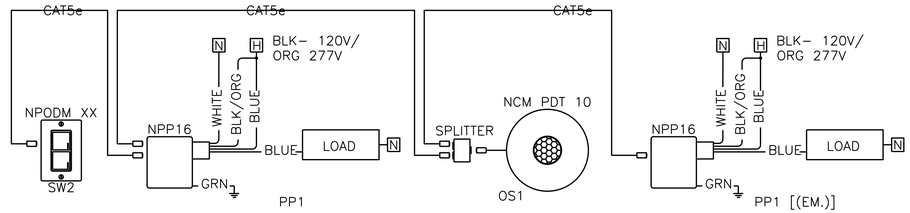
6 — NECY RISER DIAGRAM
NOT TO SCALE



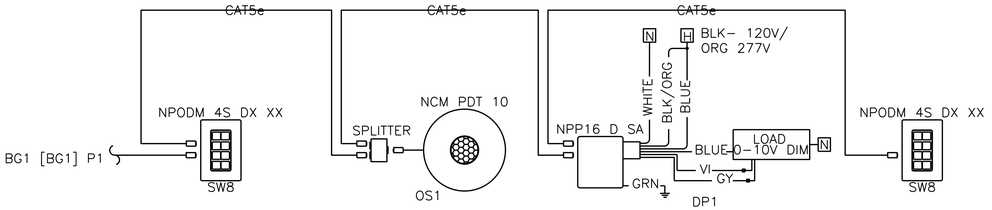
3 — TYPICAL NWSX
NOT TO SCALE



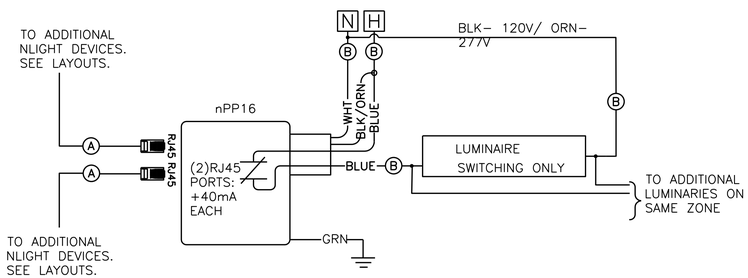
4 — TYPICAL RESTROOM
NOT TO SCALE



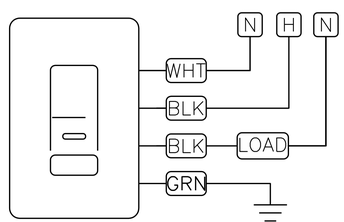
5 — TYPICAL OPEN OFFICE
NOT TO SCALE



7 — TYPICAL CLASSROOM/CONFERENCE RM
NOT TO SCALE

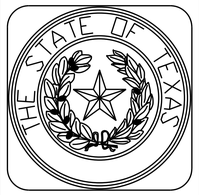


8 — TYPICAL WIRING DIAGRAM: POWER RELAY PACK NPP16
NOT TO SCALE



9 — TYPICAL WSX
NOT TO SCALE





PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: JF
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

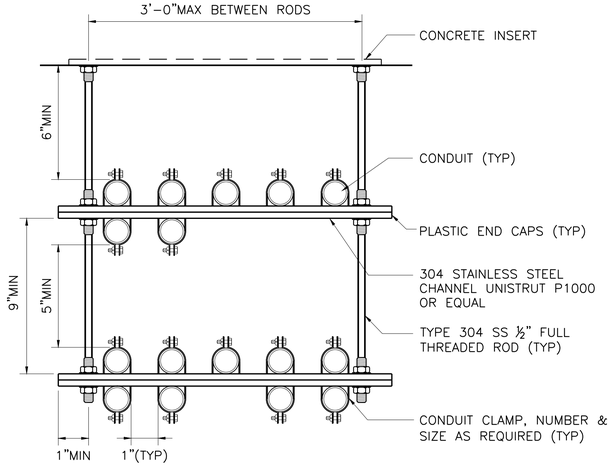
TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
AUSTIN, TEXAS 78763–5218
CAMP MABRY P.O. BOX 5218
(512) 782–6131 FAX (512) 782–1481
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

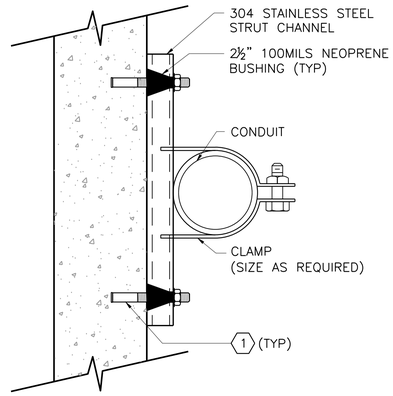
ELECTRICAL LIGHTING CONTROL DIAGRAMS II

E-28

SHT. 103 of 129

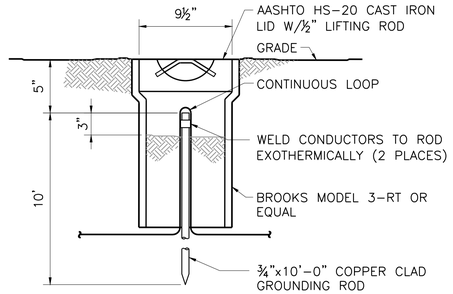


1 – CEILING MOUNTED CONDUIT RACK
NOT TO SCALE

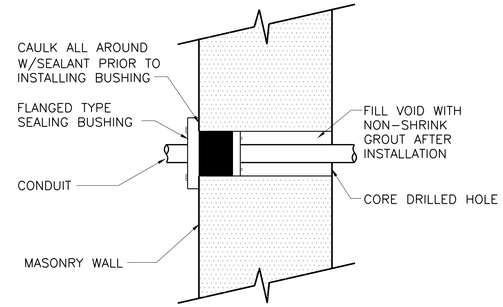


NO.3 NOTES BY SYMBOL "1"
1. ANCHORS SHALL BE ½"DIA STAINLESS STEEL KWIK BOLT III WITH 3½" EMBEDMENT. DO NOT DAMAGE EXISTING STRUCTURE DURING ANCHOR INSTALLMENT.

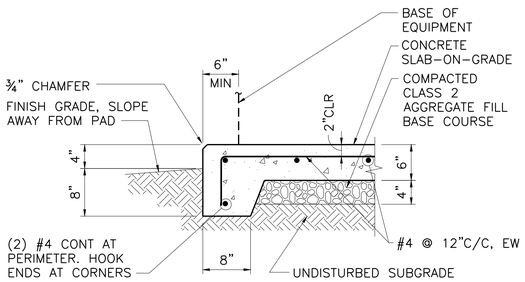
2 – CEILING OR WALL EXPOSED CONDUIT INSTALLATION
NOT TO SCALE



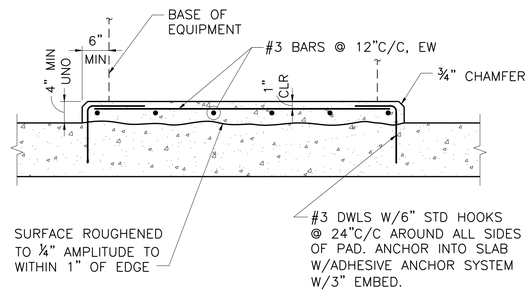
3 – GROUND ROD DETAIL
NOT TO SCALE



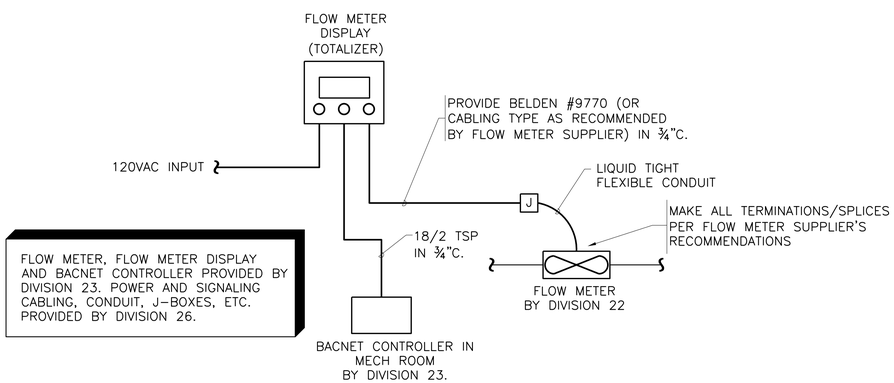
4 – WATERTIGHT CONDUIT PENETRATION
NOT TO SCALE



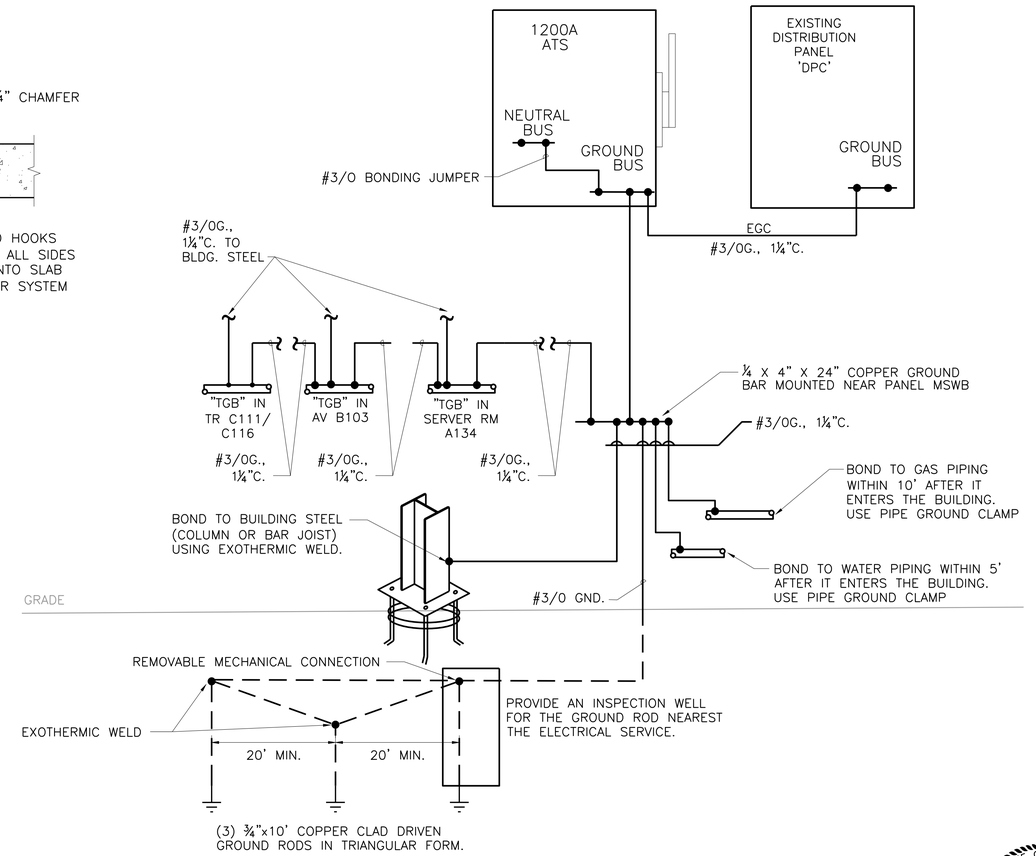
5 – TYPICAL EXTERIOR EQUIPMENT PAD
NOT TO SCALE



6 – INTERIOR EQUIPMENT PAD
NOT TO SCALE

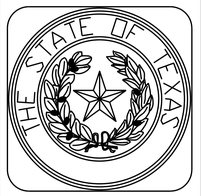


7 – FLOW METER/TOTALIZER WIRING DIAGRAM
NOT TO SCALE



8 – GROUNDING DIAGRAM
NOT TO SCALE





PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL DETAILS I

E-29

SHT. 104 of 129

SYSTEM OUTPUTS

SYSTEM INPUT		FA/MASS NOTIFICATION ANNUNCIATION						NOTIFICATION										LIFE SAFETY AND SUPPLEMENTAL CONTROLS							
		ACTUATE COMMON ALARM SIGNAL INDICATOR	ACTUATE AUDIBLE ALARM SIGNAL	ACTUATE COMMON SUPERVISORY SIGNAL INDICATOR	ACTUATE AUDIBLE SUPERVISORY SIGNAL	ACTUATE COMMON TROUBLE SIGNAL INDICATOR	ACTUATE AUDIBLE TROUBLE SIGNAL	DISPLAY STATUS	BROADCAST FIRE ALARM SIGNAL THROUGH SPEAKERS	BROADCAST MASS NOTIFICATION SIGNAL THROUGH SPEAKERS	ACTIVATE MASS NOTIFICATION STROBES	DE-ACTIVATE FIRE ALARM STROBES	BROADCAST GIANT VOICE SIGNAL THROUGH SPEAKERS (IF PRESENT)	SILENCE FIRE ALARM SIGNAL	ACTIVATE EXTERIOR HORN/STROBE				RELEASE MAGNETICALLY HELD SMOKE DOORS	UNLOCK EXITS/ACCESS CONTROL	SHUT DOWN DUCT FIRE SMOKE DAMPERS	TRANSMIT MNS ACTIVATE TO TRANSMIT TO REMOTE STATION	MNS OVERRIDE OF ACTIVE FIRE ALARM	TRANSMIT ALARM SIGNAL TO REMOTE STATION	TRANSMIT TROUBLE SIGNAL TO REMOTE STATION	TRANSMIT SUPERVISORY SIGNAL TO REMOTE STATION
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	MANUAL PULL STATION	●	●					●	●											●				●		
2	SMOKE (OR HEAT) DETECTOR	●	●					●	●											●				●		
3	DUCT DETECTOR			●	●			●													●					●
4	MONITOR POINT: KITCHEN HOOD EXHAUST FAN	●	●					●	●											●				●		
5	FIRE ALARM SYSTEM LOW BATTERY					●	●	●																	●	
6	FIRE ALARM SYSTEM AC POWER FAILURE					●	●	●												●					●	
7	OPEN CIRCUIT					●	●	●																	●	
8	GROUND FAULT					●	●	●																	●	
9	NOTIFICATION APPLIANCE SHORT CIRCUIT					●	●	●																	●	
10	MASS NOTIFICATION MESSAGE (PUSHBUTTON ON LOC)									●	●	●	●	●									●	●		
11	MASS NOTIFICATION LIVE PAGE (PUSHBUTTON ON LOC)									●	●	●	●	●									●	●		
12	FIRE ALARM MESSAGE (PUSHBUTTON ON LOC)								●																	
13	MASS NOTIFICATION MESSAGE (PUSHBUTTON ON FACP)									●	●	●	●	●									●	●		
14	MASS NOTIFICATION LIVE PAGE (PUSHBUTTON ON FACP)									●	●	●	●	●									●	●		
15	FIRE ALARM MESSAGE (PUSHBUTTON ON FACP)								●																	
16	HVAC SHUTDOWN (PUSHBUTTON ON FACP)																				●					
17	CONTACT GIANT VOICE (IF PRESENT)												●	●												
18	FIRE ALARM MESSAGE (PUSHBUTTON ON FACP)																						●	●		
19	FIRE ALARM MESSAGE (PUSHBUTTON ON FACP)																									
20	CARBON MONOXIDE DETECTOR	●	●					●	●											●				●		
21	CARBON DIOXIDE DETECTOR	●	●					●	●											●				●		

SEQUENCE OF OPERATIONS FOR FIRE ALARM/MASS NOTIFICATION CONTROL PANEL

1 –

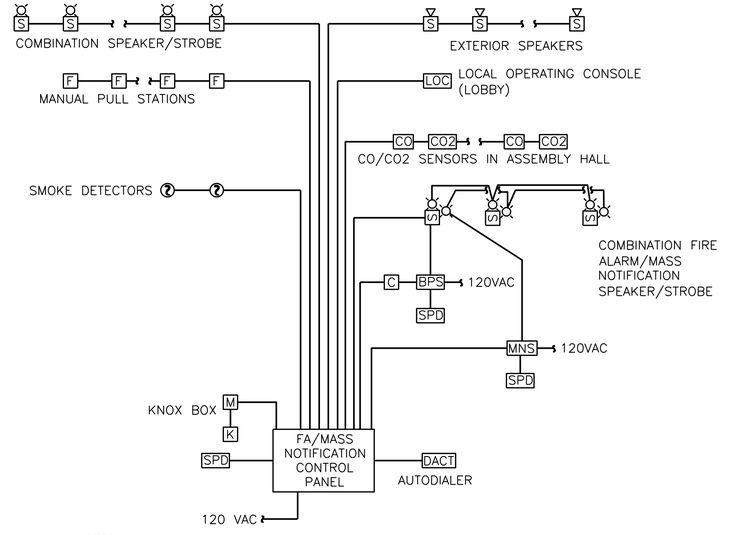
NOT TO SCALE

FIRE ALARM/MASS NOTIFICATION GENERAL NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH NFPA72, NATIONAL FIRE ALARM CODE, MOST RECENT EDITION.
2. ALL EQUIPMENT AND DEVICES SHOWN HATCHED SHALL BE REMOVED.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ALL ABANDONED CONDUIT. FIELD VERIFY ALL REQUIREMENTS.
4. REMOVE ALL SMOKE DETECTORS, HEAT DETECTORS, ETC. AND ALL ASSOCIATED CONDUIT AND CONDUCTORS BACK TO SOURCE.
5. RETAIN BACKBOXES OF EXISTING FIRE ALARM DEVICES FOR REUSE WHERE PRACTICAL. IF THE EXISTING BACKBOX WILL NOT BE REUSED, PROVIDE A COVERPLATE AND ABANDON IN PLACE.
6. ALL NEW FIRE ALARM CABLING SHALL BE INSTALLED IN CONDUIT.

FA/MASS NOTIFICATION SYMBOLS LEGEND

SYMBOL	DESCRIPTION
FACP	FIRE ALARM CONTROL PANEL
K	KNOX BOX
LOC	LOCAL OPERATING CONSOLE w/HANDSET FOR MAKING ANNOUNCEMENTS
F	MANUAL PULL STATION
M	MONITOR MODULE
C	CONTROL MODULE
TS	TAMPER SWITCH
FS	FLOW SWITCH
BPS	FIRE ALARM POWER SUPPLY
MNS	MASS NOTIFICATION POWER SUPPLY
DACT	DIGITAL ALARM COMMUNICATING TRANSMITTER (AUTO DIALER)
SPD	SURGE PROTECTION DEVICE
	DUCT DETECTOR–PHOTOELECTRIC TYPE
	SMOKE DETECTOR–PHOTOELECTRIC TYPE
C S XXcd XXdb	COMBINATION SPEAKER/STROBE "C" – INDICATES CEILING MOUNTED "XXcd" – INDICATES CANDELA RATING "XXdb" – INDICATES SOUND PRESSURE LEVEL
S WP	WEATHER–PROOF SPEAKER, BULL HORN TYPE
C S XXdb	SPEAKER "C" – INDICATES CEILING MOUNTED "XXdb" – INDICATES SOUND PRESSURE LEVEL
S XXcd XXdb R/W	COMBINATION FIRE/MASS SPEAKER/STROBE "XXcd" – CANDELA "XXdb" – DECIBEL R/W – INDICATES RED/WHITE
XXcd	STROBE 'XXcd" – INDICATES CANDELA RATING
CO	CARBON MONOXIDE SENSOR PROVIDED BY BAS CONTRACTOR
CO2	CARBON DIOXIDE SENSOR PROVIDED BY BAS CONTRACTOR
FPS	FIRE ALARM AUXILIARY POWER SUPPLY
MPS	MASS NOTIFICATION AUXILIARY POWER SUPPLY
AIM	KITCHEN HOOD INTERFACE MODULE



NOTES:
1. REFER TO FLOOR PLANS FOR EXACT NUMBER OF DEVICES.
2. THIS DIAGRAM IS SCHEMATIC IN NATURE.
3. ALL INITIATION DEVICES CAN BE ON THE SAME SLC LOOP.

FIRE ALARM/MASS NOTIFICATION SYSTEM RISER

2 –

NOT TO SCALE

STATE OF TEXAS · TERESA CASTILLON · 111323 · LICENSED · PROFESSIONAL ENGINEER · 4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HW
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763–5218
(512) 782–6131 FAX (512) 782–1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

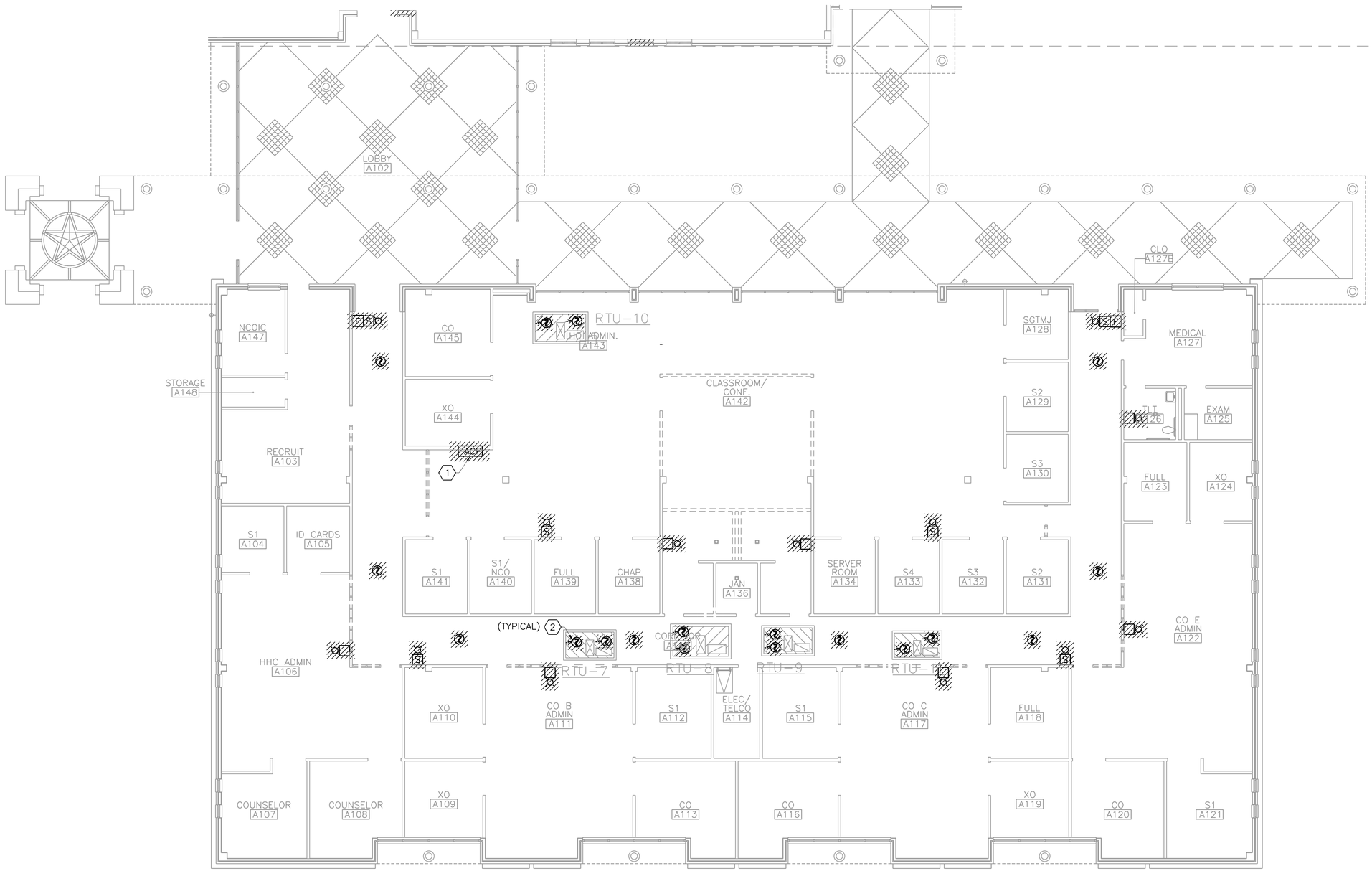
FIRE ALARM LEGEND

FA-1

SHT. 105 of 129

NOTES BY SYMBOL "⬡"

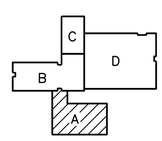
1. REMOVE FIRE ALARM CONTROL PANEL AND ALL ASSOCIATED WIRING AND CONDUIT. PATCH AND REPAIR WALL TO MATCH EXISTING.
2. REMOVE DUCT DETECTOR.



NORTH TRUE / NORTH PLAN

1 — FIRE ALARM DEMOLITION PLAN – AREA 'A'

1/8"=1'-0"



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HW
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO RC MAJOR MAINTENANCE

TXARNG CFMO

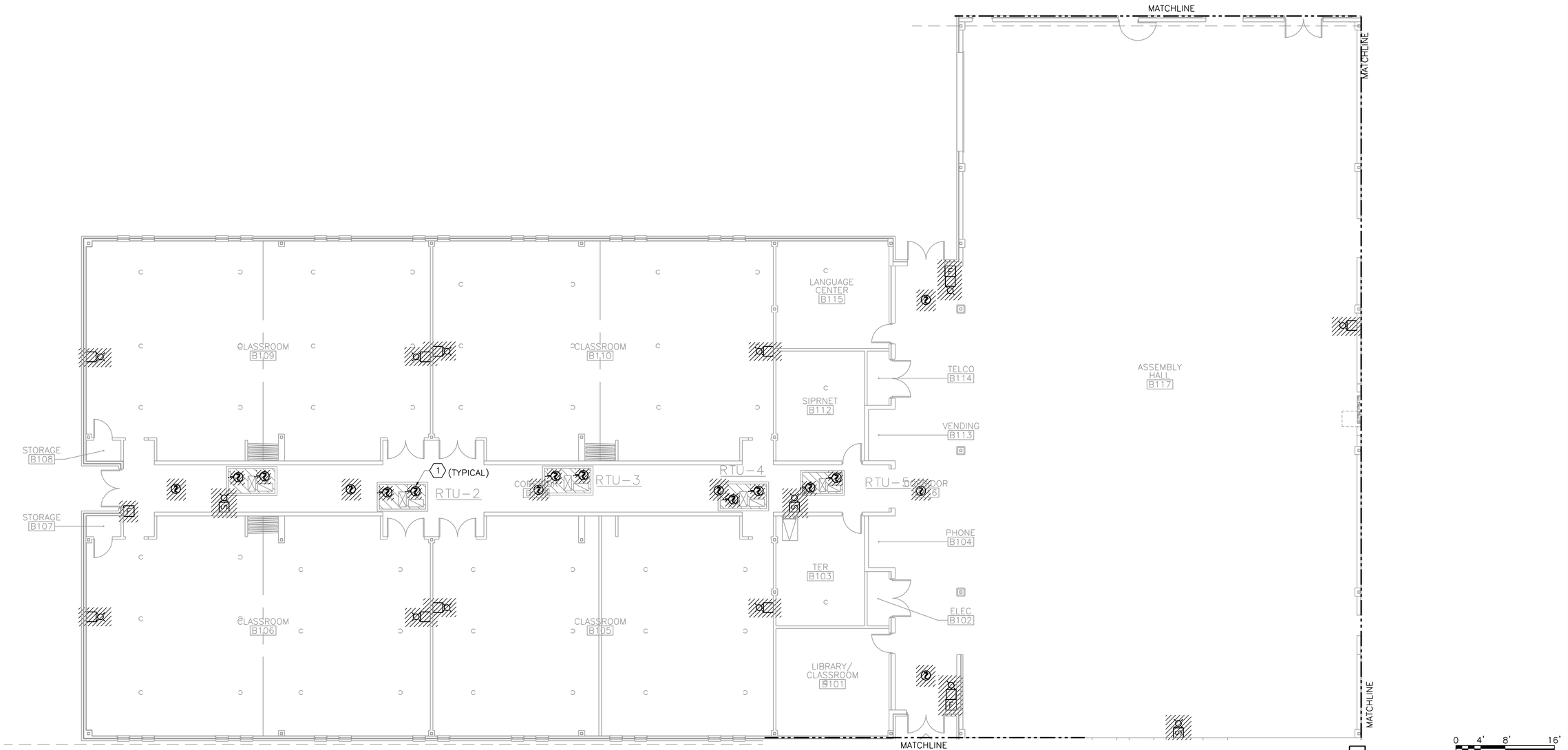
FIRE ALARM DEMOLITION PLAN - AREA 'A'

FA-2

SHT. 106 of 129

NOTES BY SYMBOL "⬡"

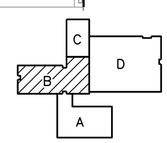
1. REMOVE DUCT DETECTOR.



NORTH TRUE / NORTH PLAN 1

FIRE ALARM DEMOLITION PLAN – AREA 'B'

1/8"=1'-0"



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

Teresa Castillon

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HW
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

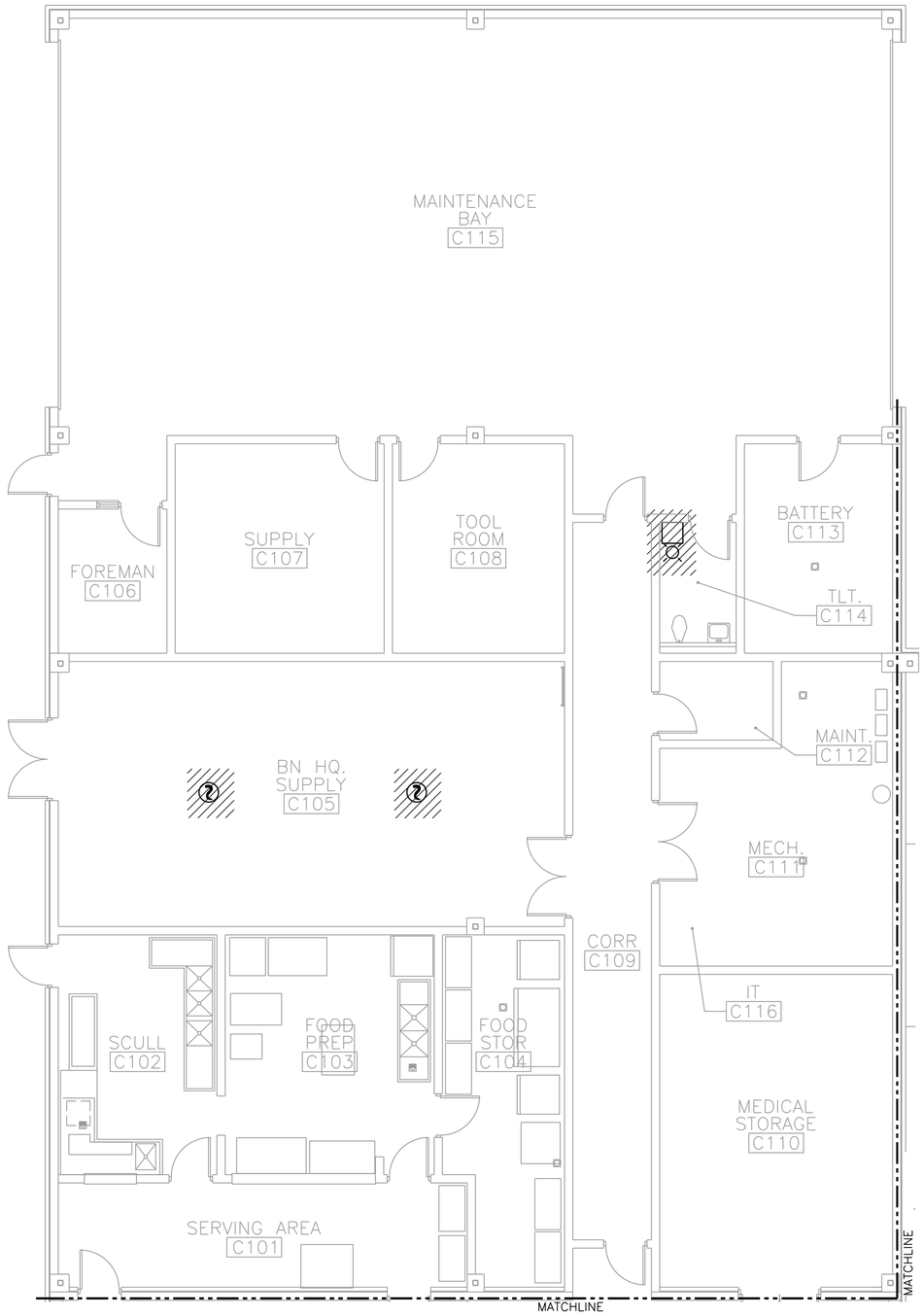
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

FIRE ALARM DEMOLITION PLAN - AREA 'B'

FA-3

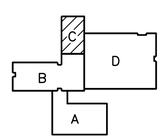
SHT. 107 of 129



NORTH TRUE NORTH PLAN 1 —

FIRE ALARM DEMOLITION PLAN – AREA 'C'

3/16"=1'-0"



KEY PLAN

0 4' 8'

3/16"=1'-0"

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HW
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

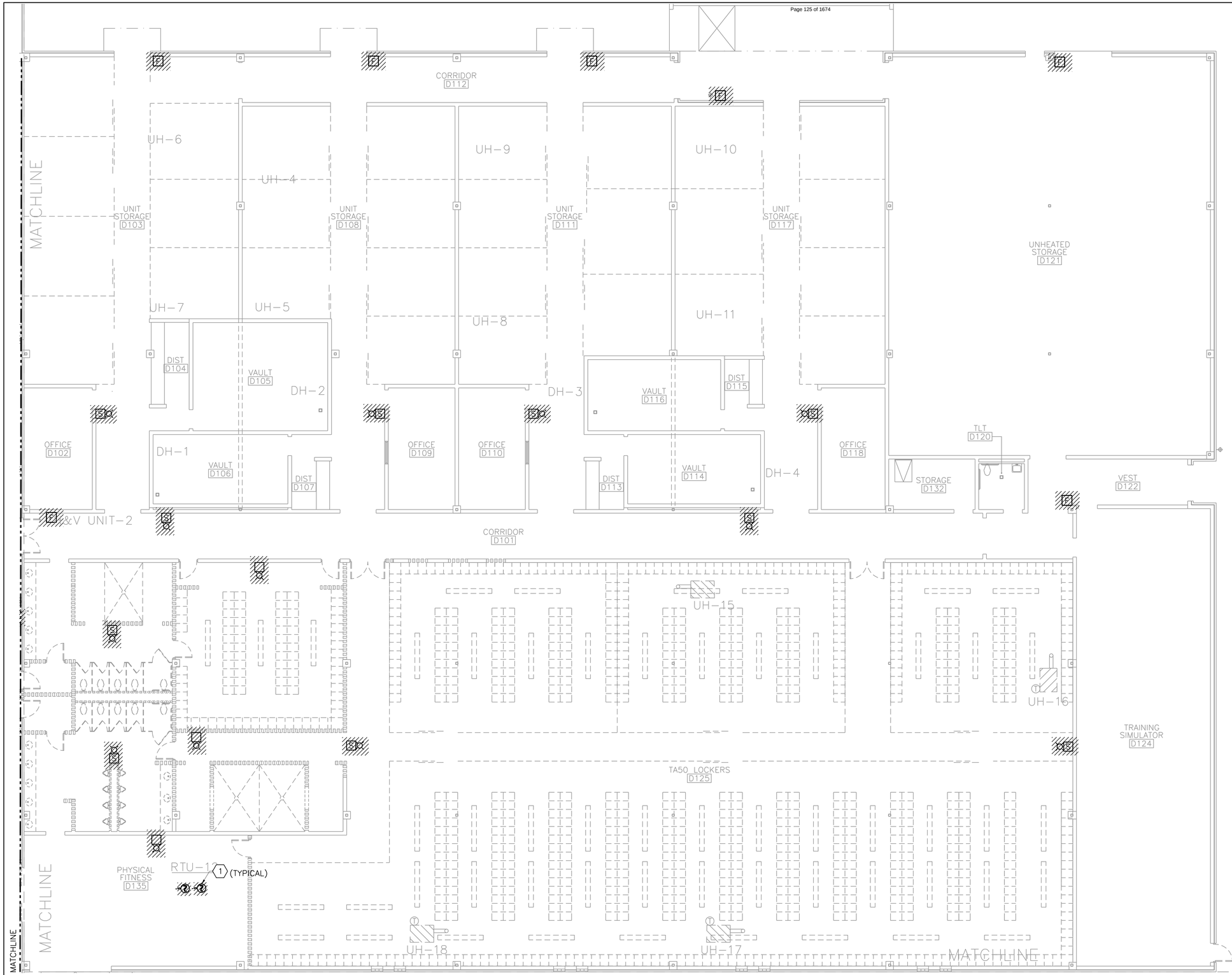
FIRE ALARM DEMOLITION PLAN - AREA 'C'

FA-4

SHT. 108 of 129

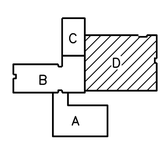
NOTES BY SYMBOL "⬡"

1. REMOVE DUCT DETECTOR.



FIRE ALARM DEMOLITION PLAN – AREA 'D'

1/8"=1'-0"



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HW
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

FIRE ALARM DEMOLITION PLAN - AREA 'D'

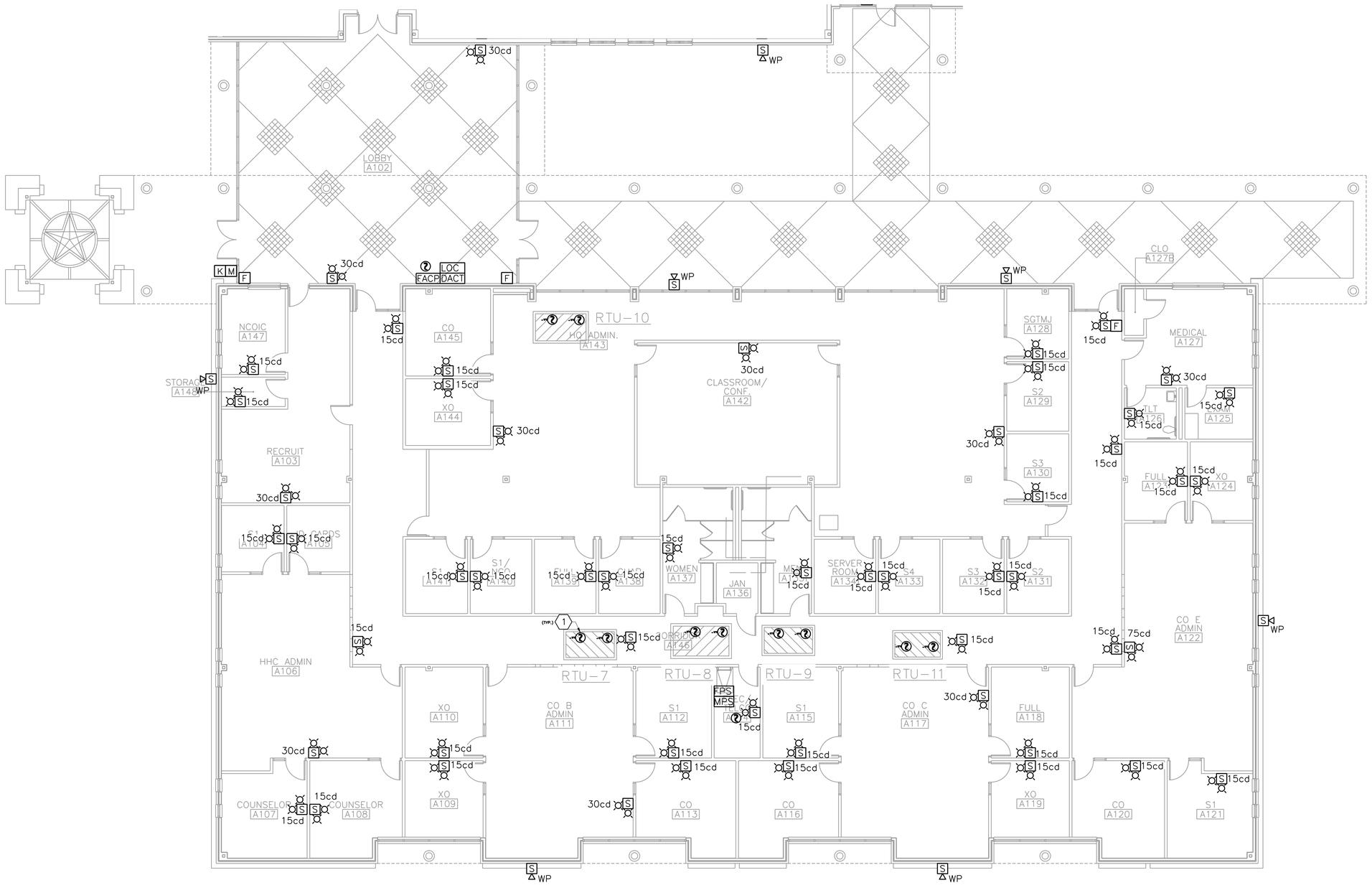
FA-5

SHT. 109 of 129

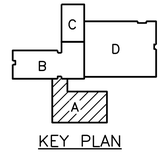
TERESA CASTILLON 111323 LICENSED PROFESSIONAL ENGINEER 4/20/18

NOTES BY SYMBOL "⬡"

1. DUCT DETECORS TO BE PROVIDED BY OTHERS. PROVIDE CONNECTION TO FIRE ALARM/MASS NOTIFICATION SYSTEM. COORDINATE REQUIREMENTS WITH MECHANICAL CONTRACTOR.



FIRE ALARM PLAN – AREA 'A'
1/8"=1'-0"



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

TERESA CASTILLON 111323 LICENSED PROFESSIONAL ENGINEER 4/20/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HW
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

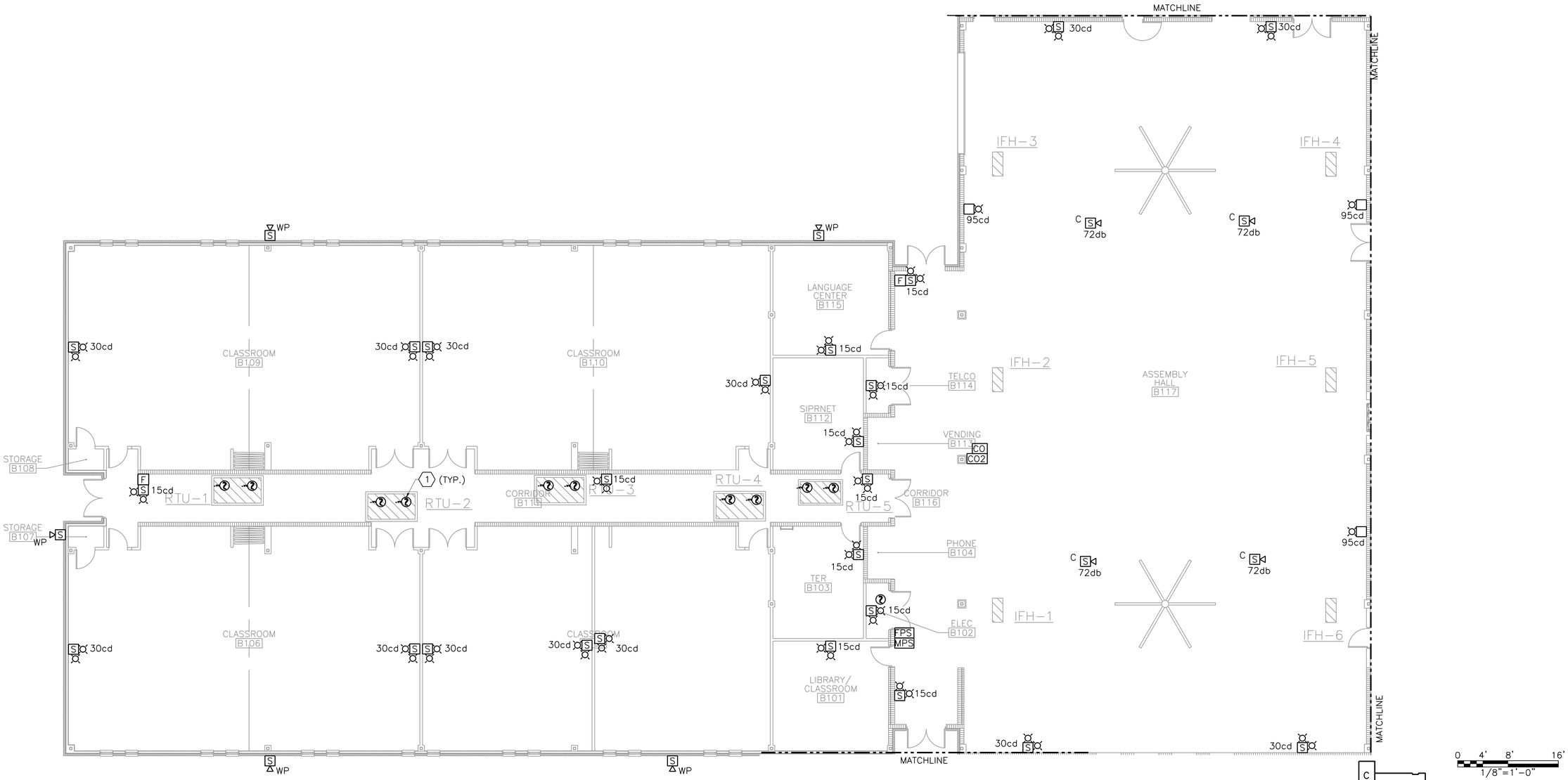
FIRE ALARM PLAN - AREA 'A'

FA-6

SHT. 110 of 129

NOTES BY SYMBOL "⬡"

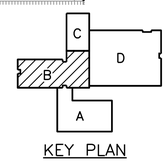
1. DUCT DETECORS TO BE PROVIDED BY OTHERS. PROVIDE CONNECTION TO FIRE ALARM/MASS NOTIFICATION SYSTEM. COORDINATE REQUIREMENTS WITH MECHANICAL CONTRACTOR.



NORTH TRUE NORTH PLAN 1 –

FIRE ALARM PLAN – AREA 'B'

1/8"=1'-0"



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HW
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

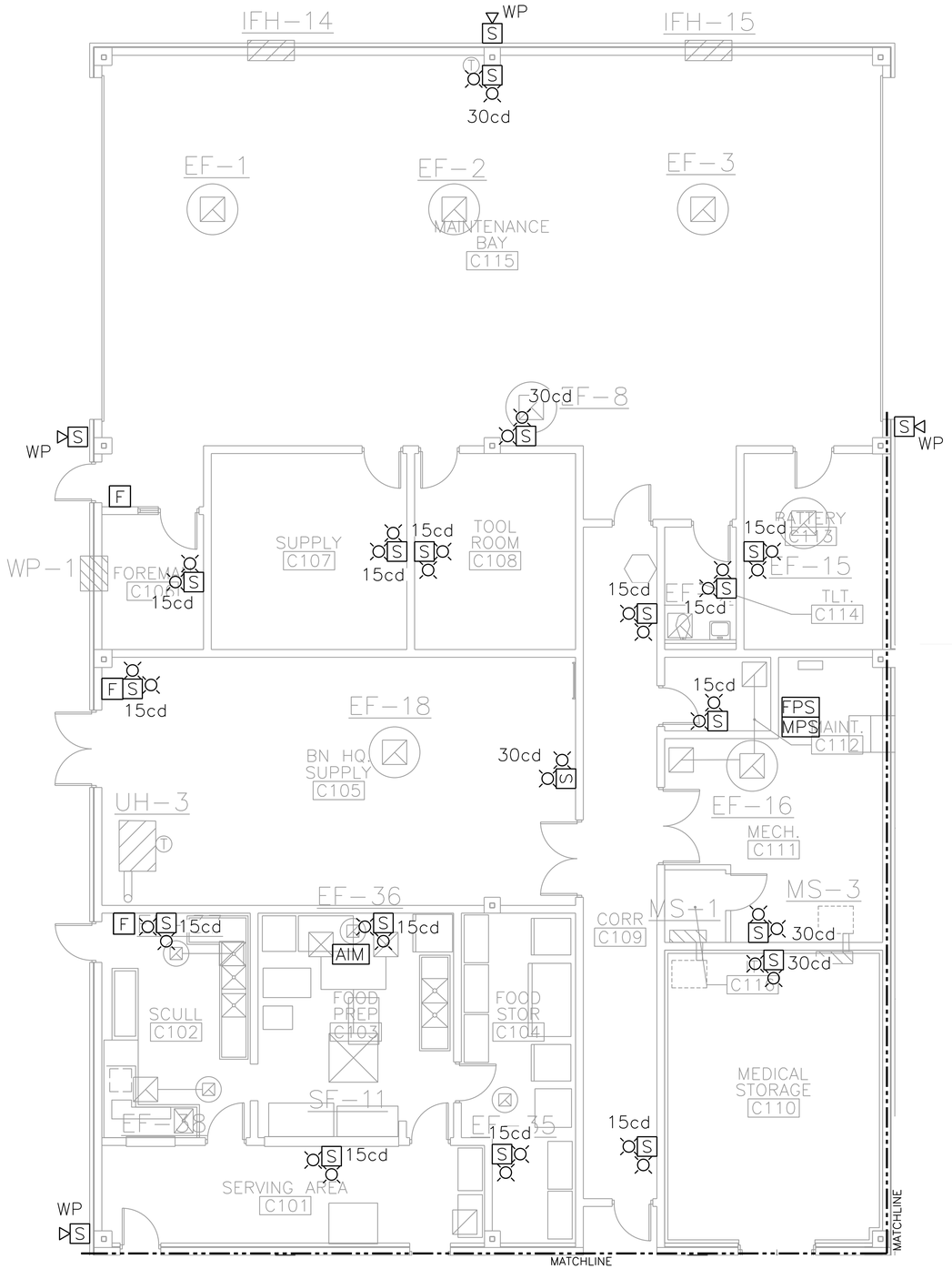
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

FIRE ALARM PLAN - AREA 'B'

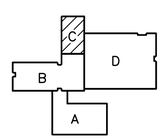
FA-7

SHT. 111 of 129



FIRE ALARM PLAN – AREA 'C'

3/16"=1'-0"



KEY PLAN

0 4' 8'

3/16"=1'-0"

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED
PROFESSIONAL ENGINEER
4/20/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HW
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763–5218
(512) 782–6131
FAX (512) 782–1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

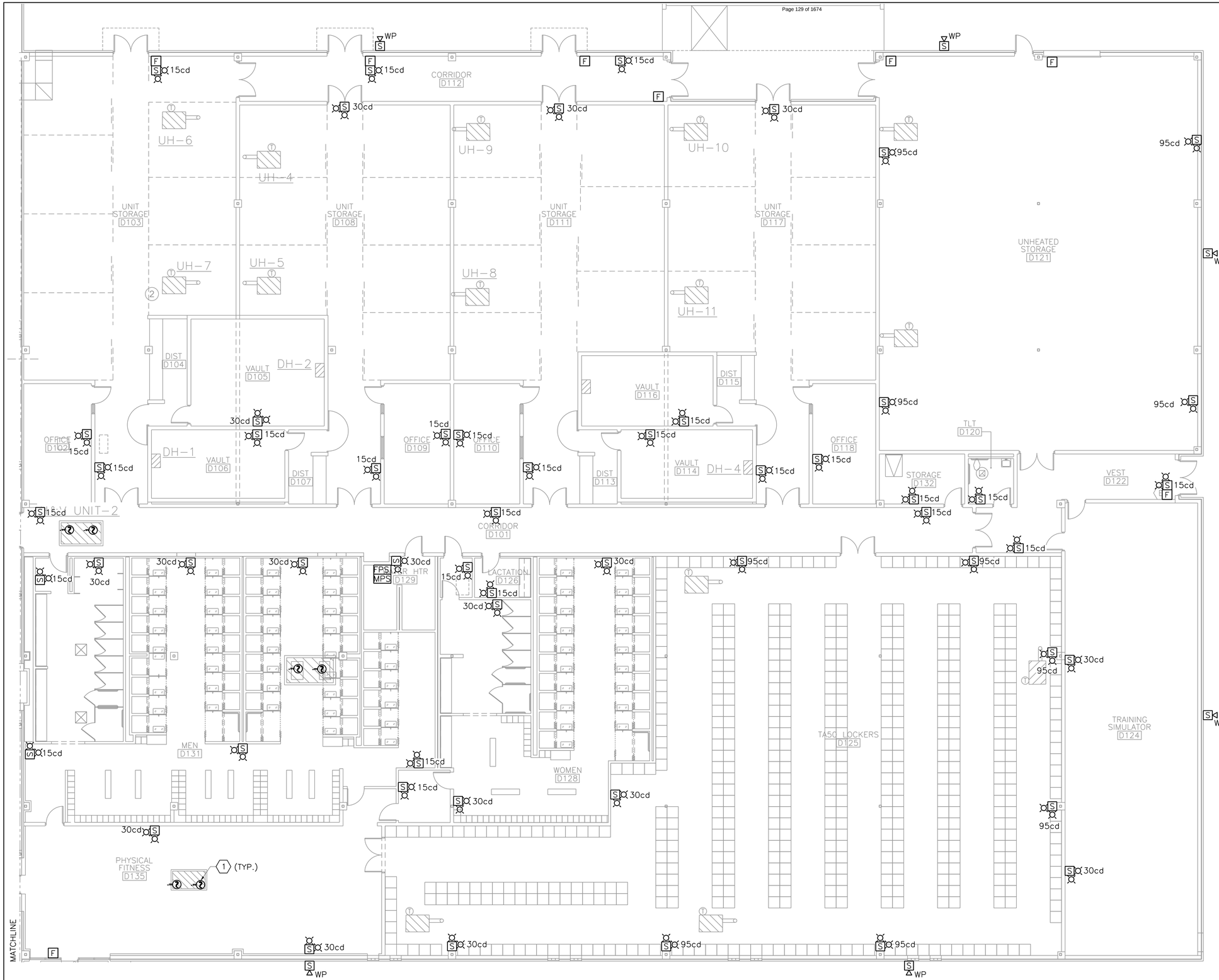
FIRE ALARM PLAN - AREA 'C'

FA-8

SHT. 112 of 129

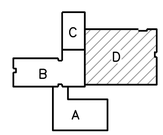
NOTES BY SYMBOL "⬡"

1. DUCT DETECORS TO BE PROVIDED BY OTHERS. PROVIDE CONNECTION TO FIRE ALARM/MASS NOTIFICATION SYSTEM. COORDINATE REQUIREMENTS WITH MECHANICAL CONTRACTOR.



FIRE ALARM PLAN – AREA 'D'

1/8"=1'-0"



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLÓN
111323
LICENSED PROFESSIONAL ENGINEER
4/20/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ELECTRICAL PLAN - AREA 'D'

FA-9

SHT. 113 of 129

ABBREVIATIONS: (ALL ABBREVIATIONS SHOWN ARE NOT NECESSARILY USED ON DRAWINGS)

A

ABV	ABOVE
ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
AP	ACCESS POINT
ARCH	ARCHITECT, ARCHITECTURAL
AWG	AMERICAN WIRE GAUGE

B

BLDG	BUILDING
BMS	BUILDING MANAGEMENT SYSTEM

C

C	CONDUIT
CFCI	CONTRACTOR FURNISHED CONTRACTOR INSTALLED
CLG	CEILING
CL	CEILING LINE
COMM	COMMUNICATIONS
CONF	CONFERENCE
CORR	CORRIDOR
CR	COMMUNICATIONS ROOM

D

DEMO	DEMOLISH
DIA	DIAMETER
DN	DOWN

E

EA	EACH
EF	ENTRANCE FACILITY
EL	ELEVATOR
ELEC	ELECTRICAL
EMT	ELECTRICAL METALLIC TUBING
ENCL	ENCLOSURE
EXIST	EXISTING

F

FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FOC	FIBER OPTIC CABLE
FMS	FACILITIES MAINTENANCE SHOP

G

GA	GAUGE
GALV	GALVANIZED
G,GND	GROUND
GUI	GRAPHIC USER INTERFACE

H

HH	HAND HOLES

I

ID	INSIDE DIAMETER
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
IDF	INTERMEDIATE DISTRIBUTION FRAME

J

J-BOX	JUNCTION BOX

K

KVA	KILO VOLT AMPERE
KW	KILOWATTS

L

LB	POUNDS
LCD	LIQUID CRYSTAL DISPLAY
LF	LINEAR FEET
LTG	LIGHTING

M

MATV	MASTER ANTENNA TV
MAX	MAXIMUM
MDF	MAIN DISTRIBUTION FRAME
MECH	MECHANICAL
MT	MOUNTED

N

N/A	NOT APPLICABLE
NEC	NATIONAL ELECTRIC CODE
NEMA	NATIONAL ELECTRIC MANUFACTURERS ASSOCIATION
NIC	NOT IN CONTRACT
N.T.S	NOT TO SCALE

O

O.A.R.	OWNER AUTHORIZED REPRESENTATIVE
OD	OUTSIDE DIAMETER
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED OWNER INSTALLED

P

PDS	PREMISE DISTRIBUTION SYSTEM
PVC	POLYVINYL CHLORIDE
PWR	POWER

Q

QTY	QUANTITY

R

RCP	REFLECTED CEILING PLAN
REF:	REFERENCE, REFER
REST	RESTROOM
REQD	REQUIRED
REV	REVISED, REVISION, REVISE
RGS	RIGID GALVANIZED STEEL
RM	ROOM
RMC	RIGID METALLIC CONDUIT
RU	RACK UNIT

S

SCS	STRUCTURED CABLING SYSTEM
SECT	SECTION
SF	SQUARE FEET
ST	STAIR
STD	STANDARD
STOR	STORAGE
SUSP	SUSPEND
SVC	SERVICE

T

TBD	TO BE DETERMINED
TR	TELECOMMUNICATIONS ROOM
TEF	TELECOM ENTRANCE FACILITY
TER	TELECOM EQUIPMENT ROOM
TMD	TEXAS MILITARY DEPARTMENT
TGB	TELECOMMUNICATIONS GROUND BUSBAR
THRU	THROUGH
TYP	TYPICAL

U

UL	UNDERWRITERS LABORATORIES, INC.
UNO	UNLESS NOTED OTHERWISE
UTP	UNSHIELDED TWISTED PAIR

V

VERT	VERTICAL
VEST	VESTIBULE
VIP	VERY IMPORTANT PERSON

W

W/	WITH
WAO	WORK AREA OUTLET
W/O	WITHOUT
WP	WEATHER-PROOF

GENERAL NOTES:

1. DRAWINGS ARE DRAWN TO SCALE UNLESS OTHERWISE NOTED. CONTRACTOR IS RESPONSIBLE FOR COORDINATING EXACT ROUTING OF ALL SERVICES WITH EXISTING CONDITIONS AND WITH ALL OTHER TRADES.
2. IN THE INSTALLATION OF THIS WORK, THE CONTRACTOR SHALL COMPLY IN EVERY WAY WITH THE REQUIREMENTS OF LOCAL LAWS AND ORDINANCES, THE LAWS OF THE STATE OF TEXAS, AND THE NATIONAL ELECTRICAL CODE.
3. CAREFULLY EXAMINE THE PREMISES TO DETERMINE THE EXTENT OF WORK AND THE CONDITIONS UNDER WHICH IT MUST BE DONE. IF THERE ARE ANY QUESTIONS REGARDING THE PROJECT, THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING CLARIFICATIONS FROM THE DESIGN CONSULTANT OR THEIR DESIGNATED REPRESENTATIVE BEFORE PROCEEDING WITH WORK OR RELATED WORK IN QUESTION.
4. ANY DISCREPANCIES BETWEEN THESE PLANS AND ACTUAL FIELD CONDITIONS MUST BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE OAR FOR CLARIFICATION.
5. ALL WORK SHALL BE DONE IN A THOROUGH AND CONSCIENTIOUS MANNER ACCORDING TO INDUSTRY STANDARDS AND SHALL BE SUBJECT TO INSPECTION AND ACCEPTANCE. WORK THAT IS DEEMED SUBSTANDARD OR NOT TO INDUSTRY STANDARD WILL BE SUBJECT TO REPLACEMENT OR REPAIR AT NO ADDITIONAL COST TO THE OWNER OR GENERAL CONTRACTOR.
6. CONTRACTOR TO COORDINATE ALL DEMOLITION ACTIVITIES WITH GENERAL CONTRACTOR, OWNER AND SERVICE PROVIDERS PRIOR TO PERFORMANCE OF ALL ACTIVITIES.
7. CONTRACTOR MUST RETURN ALL ACTIVE EQUIPMENT AND ELECTRONICS REMOVED AS PART OF THE DEMOLITION SCOPE TO OWNER. ALL EQUIPMENT MUST BE REMOVED, STORED, LOGGED AND LABELED CAREFULLY.
8. PRIOR TO DEMOLITION OF ANY COMMUNICATIONS COPPER OR FIBER CABLES, CONTRACTOR SHALL VERIFY WITH DESIGN CONSULTANT AND OWNER THAT ALL ACTIVE CIRCUITS HAVE BEEN CUT OVER OR DEACTIVATED. DO NOT DEMO WITHOUT AUTHORIZATION FROM OWNER OR TENANTS.
9. THE CONTRACTOR SHALL PROVIDE, INSTALL, TERMINATE, PATCH, CROSS-CONNECT, LABEL, AND DOCUMENT COMMUNICATIONS CABLING SYSTEMS BASED ON THE PROJECT SPECIFICATIONS AND ACCOMPANYING DRAWINGS.
10. CONTRACTOR SHALL PROVIDE, INSTALL, TERMINATE, AND LABEL RACKS, PATCH PANELS, WIRE MANAGEMENT AND CABLING AS DESCRIBED IN THE DRAWINGS.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER BONDING AND GROUNDING OF THE SYSTEMS IN ACCORDANCE WITH APPLICABLE ELECTRICAL CODES AND ANSI-J-STD-607-C.
12. ALL CONDUITS SHALL BE ROUTED TO ACCESSIBLE CEILING SPACE OR AN ACCESS PANEL SHALL BE PROVIDED. ACCESS PANELS SHALL COMPLY WITH FIRE CODE.
13. DIVISION 26 ELECTRICAL CONTRACTOR TO PROVIDE (1) 4-11/16" X 4-11/16" X 2-1/8" BACKBOX AND SINGLE GANG DEVICE RING WITH (1) ONE-INCH CONDUIT TO EITHER THE CABLE TRAY OR ABOVE ACCESSIBLE CEILING AS REQUIRED FOR STANDARD, CEILING AND WALL MOUNTED TELEPHONE/DATA COMMUNICATION WORK-AREA-OUTLETS (WAO), UNLESS NOTED OTHERWISE.
14. COORDINATE WORK AREA OUTLET PLACEMENT WITH THE PLACEMENT OF ELECTRICAL OUTLETS WHEREVER POSSIBLE. IN ALL CASES THERE SHALL BE A ELECTRICAL OUTLET NO FURTHER THAN ONE STUD BAY DISTANCE FROM A LOW VOLTAGE WAO.

TELECOMM PATHWAY NOTES:

GENERAL:

1. CONDUITS SHALL HAVE A MAXIMUM 40% FILL RATIO. CABLE TRAY SHALL HAVE A MAXIMUM 50% FILL RATIO.
2. NON-CONTINUOUS CABLE SUPPORT SYSTEMS (J-HOOKS) INSTALLATION AND CONFIGURATION SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT REVISION LEVELS OF ANSI/EIA/TIA STANDARDS 568 & 569, NFPA 70 (NATIONAL ELECTRICAL CODE), APPLICABLE LOCAL CODES, AND TO THE MANUFACTURERS INSTALLATION INSTRUCTIONS AND THE NEMA VE-2 GUIDELINES.
3. REGARDLESS OF PATHWAY TYPE, ALL CABLING SHALL BE SUPPORTED AT A 5'-0" MAXIMUM INTERVAL.
4. UNLESS OTHERWISE NOTED, CABLE PATHWAY WITHIN ROOMS WILL RUN PARALLEL TO WALLS.
5. UNLESS OTHERWISE NOTED ALL CONDUITS ARE ONE-INCH IN DIAMETER.

CONDUIT:

1. CONDUIT RUNS SHALL NOT CONTAIN 90° CONDUIT BODIES (OR LB'S).
2. MAINTAIN PROPER CONDUIT BEND RADIUS IN ACCORDANCE WITH ANSI/EIA/TIA-569-B. FOR CONDUIT WITH AN INTERNAL DIAMETER OF 2" OR LESS, MAINTAIN A BEND RADIUS OF AT LEAST 6 TIMES THE INTERNAL CONDUIT DIAMETER. FOR CONDUIT WITH AN INTERNAL DIAMETER GREATER THAN 2", MAINTAIN A BEND RADIUS OF AT LEAST 10 TIMES THE INTERNAL CONDUIT DIAMETER.
3. DO NOT CONSIDER A PULL BOX AS A BEND. ALL CONDUITS MUST RUN STRAIGHT THROUGH A PULL BOX WITH THE BEND EITHER BEFORE OR AFTER THE PULL BOX.
4. REAM ALL CONDUIT ENDS. FIT STUBBED CONDUITS WITH AN INSULATED BUSHING TO ELIMINATE SHARP EDGES THAT MAY DAMAGE CABLE DURING INSTALLATION OR SERVICE. EQUIP ALL CONDUIT WITH PULL CORD WITH A MINIMUM TEST RATING OF 200LBS.
5. ALL OUTLET BOX CONDUITS SHALL BE ROUTED TO NEAREST ACCESSIBLE CEILING SPACE WHETHER OR NOT SHOWN AS SUCH ON DRAWINGS.

SYMBOL LEGEND (NOT ALL SYMBOLS MAY BE USED)

X Y	WALL VOICE/DATA MOUNTED OUTLET - "X" DENOTES QTY OF DATA SERVICES CAT6 CABLES, "Y" DENOTES QTY OF VOICE SERVICES CAT6 CABLES
X	WALL DATA MOUNTED OUTLET - "X" DENOTES QTY OF DATA SERVICES CAT6 CABLES
W	WALL MOUNTED PHONE AT 48" AFF. - (1) CAT6 VOICE CABLE
WAP	WIRELESS ACCESS POINT
	WIRE MESH CABLE TRAY, TYPICAL
	WALL MOUNT QUAD OUTLET - 5-20R
	WALL MOUNTED L5-20R
	CONDUIT TURNING UP
	CONDUIT TURNING DOWN
	CONDUIT UP
	CONDUIT DOWN
	CONDUIT TERMINATION (SLEEVE/STUB)

DEMOLITION GENERAL NOTES:

1. CONTRACTOR TO COORDINATE ALL DEMOLITION ACTIVITIES WITH GENERAL CONTRACTOR, OWNER AND SERVICE PROVIDERS PRIOR TO PERFORMANCE OF ALL ACTIVITIES.
2. CONTRACTOR SHALL COORDINATE REMOVAL OF ALL DEVICES AND THEIR REQUIREMENT TO BE DEMOLISHED, SALVAGED, REUSED OR RELOCATED WITH THE GENERAL CONTRACTOR AND OWNER PRIOR TO DEMOLITION.
3. EXISTING HORIZONTAL OUTLET CONDUITS INSIDE WALLS ARE TO REMAIN. INCLUDING THE BACKBOX AND CONDUIT UP TO ACCESSIBLE CEILING. THE EXISTING DATA CABLING IS TO BE DEMOLISHED AS PART OF THIS WORK. THE PATHWAY SHALL REMAIN AVAILABLE FOR FUTURE USE DURING CONSTRUCTION WHERE APPROPRIATE AND APPROVED.
4. CONTRACTOR MUST RETURN ALL ACTIVE EQUIPMENT AND ELECTRONICS REMOVED AS PART OF THE DEMOLITION SCOPE TO OWNER. ALL EQUIPMENT MUST BE REMOVED, STORED, LOGGED AND LABELED CAREFULLY.
5. PRIOR TO DEMOLITION OF ANY COMMUNICATIONS COPPER OR FIBER CABLES, CONTRACTOR SHALL VERIFY WITH DESIGN CONSULTANT AND OWNER THAT ALL ACTIVE CIRCUITS HAVE BEEN CUT OVER OR DEACTIVATED. DO NOT DEMO WITHOUT AUTHORIZATION FROM OWNER OR TENANTS.
6. CONTRACTOR SHALL PROTECT ANY EQUIPMENT IN THE DESIGNATED DEMOLITION AND/OR CONSTRUCTION AREA FROM DAMAGE PRIOR TO COMMENCING WORK.
7. REMOVAL OF EQUIPMENT AND DEVICES SHALL INCLUDE BRACKETS, CABLING, CONDUIT, JUNCTION BOXES, MOUNTING HARDWARE, TRIM PIECES AND RELATED EQUIPMENT HARDWARE.
8. ITEMS SHOWN ON DRAWINGS MAY NOT BE DRAWN TO EXACT SCALE. CONTRACTOR IS RESPONSIBLE FOR COORDINATING EXACT ROUTING OF ALL SERVICES WITH EXISTING CONDITIONS AND WITH OTHER TRADES.
9. IN THE EXECUTION OF THIS WORK, THE CONTRACTOR SHALL COMPLY IN EVERY WAY WITH THE REQUIREMENTS OF LOCAL LAWS AND ORDINANCES, THE LAWS OF THE STATE OF TEXAS, THE NATIONAL BOARD OF FIRE UNDERWRITERS, AND THE NATIONAL ELECTRICAL CODE.
10. CAREFULLY EXAMINE THE PREMISES TO DETERMINE THE EXTENT OF WORK AND CONDITION UNDER WHICH IT MUST BE DONE. IF THERE ARE ANY QUESTIONS REGARDING THE PROJECT, THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING CLARIFICATIONS FROM THE DESIGN CONSULTANT, OR THEIR DESIGNATED REPRESENTATIVE BEFORE PROCEEDING WITH WORK OR RELATED WORK IN QUESTION.
11. ANY DISCREPANCIES BETWEEN THESE PLANS AND ACTUAL FIELD CONDITIONS MUST BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE OWNER AUTHORIZED REPRESENTATIVE OR THEIR DESIGNATED REPRESENTATIVE FOR CLARIFICATION.
12. ALL WORK SHALL BE DONE IN A THOROUGH AND CONSCIENTIOUS MANNER ACCORDING TO INDUSTRY STANDARDS AND SHALL BE SUBJECT TO INSPECTION AND ACCEPTANCE. WORK THAT IS DEEMED SUB-STANDARD OR NOT TO INDUSTRY STANDARD WILL BE SUBJECT TO REPLACEMENT OR REPAIR AT NO ADDITIONAL COST TO THE OWNER OR GENERAL CONTRACTOR.
13. PRIOR TO STARTING THE INSTALLATION, THE ASSIGNED INSTALLATION SUPERVISOR OR LEAD TECHNICIAN SHALL PARTICIPATE IN A WALK-THROUGH OF THE PROJECT LOCATION WITH THE DESIGN CONSULTANT, OR THEIR DESIGNATED REPRESENTATIVE, TO REVIEW THE INSTALLATION DOCUMENTATION.
14. THE CONTRACTOR IS REQUIRED TO PROPERLY FIRESTOP ANY CORES, UTILIZED FOR THE PLACEMENT OF COMMUNICATIONS CABLING, WITH APPROVED FIRESTOPPING COMPOUND AND ACCORDING TO LOCAL AND NATIONAL CODES.
15. COMPLETION OF THIS WORK MUST BE COORDINATED WITH WORK BEING PERFORMED UNDER CONCURRENT, ADJACENT PROJECTS. CONTRACTOR SHALL COORDINATE WITH OWNER AND OTHER CONTRACTORS AS REQUIRED REGARDING SCHEDULE, PATHWAYS, LABELING, TESTING, ET AL.
16. COORDINATE TELECOM PATHWAYS WITH OTHER CONDUIT.
17. CONTRACTOR TO PERFORM DEMOLITION OF CABLING BEGINNING AT ENDS OF THE CABLING RUN TO VERIFY CONNECTIVITY STATUS. REGARDLESS OF ANY CABLING LABELS ATTACHED TO SUBJECT RUN.

IT SYSTEMS OVERVIEW:

TECHNOLOGY SYSTEMS OVERVIEW

THIS DRAWING PACKAGE CONSISTS OF TECHNOLOGY SYSTEMS INFRASTRUCTURE REQUIRED IN THE DEMOLITION, CONSTRUCTION AND RENOVATION OF THE EXISTING WESLACO ARMORY READINESS CENTER FACILITY. THIS PACKAGE PROVIDES LOCATIONS OF DEVICE AND CABLING TERMINATIONS, MAJOR CABLING PATHWAY ACCOMMODATIONS AND COMMUNICATIONS ROOMS REQUIREMENTS. THE TECHNOLOGY SYSTEMS INCLUDED IN THIS PACKAGE ARE IDENTIFIED BELOW.

DEMOLITION

CONTRACTOR IS RESPONSIBLE FOR DEMOLITION OF ALL VOICE/DATA SYSTEMS CABLING WITHIN THE SCOPE OF WORK BOUNDARIES. CONTRACTOR MUST PROTECT AND LABEL ALL INFRASTRUCTURE SHOWN ON DRAWINGS TO REMAIN THROUGHOUT CONSTRUCTION. ALL PHONE, NETWORK SWITCHGEAR AND AUDIO-VISUAL END DEVICES SHALL BE REMOVED BY OWNER. CONTRACTOR SHALL RETURN ANY ADDITIONAL NETWORK EQUIPMENT FOUND IN DEMOLITION AREA TO OWNER FOR RE-USE OR DISPOSAL.

BUSINESS CONTINUITY AND SELECTIVE DEMOLITION

THE CURRENT COPPER BACKBONE INFRASTRUCTURE WILL BE REQUIRED TO BE PROTECTED, OPERATIONAL AND MAINTAINED THROUGHOUT THE LIFECYCLE OF THE PROJECT. SERVICE INTERRUPTIONS ARE NOT PERMITTED AT ANY TIME. CONTRACTOR SHALL PROVIDE A THOROUGH WRITTEN PLAN TO TEST, TAG, LABEL AND PROTECT CRITICAL SYSTEM COMPONENTS. IN THE MAIN TELECOMM EQUIPMENT ROOM (TER) SELECTIVE DEMOLITION WILL BE REQUIRED TO REPLACE THE OLD DEMARC BACKBOARD, DEMOLISH SELECTED OLD TECHNOLOGIES, MAINTAIN CURRENT SYSTEMS AND ADD NEW SYSTEMS. THOROUGH COORDINATION BETWEEN THE OWNER AND CONTRACTOR IS REQUIRED.

COMMUNICATIONS ROOMS

CONTRACTOR SHALL INSTALL ALL NEW COMMUNICATIONS ROOM INFRASTRUCTURE AS INDICATED ON DRAWINGS. THIS INCLUDES WALL/FLOOR PENETRATIONS, WORK AREA OUTLETS, EQUIPMENT CABINETS/RACKS, ETC. INDICATED ON PLANS UNLESS NOTED OTHERWISE.

BACKBONE CABLING

CONTRACTOR SHALL INSTALL ALL CONDUIT PATHWAY INFRASTRUCTURE AS INDICATED ON DRAWINGS. CONTRACTOR SHALL PRODIVE AND INSTALL ALL BACKBONE COPPER AND FIBER CABLING WITH ALL ASSOCIATED TERMINATION HARDWARE AS IDENTIFIED IN THE DRAWINGS.

HORIZONTAL CABLING

CONTRACTOR SHALL INSTALL ALL HORIZONTAL CABLING INFRASTRUCTURE, INCLUDING CONDUIT AND CABLE TRAY, AS REQUIRED ON THE DRAWINGS AND SPECIFICATIONS. INSTALL TMD PHONE AND DATA OUTLETS AND CABLE FROM THE NEAREST COMMUNICATIONS ROOM, UNLESS NOTED OTHERWISE. PROVIDE COPPER PATCH CABLES FOR ALL INSTALLED OUTLETS AS REQUIRED IN SPECIFICATIONS.

BIDDING INSTRUCTIONS

THIS DRAWING PACKAGE CONSISTS OF TWO BID SCENARIOS, A BASE BID AND BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972.887.5555
WWW.MOYECONSULTING.COM

BICSI REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
AARON T ROSE
REG. NO. 201545R
EXPIRES 12-31-20
SIGNATURE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TXARNG CFMO

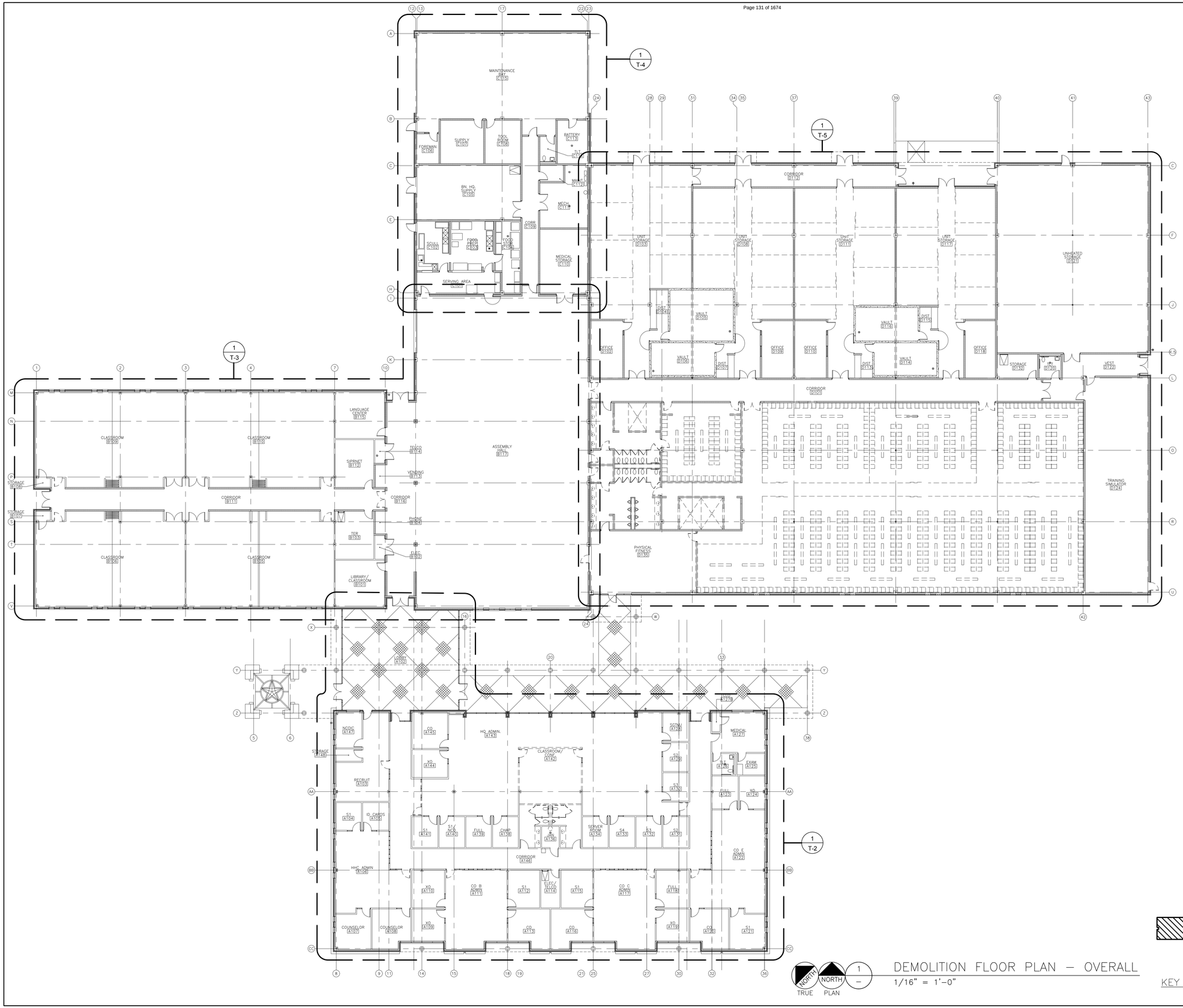
TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE – CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TECHNOLOGY SYSTEMS OVERVIEW AND SYMBOLS

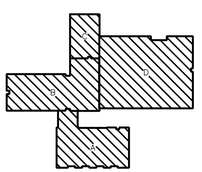
T-0

SHT 114 OF 129



GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.



KEY PLAN

0 8' 16' 32'
1/16"=1'-0"

NORTH TRUE NORTH PLAN 1 –

DEMOLITION FLOOR PLAN – OVERALL
1/16" = 1'-0"

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM

Bicsi
AARON T ROSE
REG. NO. 201545R
EXPIRES 12-31-20
REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

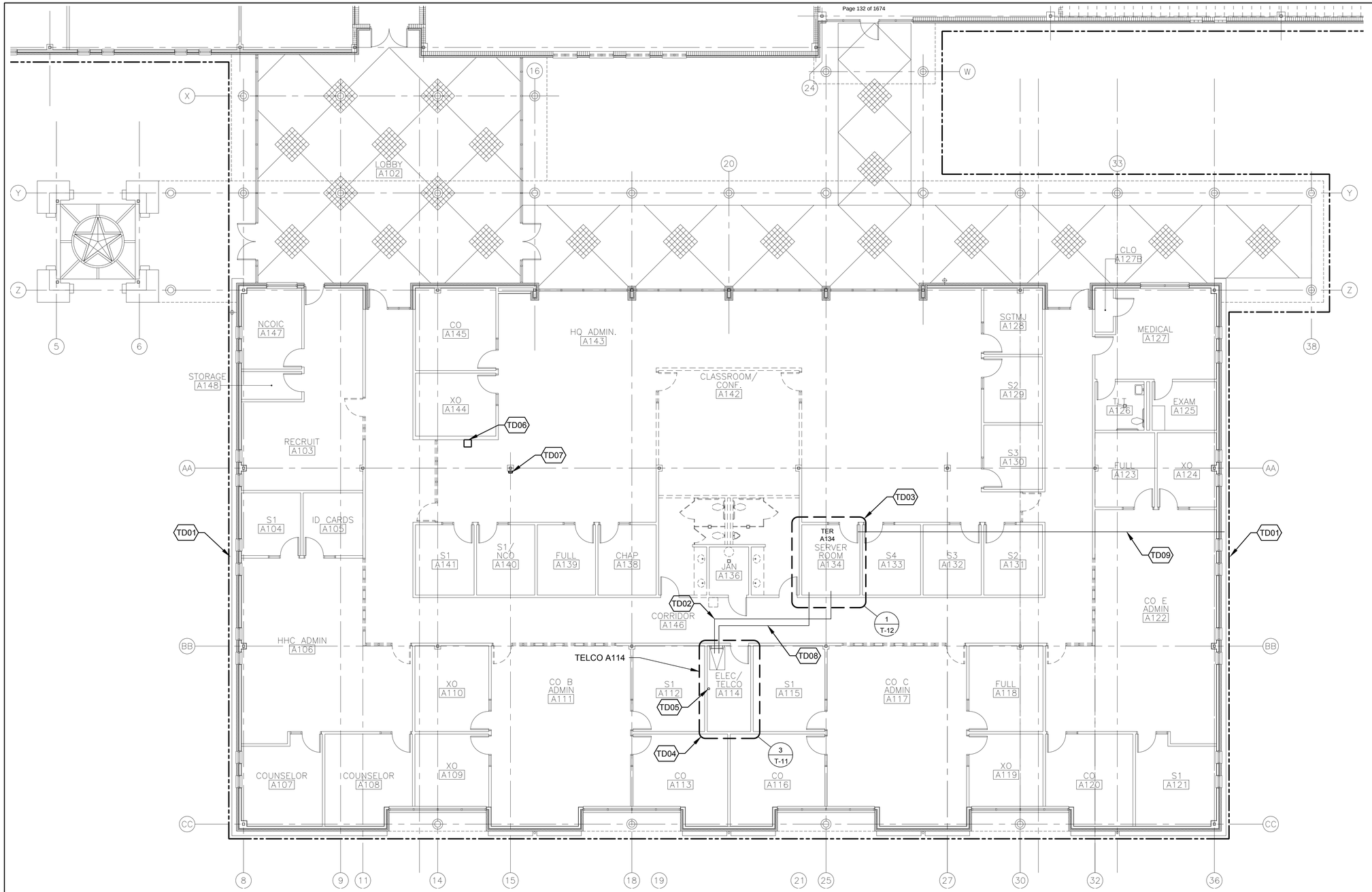
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY OVERALL DEMOLITION FLOOR PLAN

T-1

SHT 115 OF 129



FLOOR PLAN – AREA "A"

1/8" = 1'-0"

KEYED DEMO NOTES

- TD01 GENERAL LOW VOLTAGE DEMOLITION BOUNDARY AREA. CONTRACTOR TO DEMO ALL LOW VOLTAGE CABLING AND PATHWAY WITHIN BOUNDARY BACK TO POINT OF ORIGIN, UNLESS NOTED OTHERWISE.
- TD02 EXISTING FIBER OPTIC CABLE IN CEILING FROM SERVICE PROVIDER PROTECT IN PLACE THROUGHOUT CONSTRUCTION.
- TD03 EXISTING TELECOM EQUIP (TER) ROOM A134 TO REMAIN ACTIVE THROUGHOUT CONSTRUCTION. REFER TO T-11 SELECTIVE DEMO REQUIREMENTS IN THIS ROOM.
- TD04 EXISTING TELECOM EQUIP (TELCO) ROOM A114 TO REMAIN ACTIVE THROUGHOUT CONSTRUCTION. REFER TO T-11 SELECTIVE DEMO REQUIREMENTS IN THIS ROOM.
- TD05 4" ENTRANCE CONDUIT.
- TD06 EXISTING FLOOR MOUNTED PA HEAD END. TO REMAIN IN PLACE.
- TD07 EXISTING WALL MOUNTED AIPHONE MASTER CONSOLE AT 60" AFF. TO REMAIN IN PLACE.
- TD08 EXISTING (4) 25 PAIR COPPER CABLES IN CEILING PROTECT IN PLACE THROUGHOUT CONSTRUCTION.
- TD09 EXISTING INCOMING SERVICE PROVIDER FIBER OPTIC CABLE IN CEILING FROM SERVICE PROVIDER PROTECT IN PLACE THROUGHOUT CONSTRUCTION.

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM

Bicsi
AARON T ROSE
Reg. No. 201545R
EXPIRES 12-31-20
REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
SIGNATURE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

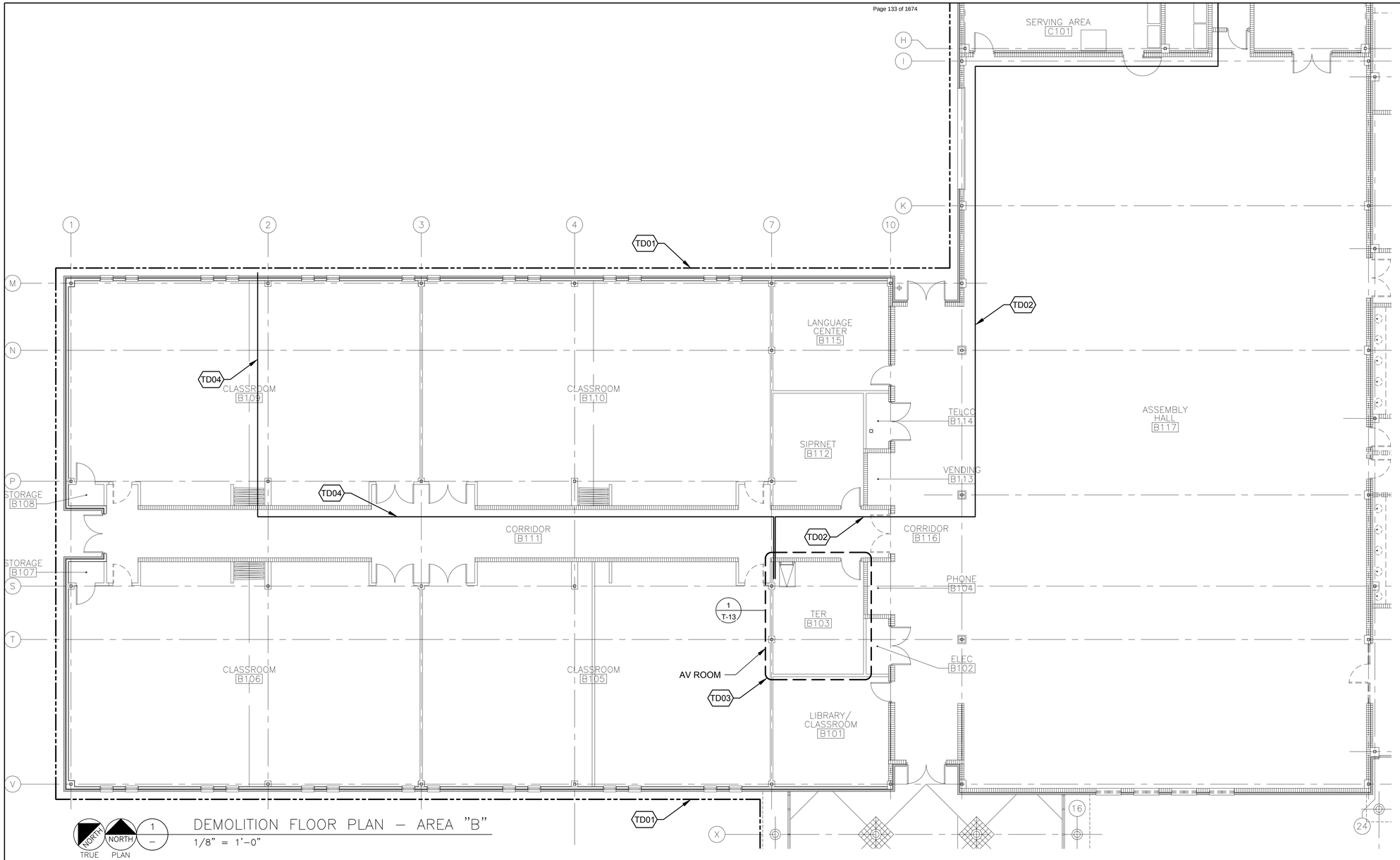
STAR CAMPAIGN FY18 - WESLACO RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY DEMOLITION FLOOR PLAN - AREA A

T-2

SHT 116 OF 129



1 — DEMOLITION FLOOR PLAN – AREA "B"

1/8" = 1'–0"

KEYED DEMO NOTES

TD01 GENERAL LOW VOLTAGE DEMOLITION BOUNDARY AREA. CONTRACTOR TO DEMO ALL LOW VOLTAGE CABLING AND PATHWAY WITHIN BOUNDARY BACK TO POINT OF ORIGIN, UNLESS NOTED OTHERWISE.

TD02 EXISTING 2" OVERHEAD CONDUIT FROM C111/C116 TO B103 EXISTING 12 STRAND SM FIBER. PROTECT IN PLACE.

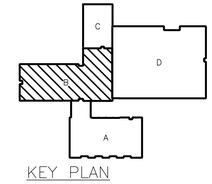
TD03 EXISTING TELECOM EQUIP (AV) ROOM B103 TO REMAIN ACTIVE THROUGHOUT CONSTRUCTION. REFER TO T-11 SELECTIVE DEMO REQUIREMENTS IN THIS ROOM.

TD04 EXISTING CONDUIT WITH FIBER OPTIC CABLE. TO REMAIN. PROTECT IN PLACE.

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM



0 4' 8' 16'
1/8"=1'–0"

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
Bicsi
AARON T ROSE
REG. No. 201545R
EXPIRES 12-31-20
SIGNATURE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

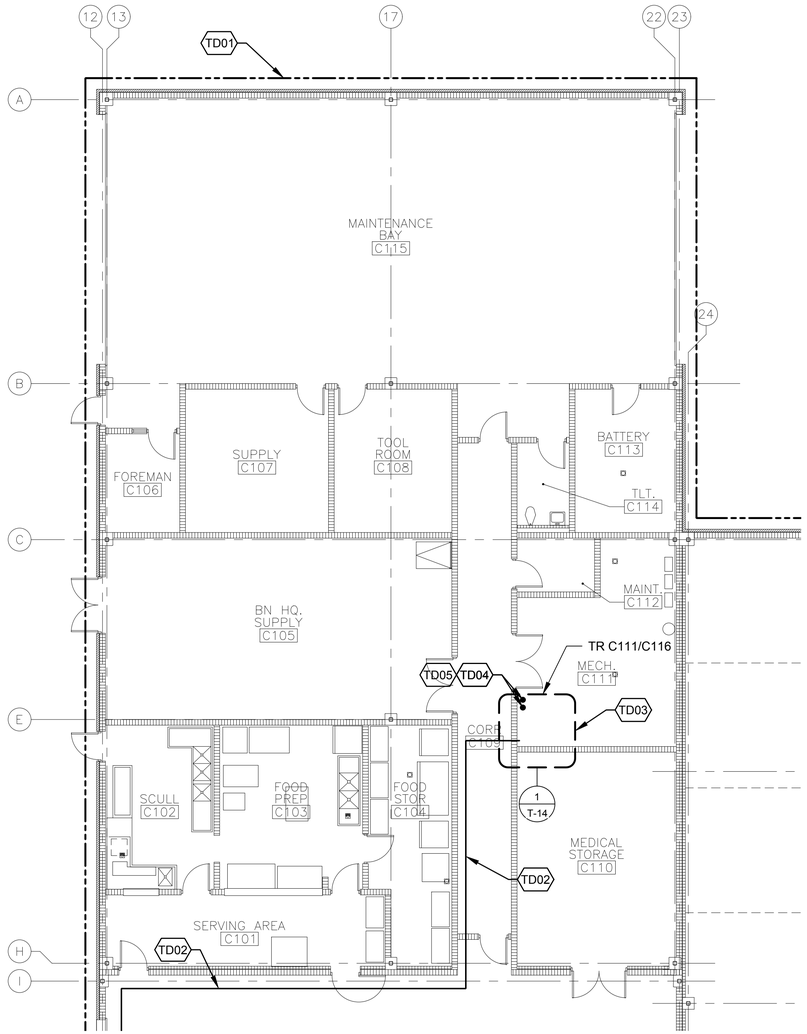
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY DEMOLITION FLOOR PLAN - AREA B

T-3

SHT 117 OF 129



DEMOLITION FLOOR PLAN – AREA "C"

1/8" = 1'–0"

NORTH TRUE / NORTH PLAN 1 –

KEYED DEMO NOTES

TD01 GENERAL LOW VOLTAGE DEMOLITION BOUNDARY AREA. CONTRACTOR TO DEMO ALL LOW VOLTAGE CABLING AND PATHWAY WITHIN BOUNDARY BACK TO POINT OF ORIGIN, UNLESS NOTED OTHERWISE.

TD02 EXISTING 2" OVERHEAD CONDUIT FROM C111/C116 TO B103 EXISTING 12 STRAND SM FIBER. PROTECT IN PLACE.

TD03 EXISTING TELECOM EQUIP (TR) ROOM C111 TO REMAIN ACTIVE THROUGHOUT CONSTRUCTION. REFER TO T-13 SELECTIVE DEMO REQUIREMENTS IN THIS ROOM.

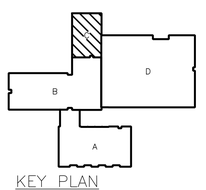
TD04 (2) 4" ENTRANCE CONDUIT. PROTECT AND PREVENT CONDUIT OBSTRUCTION, TEMP SEAL OR PLUG DURING DEMOLITION.

TD05 EXISTING INCOMING SERVICE PROVIDER FIBER OPTIC CABLE FROM FLOOR ENTRANCE CONDUITS FROM SERVICE PROVIDER PROTECT IN PLACE THROUGHOUT CONSTRUCTION.

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM



KEY PLAN

0 4' 8' 16'

1/8"=1'–0"

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
Bicsi
AARON T ROSE
Reg. No. 201545R
EXPIRES 12-31-20
SIGNATURE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

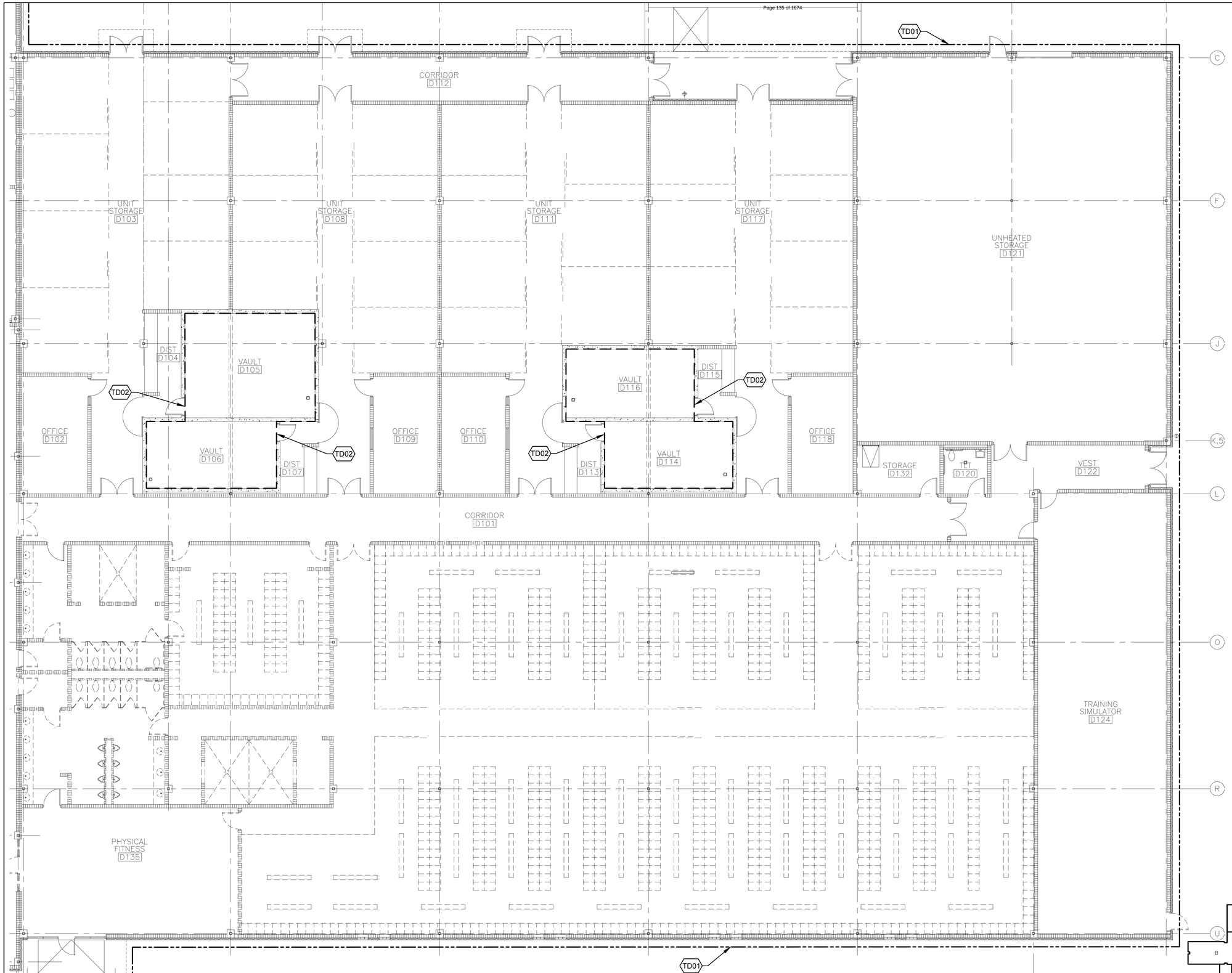
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY DEMOLITION FLOOR PLAN - AREA C

T-4

SHT 118 OF 129



DEMOLITION FLOOR PLAN – AREA "D"

1/8" = 1'-0"

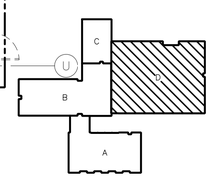
KEYED DEMO NOTES

TD01 GENERAL LOW VOLTAGE DEMOLITION BOUNDARY AREA. CONTRACTOR TO DEMO ALL LOW VOLTAGE CABLING AND PATHWAY WITHIN BOUNDARY BACK TO POINT OF ORIGIN, UNLESS NOTED OTHERWISE.

TD02 EXISTING INTRUSION DETECTION CONTROLLER AND CIRCUITS TO REMAIN. DO NOT DEMOLISH, TRACE, TAG AND PROTECT IN PLACE. MUST REMAIN ACTIVE DURING CONSTRUCTION.

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

MOYE CONSULTING

MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
Bicsi
AARON T ROSE
REG. NO. 201545R
EXPIRES 12-31-20
RCDD
SIGNATURE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE AND NICHOLS

4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

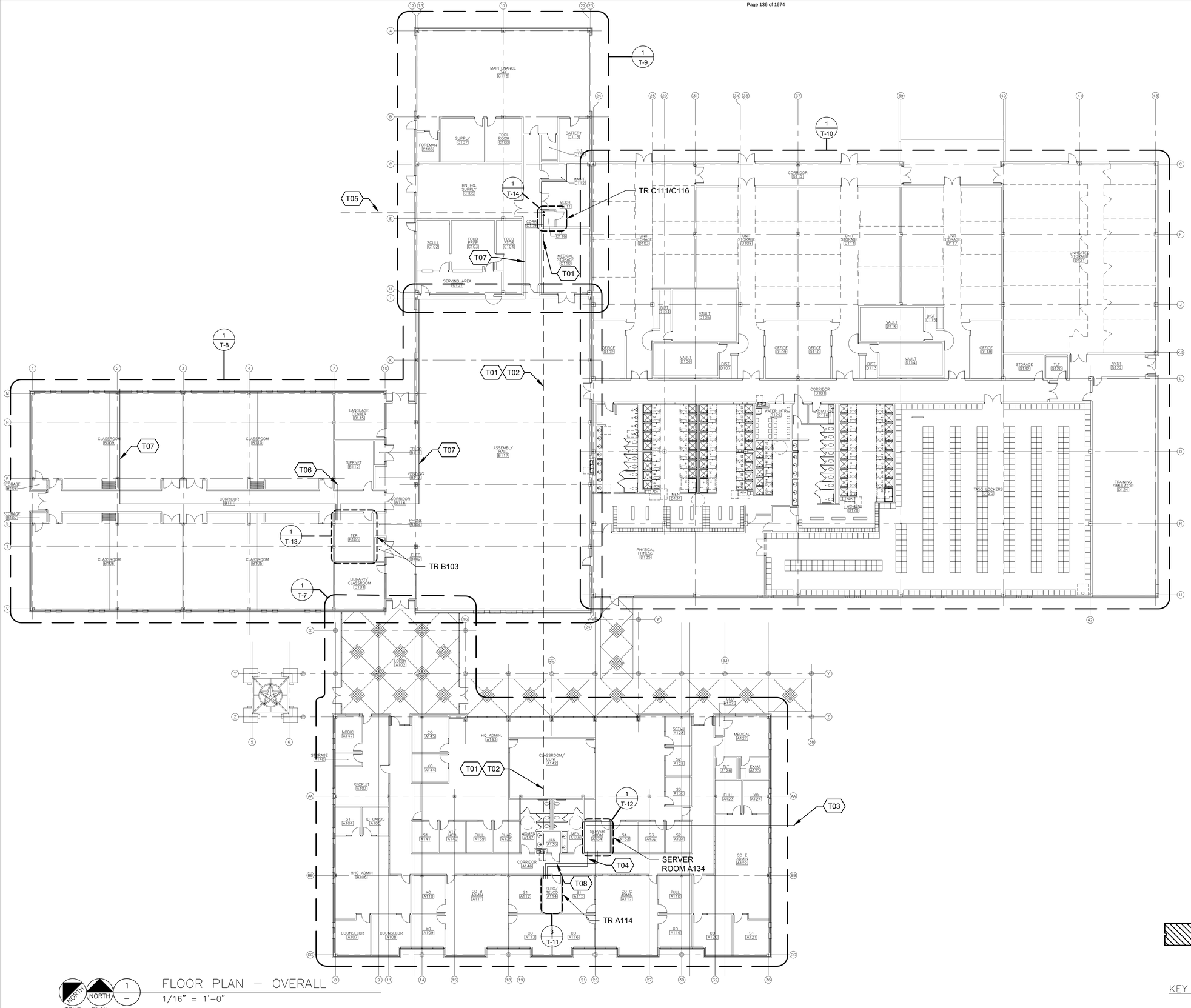
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY DEMOLITION FLOOR PLAN - AREA D

T-5

SHT 119 OF 129



KEY NOTES

- T01 EXISTING UNDERGROUND 4" CONDUIT FROM A114 TO C111/C116.
- T02 PROVIDE AND INSTALL NEW 24 STRAND SINGLE MODE FIBER OPTIC CABLE FROM C116 TO A134. TERMINATE NEW FIBER OPTIC CABLE WITH LC CONNECTORS IN A134 RACK 1. REFER TO SHEET T-14 FOR FIBER TERMINATION LOCATION.
- T03 PROTECT SERVICE PROVIDER (LEC) FIBER OPTIC CABLE IN CEILING FROM A134 TO EAST EXTERIOR WALL.
- T04 PROVIDE AND INSTALL NEW 2" CONDUIT FOR NEW FIBER OPTIC CABLE. ROUTE NEW 24 SMF THROUGH A114 TO SERVER ROOM A134.
- T05 UNDERGROUND 4" CONDUIT TO FMS FROM C111/C116.
- T06 PROVIDE AND INSTALL A NEW 2" RMC-CONDUIT. REF: 4/T-15 FUTURE SIPR ROOM.
- T07 EXISTING CONDUIT CONTAINING FIBER OPTIC BACKBONE CABLING TO REMAIN IN PLACE.
- T08 EXISTING FIBER OPTIC BACKBONE CABLE. TO REMAIN PROTECT IN PLACE.

FLOOR PLAN – OVERALL
1/16" = 1'-0"

KEY PLAN

0 8' 16' 32'
1/16"=1'-0"

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO RC MAJOR MAINTENANCE

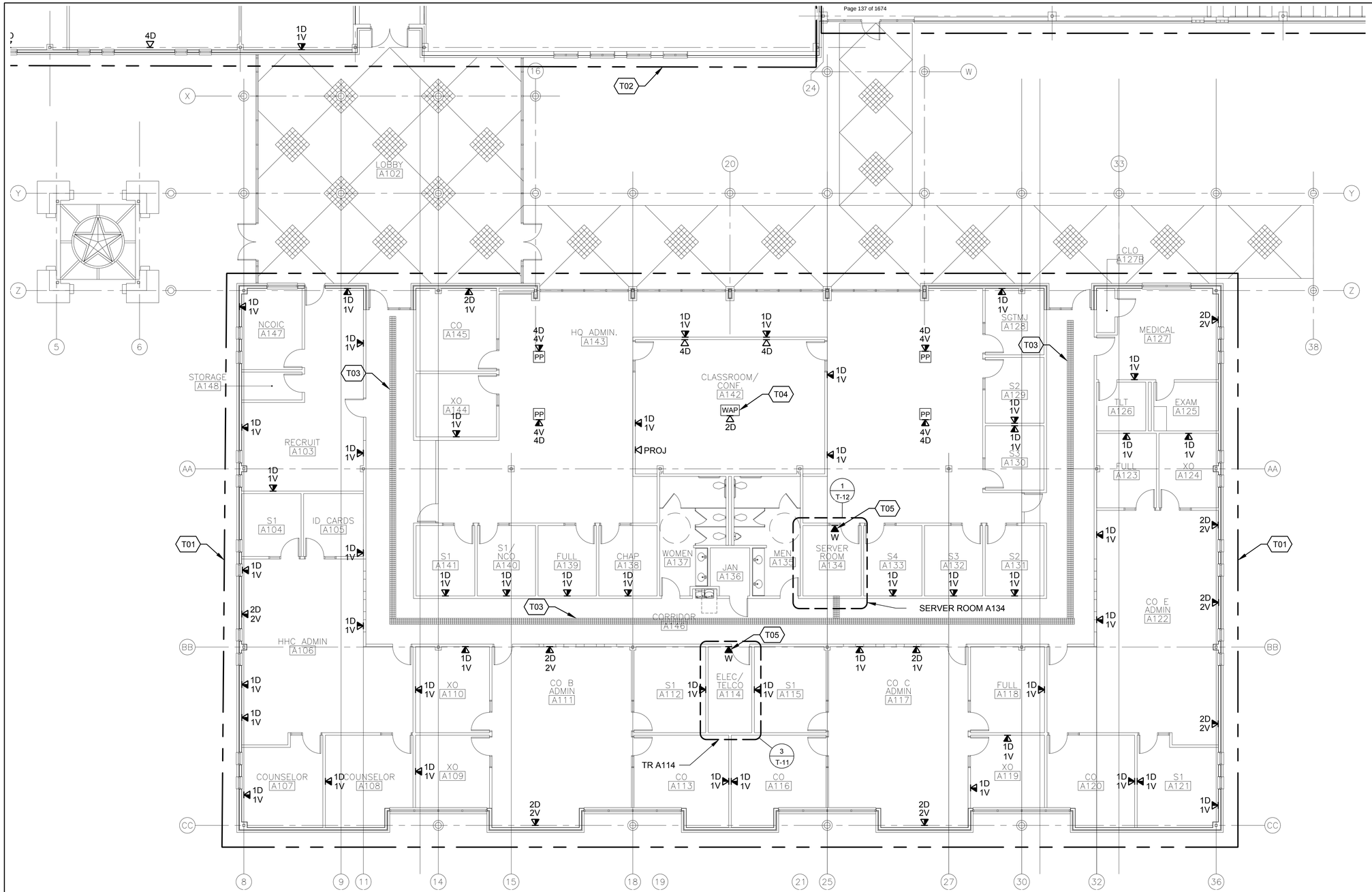
TXARNG CFMO

Bicsi
AARON T ROSE
REG. NO. 201545R
EXPIRES 12-31-20
REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
SIGNATURE

TECHNOLOGY OVERALL FLOOR PLAN

T-6

SHT 120 OF 129



FLOOR PLAN – AREA "A"

1/8" = 1'-0"

KEYED NOTES

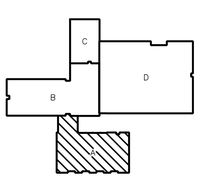
- T01 ALL OUTLETS HOME RUN TO TELECOM EQUIP. ROOM (SERVER ROOM) # A134.
- T02 ALL OUTLETS HOME RUN TO TELECOM EQUIP. ROOM (TR) # B103.
- T03 FURNISH AND INSTALL NEW OVERHEAD 12" WIRE MESH CABLE TRAY.
- T04 CONTRACTOR TO PROVIDE AND INSTALL CEILING MOUNTED, WALL MOUNT BOX WITH (2) CAT6 DATA (GREEN) CABLES FOR WAP AT THIS LOCATION. OWNER TO FURNISH, CONFIGURE AND INSTALL WAP.
- T05 (1) WHITE CAT6 VOICE SERVICES, OUTLET MOUNTED ON STAINLESS STEEL FACEPLATE FOR WALL MOUNTED PHONE AT 48" A.F.F.

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.

MOYE CONSULTING

MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

Bicsi
AARON T ROSE
REG. NO. 201545R
EXPIRES 12-31-20
REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
RCDD
SIGNATURE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

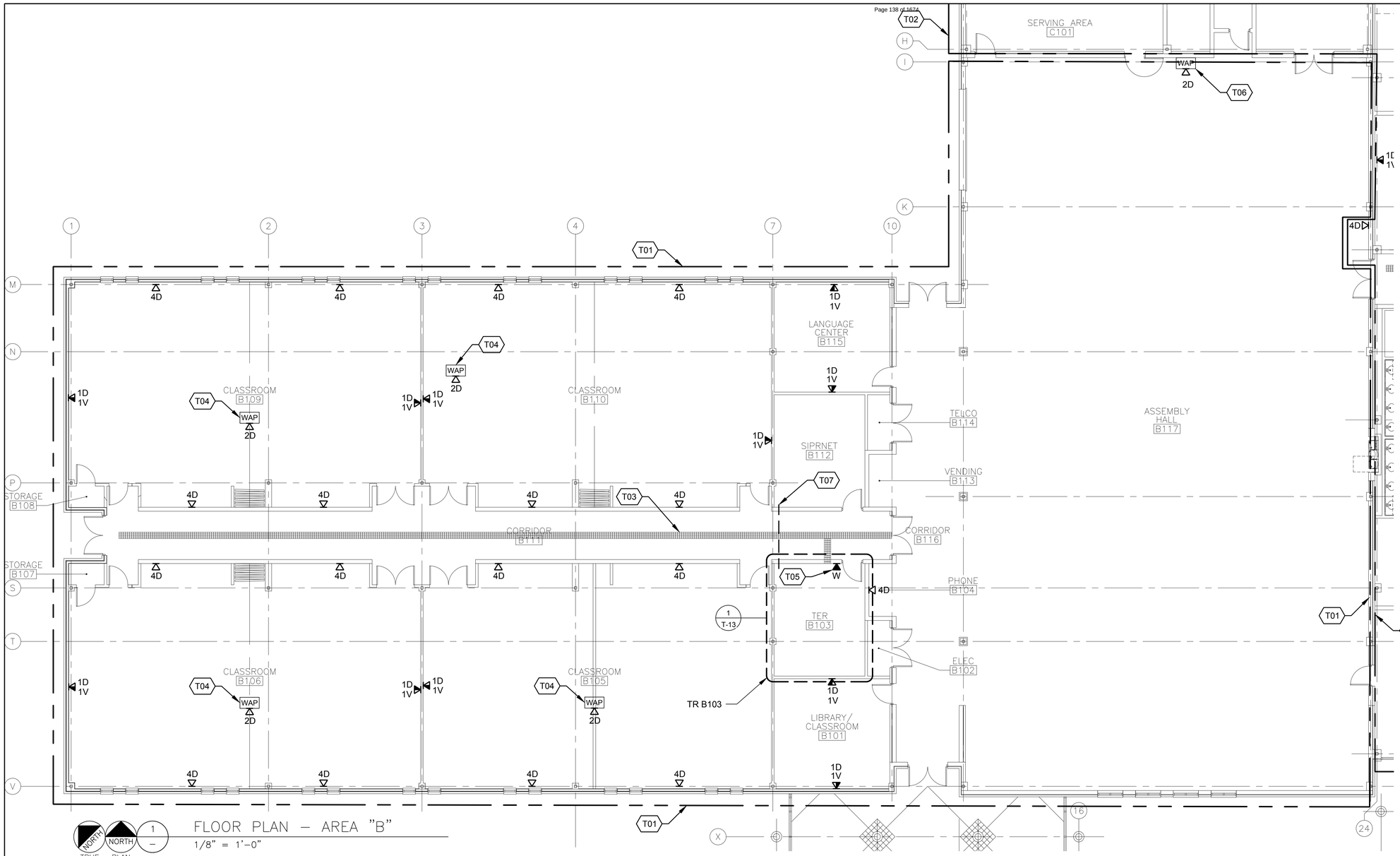
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY FLOOR PLAN - AREA A

T-7

SHT 121 OF 129



NORTH TRUE NORTH PLAN

1 — FLOOR PLAN – AREA "B"

1/8" = 1'-0"

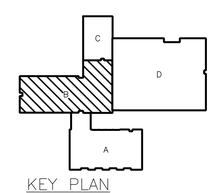
KEYED NOTES

- T01 ALL OUTLETS HOME RUN TO TELECOM EQUIP. ROOM (TR) # B103.
- T02 ALL OUTLETS HOME RUN TO TELECOM EQUIP. ROOM (IT/TER) # C111/C116.
- T03 FURNISH AND INSTALL NEW OVERHEAD 12" WIRE MESH CABLE TRAY.
- T04 CONTRACTOR TO PROVIDE AND INSTALL CEILING MOUNTED, WALL MOUNT BOX WITH (2) CAT6 DATA (GREEN) CABLES FOR WAP AT THIS LOCATION. OWNER TO FURNISH, CONFIGURE AND INSTALL WAP.
- T05 (1) WHITE CAT6 VOICE SERVICES OUTLET MOUNTED ON STAINLESS STEEL FACEPLATE FOR WALL MOUNTED PHONE AT 48" A.F.F.
- T06 CONTRACTOR TO PROVIDE AND INSTALL WALL MOUNTED AT 12' AFF, WALL MOUNT BOX WITH (2) CAT6 DATA (GREEN) CABLES FOR WAP AT THIS LOCATION. OWNER TO FURNISH, CONFIGURE AND INSTALL WAP.
- T07 PROVIDE AND INSTALL A NEW 2" RMC-CONDUIT. REF: 4/T-15 FUTURE SIPR ROOM.

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYEICONSULTING.COM



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

BICSI REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
Bicsi
AARON T ROSE
REG. NO. 201545R
EXPIRES 12-31-20
RCDD
SIGNATURE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

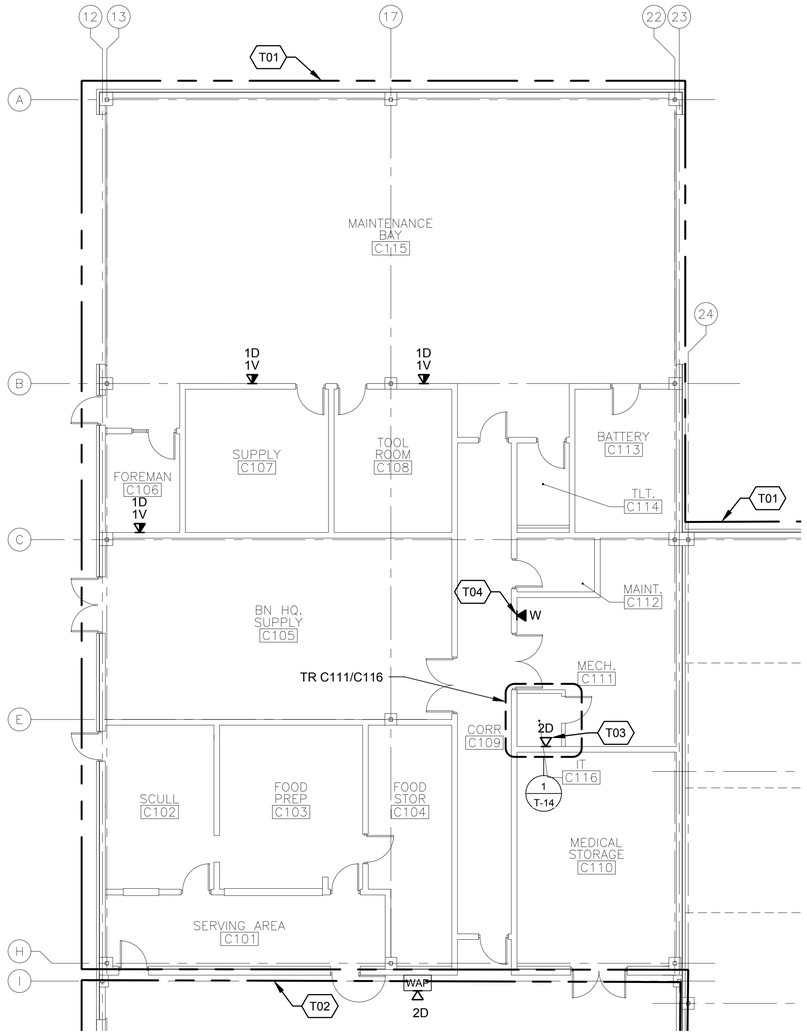
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY FLOOR PLAN - AREA B

T-8

SHT 122 OF 129



NORTH NORTH 1 — FLOOR PLAN – AREA "C"

1/8" = 1'-0"

KEYED NOTES

T01 ALL OUTLETS HOME RUN TO TELECOM EQUIP. ROOM (TR) # C111/C116.

T02 ALL OUTLETS HOME RUN TO TELECOM EQUIP. ROOM (TR) # B103.

T03 PROVIDE AND INSTALL NEW BUILDING MANAGEMENT SYSTEM (BMS) DATA LOCATION FURNISH AND INSTALL WORK AREA OUTLET FOR CONNECTIVITY.

T04 (1) WHITE CAT6 VOICE SERVICES, OUTLET MOUNTED ON STAINLESS STEEL FACEPLATE FOR WALL MOUNTED PHONE AT 48" A.F.F.

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
Bicsi
AARON T ROSE
REG. No. 201545R
EXPIRES 12-31-20
SIGNATURE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY FLOOR PLAN - AREA C

T-9

SHT 123 OF 129

KEYED NOTES

- T01 ALL OUTLETS HOME RUN TO TELECOM EQUIP. ROOM C111/C116.
- T02 FURNISH AND INSTALL NEW OVERHEAD 6" WIRE MESH CABLE TRAY.
- T03 CONTRACTOR TO PROVIDE AND INSTALL CEILING MOUNTED, WALL MOUNT BOX WITH (2) CAT6 DATA (GREEN) CABLES FOR WAP AT THIS LOCATION. OWNER TO FURNISH, CONFIGURE AND INSTALL WAP.
- T04 (1) WHITE CAT6 VOICE SERVICES, OUTLET MOUNTED ON STAINLESS STEEL FACEPLATE FOR WALL MOUNTED PHONE AT 48" A.F.F.

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.

FLOOR PLAN – AREA "D"
1/8" = 1'-0"

KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY FLOOR PLAN - AREA D

T-10

SHT 124 OF 129

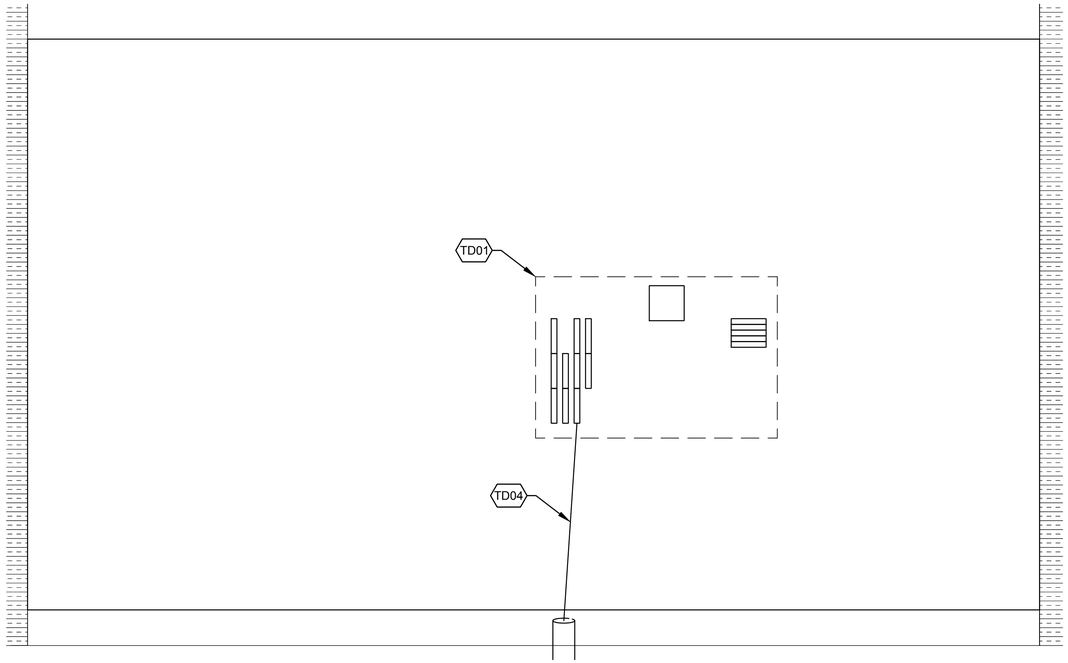
KEYED DEMO NOTES

TD01 EXISTING EQUIPMENT CONTRACTOR TO DEMO ALL CABLING AND CONNECTIVITY HARDWARE, UNLESS NOTED OTHERWISE. CONTRACTOR SHALL RETURN ALL ELECTRONIC EQUIPMENT MOUNTED TO OWNER.

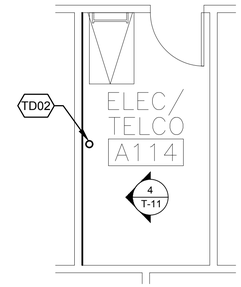
TD02 PROTECT IN PLACE ALL EXISTING FIBER OPTIC CABLE. TEMPORARILY SEAL OR PLUG CONDUIT TO PREVENT OBSTRUCTIONS.

TD03 PROTECT IN PLACE EXISTING COPPER TIE CABLES.

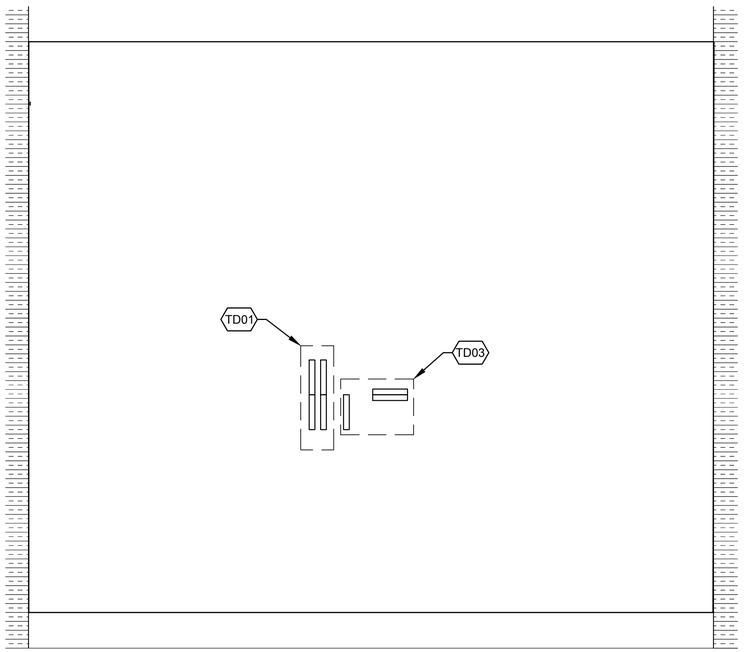
TD04 100 PAIR COPPER. PROTECT IN PLACE. DO NOT DEMO.



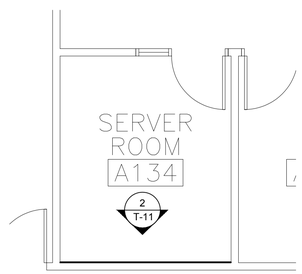
4 — DEMO ELEVATION VIEW ELEC/TELCO A114
N.T.S.



NORTH TRUE NORTH PLAN 3 — DEMO ENLARGED PLAN ELEC/TELCO A114
1/4" = 1'-0"



2 — DEMO ELEVATION VIEW SERVER A134
N.T.S.



NORTH TRUE NORTH PLAN 1 — DEMO ENLARGED PLAN SERVER ROOM A134
1/4" = 1'-0"

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM

Bicsi
AARON T ROSE
REG. No. 201545R
EXPIRES 12-31-20
RCDD
SIGNATURE

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

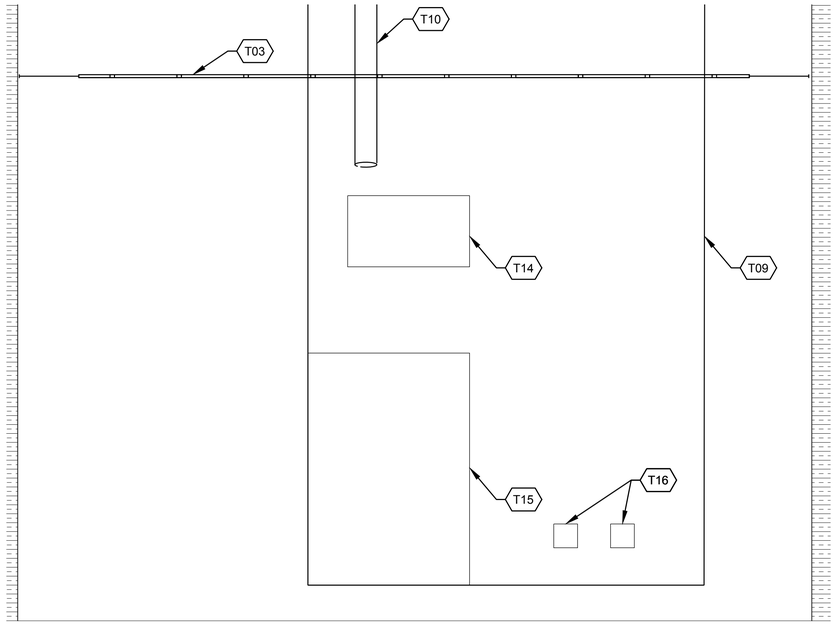
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

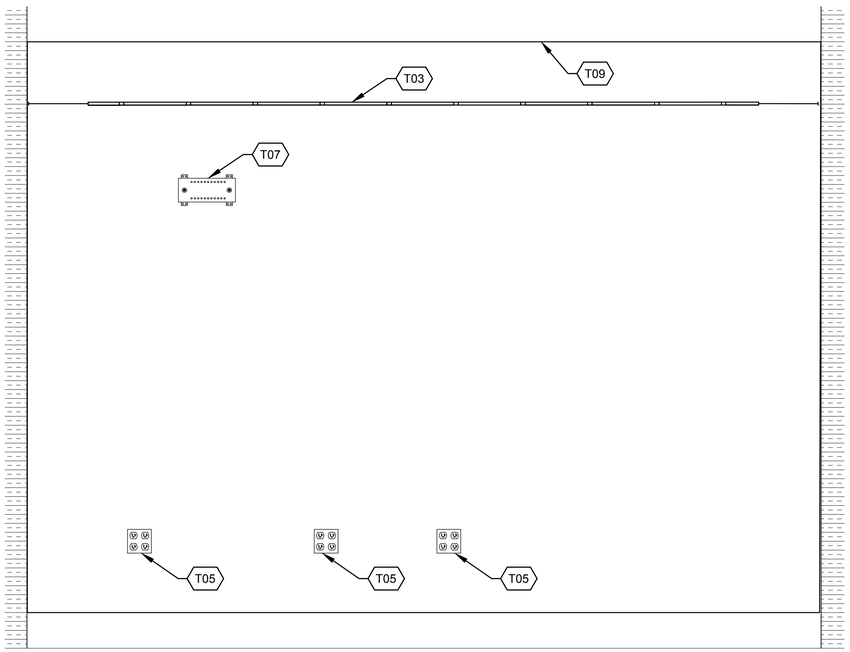
TECHNOLOGY DEMO ENLARGED PLAN

T-11

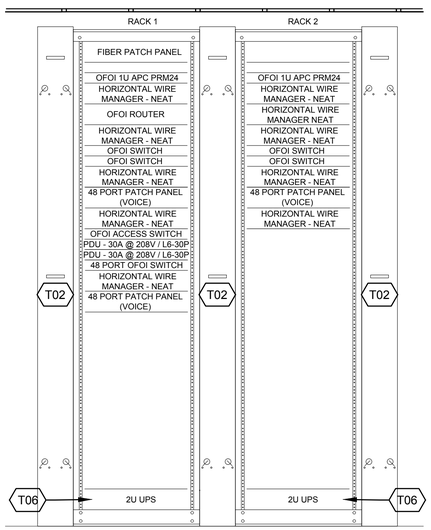
SHT 125 OF 129



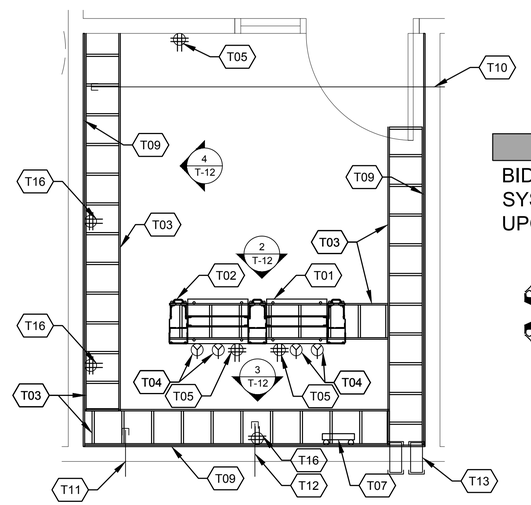
4 — WEST WALL ELEVATION SERVER ROOM A134
1" = 1'-0"



3 — SOUTH WALL ELEVATION SERVER ROOM A134
1" = 1'-0"



2 — RACK ELEVATION SERVER ROOM A134
N.T.S.



1 — ENLARGED PLAN SERVER ROOM A134
1/2" = 1'-0"

NORTH TRUE NORTH PLAN

KEYED NOTES

- T01 PROVIDE NEW 19"W X 84"H 2-POST EQUIPMENT RACK (TYPICAL).
- T02 PROVIDE NEW 6"W VERTICAL CABLE MANAGER (TYPICAL).
- T03 PROVIDE NEW 12" OVERHEAD LADDER RACK. MOUNT AT 90" AFF.
- T04 FOR REFERENCE ONLY OF LOCATION FOR NEW (2) L6-30 (DIV 26).
- T05 FOR REFERENCE ONLY OF LOCATION FOR NEW DUPLEX 120V-20A (DIV 26).
- T06 FOR REFERENCE ONLY OFOI UPS.
- T07 PROVIDE NEW 4"W X 12"L COPPER TELECOMMUNICATIONS GROUNDING BUSBAR (TGB). MOUNT AT 84" AFF.
- T08 EXISTING SERVICE PROVIDER FIBER OPTIC AND COPPER CABLING. PROTECT IN PLACE.
- T09 FURNISH AND INSTALL 3/4" FIRE-RESISTANT PLYWOOD - GRADE A/C - PAINTED ON ALL 6 SIDES WITH TWO COATS OF FIRE RETARDANT PAINT. LEAVING EACH FIRE-RATING STAMP VISIBLE. (TYPICAL).
- T10 PROTECT SERVICE PROVIDER (LEC) FIBER OPTIC CABLE IN CEILING FROM A134 TO EAST EXTERIOR WALL.
- T11 PROVIDE AND INSTALL NEW 2" CONDUIT FOR NEW FIBER OPTIC CABLE. ROUTE NEW 24 SMF THROUGH A114 TO SERVER ROOM A134.
- T12 EXISTING FIBER OPTIC BACKBONE CABLE. TO REMAIN PROTECT IN PLACE.
- T13 FURNISH AND INSTALL (2) 4" FIRESTOP SLEEVES FOR ALL NEW CABLING.
- T14 PROTECT SERVICE PROVIDER (LEC) WALL MOUNTED FIBER OPTIC TERMINATION.
- T15 PROTECT SERVICE PROVIDER (LEC) WALL MOUNTED CABINET.
- T16 (2) EXISTING ELECTRICAL OUTLET TO REMAIN.

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM

Bicsi
AARON T ROSE
REG. No. 201545R
EXPIRES 12-31-20
RCDD
SIGNATURE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

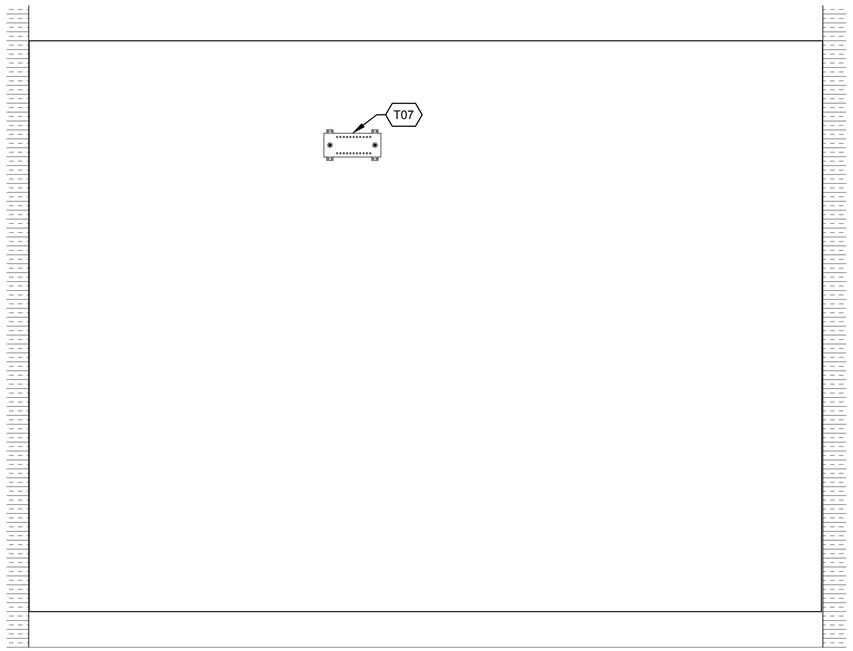
TECHNOLOGY ENLARGED PLAN

T-12

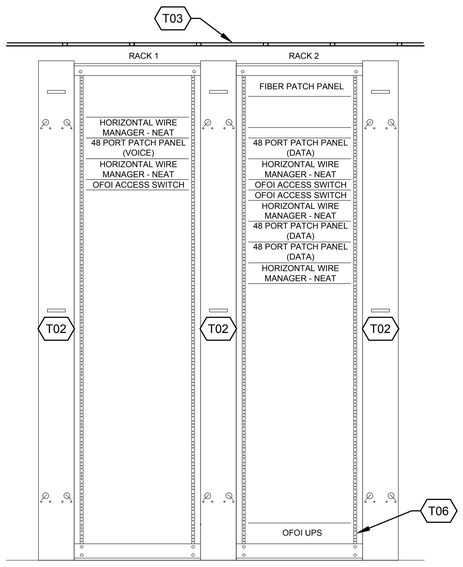
SHT 126 OF 129

KEYED NOTES

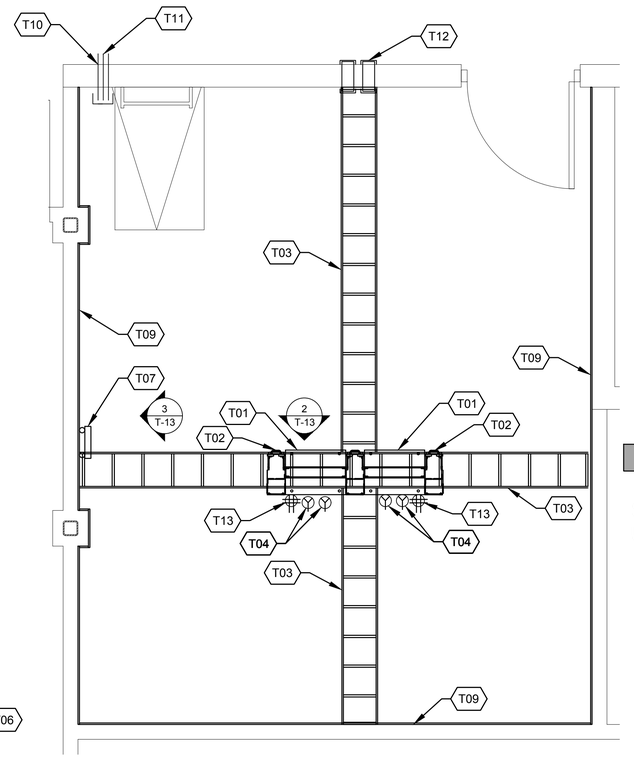
- T01 PROVIDE NEW 19"W X 84"H 2-POST EQUIPMENT RACK (TYPICAL).
- T02 PROVIDE NEW 6"W VERTICAL CABLE MANAGER (TYPICAL).
- T03 PROVIDE NEW 12" OVERHEAD LADDER RACK. MOUNT AT 90" AFF.
- T04 FOR REFERENCE ONLY OF LOCATION FOR NEW (2) L6-30 (DIV 26).
- T05 EXISTING 120 ELECTRICAL OUTLET TO REMAIN.
- T06 FOR REFERENCE ONLY OFOI UPS.
- T07 PROVIDE NEW 4"W X 12"L COPPER TELECOMMUNICATIONS GROUNDING BUSBAR (TGB). MOUNT AT 84" AFF. REFERENCE: ELECTRICAL SHEET E-29 FOR ONE LINE DIAGRAMS.
- T08 EXISTING FIBER OPTIC AND COPPER CABLING. PROTECT IN PLACE.
- T09 FURNISH AND INSTALL 3/4" FIRE-RESISTANT PLYWOOD - GRADE A/C - PAINTED ON ALL 6 SIDES WITH TWO COATS OF FIRE RETARDANT PAINT. LEAVING EACH FIRE-RATING STAMP VISIBLE. (TYPICAL).
- T10 EXISTING CONDUIT WITH FIBER OPTIC CABLE. TO REMAIN. PROTECT IN PLACE.
- T11 PROVIDE AND INSTALL A NEW 2" RMC-CONDUIT. REF: 4/T-15 FUTURE SIPR ROOM.
- T12 FURNISH AND INSTALL (2) 4" FIRESTOP SLEEVES FOR ALL NEW CABLING.
- T13 FOR REFERENCE ONLY OF LOCATION FOR NEW DUPLEX 120V-20A (DIV 26).



3 — WEST WALL ELEVATION AV B103
1" = 1'-0"



2 — RACK ELEVATION AV B103
N.T.S.



NORTH NORTH 1 — ENLARGED PLAN AV B103
1/2" = 1'-0"

GENERAL NOTES

BID OPTION #3 FULL IT SYSTEM INCLUDING UPGRADES.

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYEICONSULTING.COM

BICSI REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
AARON T ROSE
REG. NO. 201545R
EXPIRES 12-31-20
RCDD
SIGNATURE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

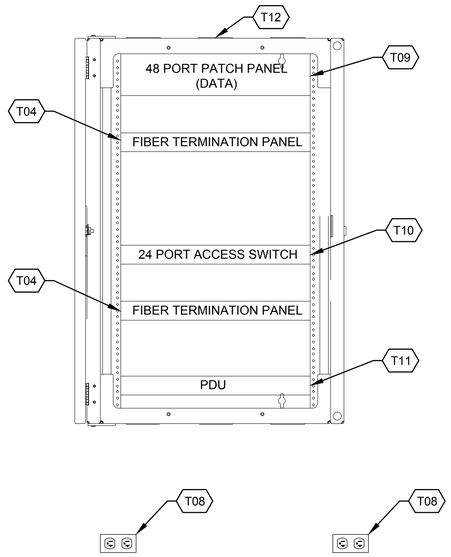
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY ENLARGED PLAN

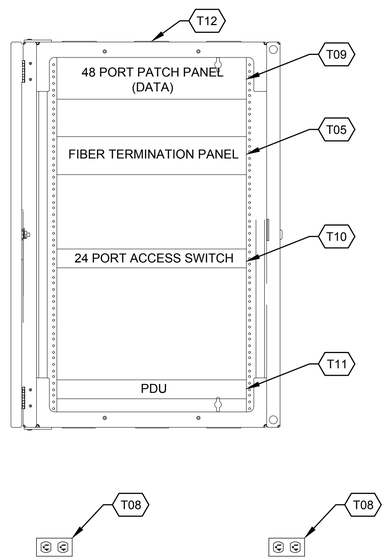
T-13

SHT 127 OF 129



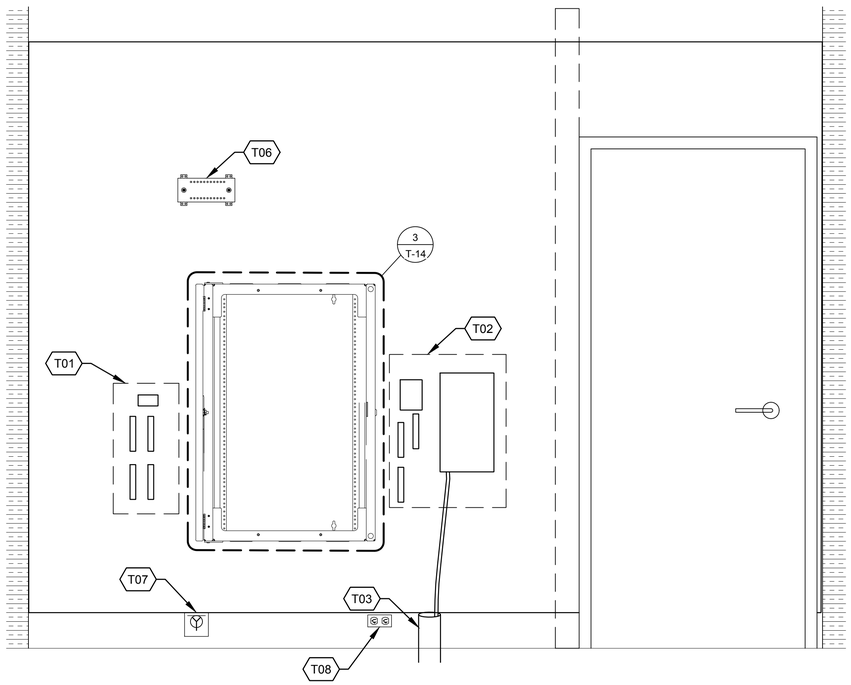
4 — EXISTING WALL MOUNT RACK DEMO C111/C116

N.T.S.



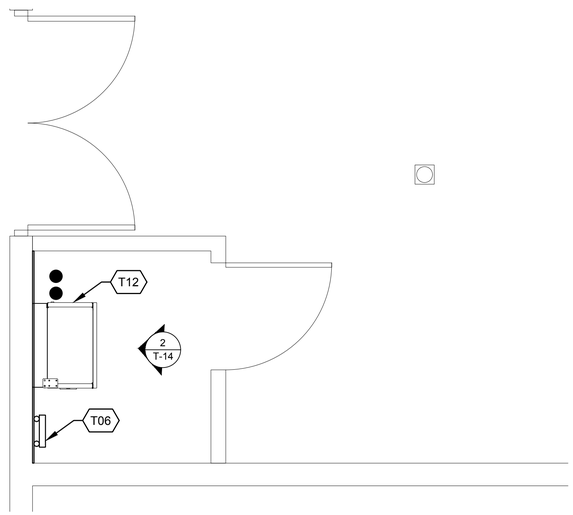
3 — WALL ELEVATION C111/C116

N.T.S.



2 — WALL ELEVATION C111/C116

N.T.S.



NORTH TRUE NORTH PLAN 1 — ENLARGED PLAN C111/C116

1/2" = 1'-0"

KEYED NOTES

- T01 TO REMAIN IN SERVICE, PROTECT IN PLACE.
- T02 TO REMAIN IN SERVICE, PROTECT IN PLACE THROUGHOUT CONSTRUCTION.
- T03 PROVIDER ENTRANCE CONDUIT TO REMAIN. PROTECT IN PLACE THROUGHOUT CONSTRUCTION.
- T04 DEMO FIBER TERMINATION SHELF. RE-TERMINATE EXISTING FIBER IN THE NEW 2U FIBER TERMINATION SHELF. ALL FIBERS SHALL BE TERMINATED WITH LC CONNECTORS.
- T05 PROVIDE AND INSTALL NEW 2U FIBER TERMINATION PANEL.
- T06 PROVIDE AND INSTALL NEW 4"W X 12"L COPPER TELECOMMUNICATIONS GROUNDING BUSBAR (TGB). MOUNT AT 84" AFF.
- T07 FOR REFERENCE ONLY OF LOCATION FOR NEW L6-30 (DIV 26).
- T08 FOR REFERENCE ONLY EXISTING TO REMAIN (1) 5-20R DUPLEX 120 ELECTRICAL OUTLET (DIV 26).
- T09 EXISTING TO REMAIN CAT5 48 PORT PATCH PANEL FOR DATA TERMINATIONS.
- T10 EXISTING TO REMAIN CISCO DATA SWITCHES.
- T11 EXISTING TO REMAIN 1U PDU.
- T12 EXISTING TO REMAIN WALL CABINET.

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM

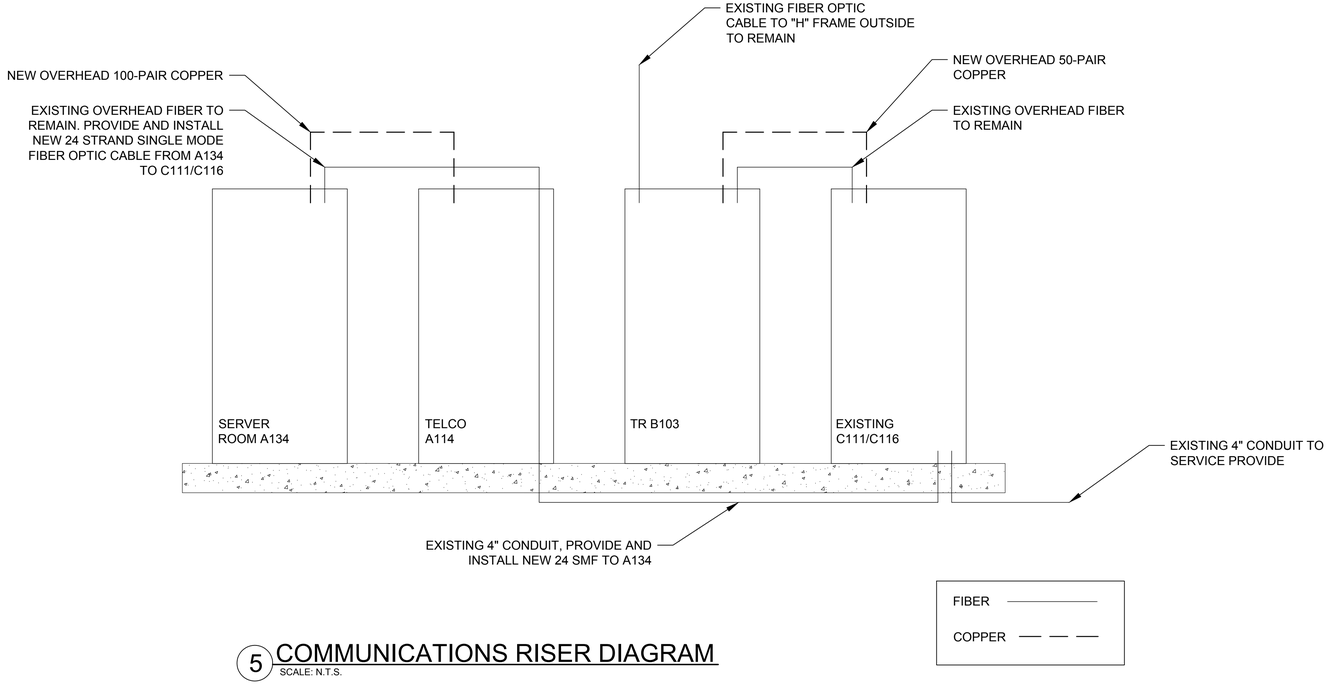
TXARNG CFMO

BICSI REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
BICSI
AARON T ROSE
REG. NO. 201545R
EXPIRES 12-31-20
RCDD
SIGNATURE

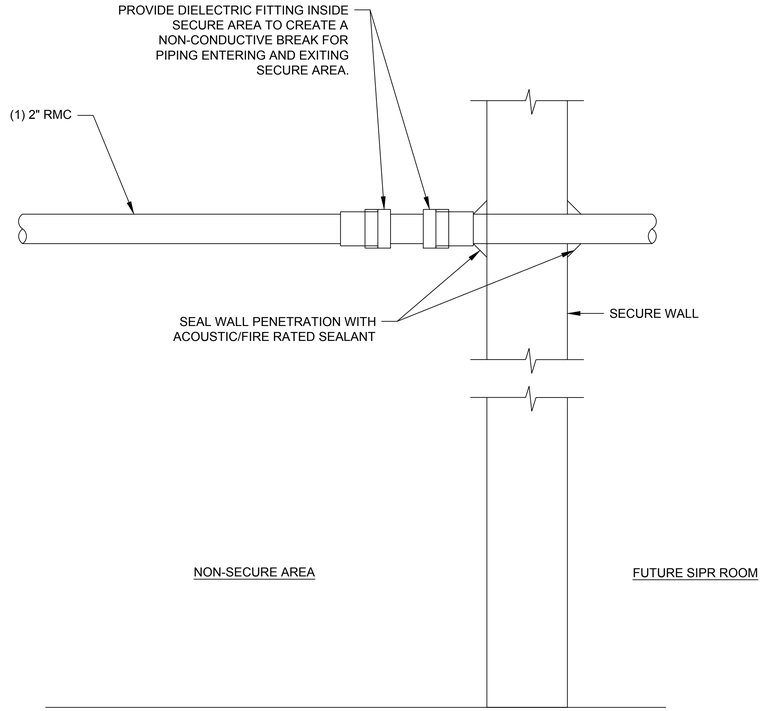
TECHNOLOGY ENLARGED PLAN

T-14

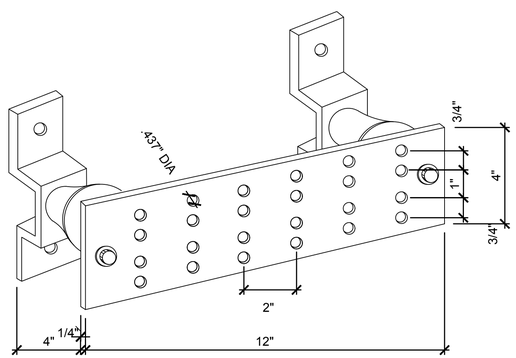
SHT 128 OF 129



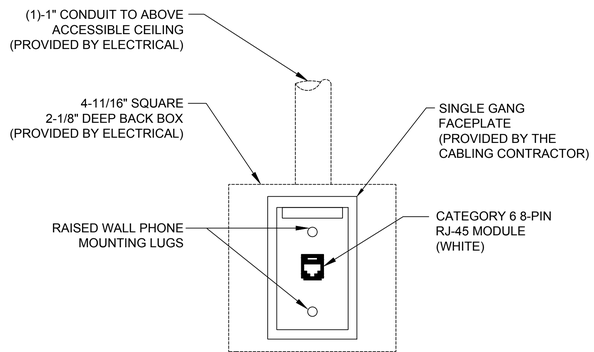
5 COMMUNICATIONS RISER DIAGRAM
SCALE: N.T.S.



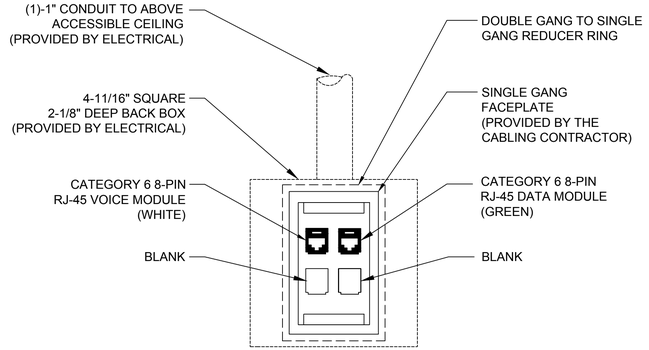
4 CONDUIT PENETRATION THRU SECURE AREA WALL
SCALE: N.T.S.



3 TELECOMMUNICATIONS GROUNDING BUSBAR
SCALE: N.T.S.



2 TYPICAL WALL PHONE OUTLET
SCALE: N.T.S.
W



1 TYPICAL WORK AREA OUTLET
SCALE: N.T.S.
1D
1V

MOYE CONSULTING
MOYE IT CONSULTING, LLC
1255 CORPORATE DRIVE, SUITE 100
IRVING, TX 75038
972 887 5555
WWW.MOYECONSULTING.COM

BICSI
AARON T ROSE
REG. NO. 201545
EXPIRES 12-31-20

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MOYE
REVIEWED BY: MOYE

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1		
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY DEPARTMENT
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

TECHNOLOGY DETAILS

T-15

SHT 129 OF 129

STAR Campaign FY18 – Weslaco Readiness Center Major Maintenance

Issued for Bid
Design Specifications

Prepared for:
Texas Military Department

Prepared by:

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109
(817) 735-7300

Texas Registered Engineering Firm F-2144

ADG17589A

April 20, 2018

STAR Campaign FY18 – Weslaco Readiness Center Major Maintenance



FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

Divisions 01, 22, 23



FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

Divisions 03, 05



FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

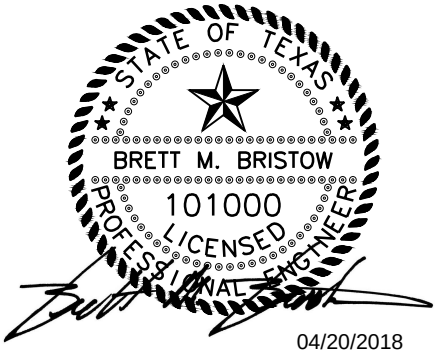
Divisions 04, 05, 06, 07, 08, 09, 10, 12, 13, 14, 32



FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

Divisions 26, 28

STAR Campaign FY18 – Weslaco Readiness Center Major Maintenance



04/20/2018

FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

Divisions 31, 32



Registered Communications Distribution Designer

Aaron Rose, RCDD	201545R	April 20, 2018
Typed Name	Registration No.	Date

Division 27 – Moye Consulting, 1255 Corporate Drive, Suite 100, Irving, Texas 75038

TABLE OF CONTENTS

DIVISION 1	**GENERAL REQUIREMENTS**
01 11 00	SUMMARY OF WORK
01 22 00	UNIT PRICES
01 23 10	BID OPTIONS AND ALLOWANCES
01 29 00	PAYMENT PROCEDURES
01 31 00	PROJECT MANAGEMENT
01 31 13	PROJECT COORDINATION
01 31 13.13	FORMS
01 32 16	CONSTRUCTION PROGRESS SCHEDULE
01 32 33	PHOTOGRAPHIC DOCUMENTATION
01 33 00	SUBMITTAL PROCEDURES
01 40 00	QUALITY REQUIREMENTS
01 42 00	REFERENCES
01 50 00	TEMPORARY FACILITIES AND CONTROLS
01 57 00	TEMPORARY CONTROLS
01 60 00	PRODUCT REQUIREMENTS
01 73 29	CUTTING AND PATCHING
01 74 19	CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT
01 74 23	FINAL CLEANING
01 75 00	STARTING AND ADJUSTING
01 78 23	OPERATIONS AND MAINTENANCE DATA
01 91 13	GENERAL COMMISSIONING AND REQUIREMENTS
DIVISION 3	**CONCRETE**
03 01 30	MAINTENANCE OF CAST IN PLACE CONCRETE
03 30 00	CAST IN PLACE CONCRETE
DIVISION 4	**MASONRY**
04 20 00	UNIT MASONRY
04 90 10	CLAY MASONRY RESTORATION AND CLEANING
DIVISION 5	**METALS**
05 12 00	STRUCTURAL STEEL FRAMING
05 50 00	METAL FABRICATIONS
DIVISION 6	**WOOD, PLASTIC & COMPOSITES**
06 10 00	ROUGH CARPENTRY
06 40 23	INTERIOR ARCHITECTURAL WOODWORK

DIVISION 7 THERMAL & MOISTURE PROTECTION
07 01 50 REPAIR OF ROOFING
07 19 00 WATER REPELLENTS
07 21 00 THERMAL INSULATION
07 27 26 FLUID-APPLIED MEMBRANE AIR BARRIER
07 62 00 SHEET METAL FLASHING AND TRIM
07 72 00 ROOF ACCESSORIES
07 84 46 FIRE RESISTIVE JOINT SYSTEMS
07 92 00 JOINT SEALANTS

DIVISION 8 OPENINGS
08 11 13 HOLLOW METAL FRAMES
08 14 16 FLUSH WOOD DOORS
08 71 00 FINISH HARDWARE
08 80 00 GLAZING
08 90 00 LOUVERS AND VENTS

DIVISION 9 FINISHES
09 22 16 NON-STRUCTURAL METAL FRAMING
09 29 00 GYPSUM BOARD
09 30 00 TILING
09 51 13 ACOUSTICAL PANEL CEILINGS
09 51 13.1 FRP PANEL CEILINGS
09 65 13 RESILIENT BASE AND ACCESSORIES
09 65 19 RESILIENT TILE FLOORING
09 91 00 ARCHITECTURAL PAINTING

DIVISION 10 SPECIALTIES
10 21 13 TOILET COMPARTMENTS
10 22 13 WIRE MESH PARTITIONS
10 26 00 WALL AND DOOR PROTECTION
10 28 00 TOILET AND BATH ACCESSORIES
10 43 10 SIGNS
10 51 13 METAL LOCKERS

DIVISION 12 FURNISHINGS
12 36 61 SIMULATED STONE COUNTERTOPS

DIVISION 13 SPECIAL CONSTRUCTION
13 34 23 MODULAR RESTROOM AND SHOWER BUILDING

DIVISION 22 PLUMBING
22 00 01 PLUMBING SYSTEMS

DIVISION 23 MECHANICAL

23 00 00 HEATING, VENTILATING AND AIR CONDITIONING
23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC
23 07 13 DUCT INSULATION
23 09 23 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC
23 23 00 REFRIGERANT PIPING
23 31 13 METAL DUCTS
23 33 00 AIR DUCT ACCESSORIES
23 34 23 HVAC POWER VENTILATORS
23 37 13 DIFFUSERS, REGISTERS AND GRILLES
23 37 16 FABRIC DUCT
23 74 09 ROOFTOP AIR CONDITIONERS
23 81 26 SPLIT SYSTEM AIR CONDITIONERS
23 82 39.16 PROPELLER UNIT HEATERS

DIVISION 26 ELECTRICAL
26 05 00 COMMON WORK RESULTS FOR ELECTRICAL
26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 23 CONTROL - VOLTAGE ELECTRICAL POWER CABLES
26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS
26 05 48 VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS
26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 05 73.01 ELECTRICAL POWER SYSTEM STUDIES
26 09 23 LIGHTING CONTROL DEVICES
26 22 00 LOW VOLTAGE SWITCHBOARDS
26 24 16 PANELBOARDS
26 27 26 WIRING DEVICES
26 28 13 FUSES
26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS
26 36 00 TRANSFER SWICTHES
26 43 13 SURGE PROTECTION DEVICE FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
26 51 00 INTERIOR LIGHTING
26 56 00 EXTERIOR LIGHTING

DIVISION 27 COMMUNICATIONS
27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS
27 05 28 PATHWAYS FOR COMMUNICATIONS SYSTEMS
27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
27 11 00 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

27 13 00 COMMUNICATIONS BACKBONE CABLING
27 15 00 COMMUNICATIONS HORIZONTAL CABLING

DIVISION 28 ELECTRONIC SAFETY AND SECURITY
28 31 00 FIRE ALARM AND MASS NOTIFICATION SYSTEM

DIVISION 31 EARTHWORK
31 05 13 SOILS FOR EARTHWORK
31 05 16 AGGREGATES FOR EARTHWORK
31 25 13.13 SEEDING FOR EROSION CONTROL

DIVISION 32 EXTERIOR IMPROVEMENTS
32 12 16 ASPHALT PAVING
32 16 13 CURBS AND GUTTERS
32 31 13.53 HIGH-SECURITY CHAIN LINK FENCES AND GATES

END OF TABLE OF CONTENTS

DIVISION 1
GENERAL REQUIREMENTS

01 11 00 SUMMARY OF WORK

1.00 GENERAL

1.01 WORK INCLUDED

A. Construct Work as described in the Contract Documents.

1. Provide the materials, equipment, and incidentals required to make the Project completely and fully operable.
2. Provide the labor, equipment, tools, and consumable supplies required for a complete Project.
3. Provide the civil, architectural, structural, mechanical, electrical, instrumentation and all other Work required for a complete and operable Project.
4. Test and place the completed Project in operation.
5. Provide the special tools, spare parts, lubricants, supplies, or other materials as indicated in Contract Documents for the operation and maintenance of the Project.
6. Install Owner provided products and place in operation.
7. The Contract Documents do not indicate or describe all of the Work required to complete the Project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer.

1.02 JOB CONDITIONS

A. The General Conditions, the Supplementary Conditions, and General Requirements apply to each Section of the Specifications.

B. Comply with all applicable state and local codes and regulations pertaining to the nature and character of the Work being performed.

1.03 DESCRIPTION OF WORK

A. Work is described in general, non-inclusive terms as:

1. Modernization of the Texas Army National Guard's Weslaco Readiness Center facility in order to mitigate life safety and code related deficiencies currently experienced at the project site. Interior building improvements include architectural, mechanical, electrical, plumbing, structural and IT/telecom trades. Exterior Building Improvements include site civil and utility modifications.

1.04 CONSTRUCTION OF UTILITIES

1. Contractor may provide temporary power, water, natural gas, telecomm and internet service if required for the project site through the governing utility.
2. Cost for providing temporary power, water, natural gas, telecomm and internet will be paid for by the Contractor.
3. Pay for temporary power, including, but not limited to construction cost, equipment, connection fees and permits.

1.05 OCCUPANCY

A. As soon as any portion of the structure and equipment are ready for use, the Owner shall have the right to occupy or operate that portion upon written notice to the Contractor.

B. The facility shall be unoccupied during the course of this project.

C. Testing of equipment and appurtenances including specified test periods, training, and startup does not constitute acceptance for operation.

D. Owner may accept the new work for continued use after startup and testing at the option of the Owner.

E. The execution of bonds is understood to indicate the consent of the surety to the technical provisions and design drawings provided for this project.

F. Provide an endorsement from the insurance carrier permitting owner partial occupancy of the structures in accordance with the provisions set forth by the Uniform General Conditions (UGCs) during the remaining period of construction.

G. Conduct operations to insure the least inconvenience to the Owner and general public.

1.06 WORK BY OWNER

A. Telecomm and IT System Components:

1. PRODUCTS Owner will perform or award separate contract for the installation of routers, switches, servers, and other accessories in all Telephone Equipment Rooms, upon Substantial Completion of the work in all telecom rooms.

B. Intrusion Detection Systems (IDS) Components:

1. Owner will perform or award separate contract for the demolition and removal of the IDS components in the existing Weapons Vaults. Contractor will coordinate with the IDS Contractor concerning placement of the infrastructure components for the IDS. Owner will perform or award separate contract for the installation of the IDS, upon Substantial Completion of the work in all telecom rooms.

C. Fire Extinguishers

1. Owner will provide all fire extinguishers for fire extinguisher cabinets upon substantial completion of all fire extinguisher cabinet work.

D. Emergency Generator

1. Owner will provide temporary generator for emergency power upon substantial completion of all emergency electrical system work.

2.00 PRODUCTS

2.01 MATERIALS

A. Provide materials and products per the individual Sections of the Specifications.

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

01 22 00 UNIT PRICES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Uniform General Conditions (UGCs)

2. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.

3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.03 DEFINITIONS

A. Unit price a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.04 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

2.00 PRODUCTS (NOT USED)

3.00 EXECUTION

3.01 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Repair of concrete cracking and concrete spalling in building.

1. Description: infill of cracked or spalled concrete, as required, according to design drawings and specification section 030130 “Maintenance of Cast-In-Place Concrete”.

2. Unit of Measurement: Cubic yard of spalled concrete repaired, based on in-place surveys of volume before and after filling. Linear feet of concrete cracks repaired, based on in-place surveys of crack length before and after filling.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012310 "Bid Options and Allowances."

END OF SECTION

01 23 10 BID OPTIONS AND ALLOWANCES

1.00 GENERAL

1.01 REQUIREMENTS

A. Bid Options:

1. This Section describes each bid option by number and describes the basic changes to be incorporated into the Work when this bid option is made a part of the Work in the Agreement.
2. Drawings and Specifications will outline the extent of Work to be included in the bid option Contract Price.
3. Coordinate related Work and modify surrounding Work as required to properly integrate the Work under each bid option, and provide a complete and functional system as required by the Contract Documents.
4. Bid options will be accepted or rejected at the option of the Owner in any sequence.
5. Bid option prices will be maintained a minimum of 120 days, unless noted otherwise.

B. Allowances:

1. Include specified allowance amount in Contract Price.
2. The amount of each allowance includes:
    a. The cost of the product to the Contractor less any applicable trade discounts.
    b. Delivery to the Site.
    c. Applicable taxes.
3. Include in the Contract Price all costs for:
    a. Handling at the Site, including unloading, uncrating, and storage per Section 01 31 00 “Project Management and Coordination.”
    b. Cost for labor and equipment for installation and finishing.
    c. Cost for related products not specifically listed in the allowance required for installation, including consumable supplies and materials.
    d. All overhead, profit, and related costs.
4. Assist Owner in the selection of products.
    a. Determine qualified Suppliers.
    b. Obtain proposals from qualified Suppliers.
    c. Present available alternates to the Owner through the Engineer. Notify Engineer of:
        1). Any objections to a particular Supplier or product.
        2). Effect on the Construction Schedule anticipated by the selection of each option.
        3). Cost of each option.

5. Upon selection of the product:
    a. Purchase and install the product.
    b. Contractor's responsibilities for products shall be the same as for products selected by the Contractor.
6. Submit a Contract Modification Request per Section 01 31 13 "Project Coordination" to adjust Contract Price if the net cost of the product is more or less than the specified amount.
    a. For products specified as Unit Price Work, the unit cost shall apply to the quantities installed per the method of payment described in Section 01 29 00 "Payment Procedures."
    b. Do not perform Work until selection of alternate has been approved in writing by the Owner.
    c. Provide actual invoices for the materials.

1.02 SUBMITTALS

A. Provide submittals for materials furnished as part of the bid option in accordance with Section 01 33 00 "Submittal Procedures."

1.03 DESCRIPTION OF BID OPTIONS

1. Temporary restroom building
2. Temporary shower building
3. Full IT system including upgrades
4. Additional HVAC upgrades/repairs/HVLS fans
5. Restroom/conference room renovation in admin wing
6. Exterior building/parking improvements/building sign
7. Exterior earthwork & drainage
8. Electrical generator provisions
9. Site security fencing to meet ATFP standoff regulations
10. New storage caging in existing northeast storage area
11. TA-50 lockers for secure equipment storage.

S1. Provide Occupancy Sensors

S2. Provide DDC Controls System

1.04 DESCRIPTION OF ALLOWAINCES

A. Allowance 1 – Concrete Repair:
    1. Provide allowance for 1000 linear feet of concrete crack repair and 50 Cu. Ft. of concrete spall repair per detail 4/S-4.

1.05 GUARANTEES

A. Provide guarantees for products furnished under bid options / proposals or purchased by allowances as required by the Contract Documents.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

01 29 00 PAYMENT PROCEDURES

1.00 GENERAL

1.01 WORK INCLUDED

A. Payments for Work shall conform to the provisions of the Uniform General Conditions 2010, the Supplemental General Conditions 2010, the Agreement, and this Section. Apply provisions for payments in the Section to all Subcontractors and Suppliers.

B. Submit Applications for Payment at the amounts indicated in the Agreement:

1. Amounts for each item in the Agreement shall include but not be limited to cost for:

a. Mobilization, demobilization, cleanup, bonds, and insurance.

b. Professional services including but not limited to engineering and legal fees.

c. The products to be permanently incorporated into the Project.

d. The products consumed during the construction of the Project.

e. The labor and supervision to complete the Project.

f. The equipment, including tools, machinery, and appliances required to complete the Project.

g. The field and home office administration and overhead costs related directly or indirectly to the Project.

h. Any and all kinds, amount or class of excavation, backfilling, pumping or drainage, sheeting, shoring and bracing, disposal of any and all surplus materials, permanent protection of all overhead, surface or underground structures; removal and replacement of any poles, conduits, pipelines, fences, appurtenances and connections, cleaning up, overhead expense, bond, public liability and compensation and property damage insurance, patent fees, and royalties, risk due to the elements, and profits, unless otherwise specified.

2. Provide Work not specifically set forth as an individual payment item but required to provide a complete and functional system. These items are a subsidiary obligation of the Contractor and are to be included in the Cost of Work.

3. Payment will be made for materials on hand.

a. Store materials properly on Site per Section 01 31 00 “Project Management and Coordination.”

1). Payment for stored materials and/or equipment confirmed by Owner and A/E to be on-site or otherwise properly stored is limited to eighty-five (85) percent of the invoice price or eighty five (85) percent of the scheduled value for the materials or equipment, whichever is less.

2). Provide delivery tickets and invoices at the time materials are included on the materials-on-hand tabulation.

b. Provide documentation of payment for materials-on-hand with the next payment request. Adjust payment to the amount actually paid if this differs from the invoice amount. Remove items from the materials on hand tabulation if this documentation is not provided so payment will not be made.

c. Payment for materials-on-hand is provided for the convenience of the Contractor and does not constitute acceptance of the product.

4. Owner will withhold from each progress payment, as a retainage, five (5) percent of the total earned amount, the amount authorized by law, or as otherwise set forth in the Supplementary General Conditions or Special Conditions. Retainage is managed in conformance with Tex. Gov't Code, Chapter 2252, Subchapter B.

a. Contractor shall provide written consent of its surety for any request for a reduction or release of retainage.

b. At least sixty five (65) percent of the contract, or such other discrete Work phase as or Work Package delineated in the contract Documents, must be completed before Owner can consider a retainage reduction or release.

c. Contractor shall not withhold retainage from their Subcontractors and supplier in amounts that are any percentage greater than that withheld in its Contract with Owner, unless otherwise acceptable to Owner.

5. The Work covered by progress payments becomes the property of the Owner at the time of payment.

1.02 SCHEDULE OF VALUES AND PAYMENTS

A. Coordinate with the Uniform General Conditions and Project Specific Milestones IAW Articles 8 and 10 of Supplemental General Conditions, and as otherwise directed by the Texas Military Department.

B. Submit a detailed Schedule of Values for the Work to be performed on the project.

1. Submit schedule within 10 days prior to submitting the first Application for Payment.

2. Line items in the Agreement are to be used as line items in the schedule.

3. Payment will be made on the quantity of Work completed per Contract Documents during the payment period and as measured per this Section.

a. Partial payments will be made for milestone items in the Agreement.

1). Milestone items in the Agreement are to be divided into smaller unit prices to allow more accurate determination of the percentage of the item that has been completed.

a). Provide adequate detail to allow more accurate determination of the percentage of Work completed for each item.

b). Break down line items for cost associated with labor, materials and equipment.

c). Provide amounts for items that do not exceed $50,000.00. An exception may be made for equipment packages that cannot be subdivided into units or subassemblies.

d). Separate product costs and installation costs.

(1). Product costs include cost for product, delivery and unloading costs, royalties and patent fees, taxes, and other cost paid directly to the Subcontractor or Supplier.

(2). Installation costs include cost for the supervision, labor and equipment for field fabrication, erection, installation, start-up, initial operation and overhead and profit.

e). Include a directly proportional amount of overhead and profit for each line item.

f). Divide principal subcontract amounts into an adequate number of line items to allow determination of the percentage of Work completed for each item.

2). These line items may be used to establish the value of Work to be added or deleted from the Project.

3). Correlate line items with other administrative schedules and forms:

a). Progress schedule.

b). List of Subcontractors.

c). Schedule of allowances.

d). Schedule of alternatives.

e). List of products and principal Suppliers.

f). Schedule of Submittals.

4). Costs for mobilization shall be listed as a separate line item and shall be actual cost for:

a). Bonds and insurance.

b). Transportation and setup for equipment.

c). Transportation and/or erection of all field offices, sheds and storage facilities.

d). Salaries for preparation of submittals required before the first Application for Payment.

e). Salaries for field personnel assigned to the Project related to the mobilization of the Project.

(1). Mobilization may not exceed 3 percent of the total Contract amount. Cost for mobilization may be submitted only for Work completed.

5). The sum of all values listed in the schedule must equal the total Contract amount.

4. Submit a schedule indicating the anticipated schedule of payments to be made by the Owner. Schedule shall indicate:

a. The Application for Payment number.

b. Date the request is to be submitted.

c. Anticipated amount of payment to be requested.

5. Update the Schedule of Values quarterly or more often if necessary to provide a reasonably accurate indication of the funds that the Owner will need to have available to make payment to the Contractor for the Work performed.

C. Provide written approval of the Schedule of Values, Application for Payment form, and method of payment by the Surety Company providing performance, and bonds prior to submitting the first Application for Payment. Payment will not be made without this approval.

D. Provide inspector's signed milestone reports, HUB subcontractors plan, construction payment affidavit, solid waste reporting sheet and contractor's affidavit of release of liens.

1.03 PAYMENT PROCEDURES

A. Submit Applications for Payment per the procedures indicated in Section 01 33 00 "Submittal Procedures." Submit a Schedule of Values in the Application for Payment format to be used.

B. Applications for Payment may be submitted on a pre-printed form as indicated in Section 01 31 13.13 "Forms" or may be generated by computer. Computer generated payment requests must have the same format and information indicated in the pre-printed form and be approved by the Engineer.

C. Progress payments shall be made as the Work progresses on a monthly basis.

1. End the payment period on the day indicated in the Agreement and submit an Application for Payment for Work completed and materials received since the end of the last payment period.

2. At the end of the payment period, submit a draft copy of the Application for Payment for that month to the Engineer. Agreement is to be reached on:

a. The percentage of Work completed for each lump sum item.

b. The percentage of Work completed for each approved Change Order item.

c. The amount of materials-on-hand.

3. On the basis of these agreements the Contractor is to prepare a final copy of the Application for Payment and submit it to the Engineer for approval.

4. The Engineer will review the Application for Payment and if appropriate will recommend payment of the application to the Owner.

D. Provide a revised and up-to-date Progress Schedule per Section 01 32 16 "Construction Progress Schedules" with each Application for Payment.

E. Provide project photographs per Section 01 32 33 "Photographic Documentation" with final Application for Payment.

1.04 MEASUREMENT PROCEDURES

A. Measure the Work described in the Agreement for payment. Payment will be made only for the actual measured and/or computed length, area, solid contents, number and weight, unless otherwise specifically provided. No extra or customary measurements of any kind will be allowed.

1.05 BASIS OF PAYMENT

A. The Basis of Payment will be established in the Contract Documents.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

01 31 00 PROJECT MANAGEMENT

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish equipment, manpower, products, and other items necessary to complete the Project with an acceptable standard of quality and within the Contract time. Construct Project in accordance with current safety practices.

B. Manage Site to allow access to Site and control construction operations.

C. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.

D. Construct temporary impounding works, channels, diversions, furnishing and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.

E. Provide temporary controls for pollutions, management of water and management of excess earth as required in Section 01 50 00 “Temporary Facilities and Controls.”

F. Cost for Project Management and Coordination as described in this section are to be included in the Contract Price.

1.02 QUALITY ASSURANCE

A. Project Superintendent shall be on-site at all times while work is being performed by either general contractor or subcontractor(s).

B. Employ competent workmen, skilled in the occupation for which they are employed. Provide Work meeting quality requirements of the Contract Documents as determined by the Engineer and Owner.

C. Contractor shall not employ any Subcontractor, supplier or other person or organization, whether initially or as a substitute, against whom Owner shall have reasonable objection, including but not limited to failing to meet requirements of background checks, as defined elsewhere in the technical specifications. Owner will communicate such objections in writing within 10 days of receipt of Contractor’s intent to use such Subcontractor, supplier or other person or organization.

D. Contractors shall not employ or substitute Subcontractors without the acceptance of the Owner.

E. Remove defective Work from the Site immediately unless provisions have been made and approved by the Engineer to allow repair of the product at the Site. Clearly mark the Work as "defective" until it is removed or allowable repairs have been completed.

1.03 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 “Submittal Procedures.”

1. Provide copies of Supplier's printed storage instructions prior to furnishing materials or products and installation instructions prior to beginning the installation. Maintain one copy of these documents at the Site until the Project is complete. Incorporate this information into submittals.
2. Incorporate field notes, sketches, recordings, and computations made by the Contractor in Record Drawings.

1.04 STANDARDS

A. Perform Work to comply with local, State and Federal ordinances and regulations.

1.05 SAFETY REQUIREMENTS

A. Assume sole responsibility for safety at the Site. Protect the safety and welfare of persons at the Site.

B. Provide safe access to move through the Site. Provide and maintain barricades, guard rails, covered walkways, and other protective devices to warn and protect from hazards at the Site.

C. Comply with latest provisions of the Occupational Health and Safety Administration and other regulatory agencies in performing Work.

D. Cooperate with accident investigations related to the Site. Provide two copies of all reports, including insurance company reports, if requested by the Owner, prepared concerning accidents, injury, or death on the Site to the Engineer as Record Data per Section 01 33 00 "Submittal Procedures."

E. Prior to allowing entry to the site, perform all security screening for personnel per the Uniform General Conditions.

1.06 COORDINATION

A. Coordinate the Work of various trades having interdependent responsibilities for installing, connecting to, and placing equipment in service.

B. Coordinate requests for substitutions to provide compatibility of space, operating elements, effect on the Work of other trades, and on the Work scheduled for early completion.

C. Coordinate the use of Project space and the sequence of installation of equipment, elevators, walks, mechanical, electrical, plumbing, or other Work that is indicated diagrammatically on the Drawings.

1. Follow routings shown for tubes, pipes, ducts, conduits, and other items as closely as practical, with due allowance for available physical space.
2. Utilize space efficiently to maximize accessibility for Owner's maintenance and repairs.
3. Schematics are diagrammatic in nature. Adjust routing of piping, ductwork, utilities, and location of equipment as needed to resolve spatial conflicts between the various trades. Document the actual routing on the Record Drawings.

D. Conceal ducts, pipes, wiring, and other non-finish items in finished areas, except as otherwise shown. Coordinate locations of concealed items with finish elements.

E. Coordinate with plans the exact location and dimensioning of items which occur within hung ceilings. Request clarification from the Engineer prior to proceeding with fabrication or installation if a conflict exists.

F. Schedule construction activities in sequence required to obtain best results where installation of one part of the Work is dependent on installation of other components, either before or after its own installation.

G. Sequence, coordinate, and integrate the various elements of mechanical, electrical, and other systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical and electrical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction.
4. Install systems, materials, and equipment as permitted by codes to provide the maximum headroom possible where mounting heights are not detailed or dimensioned.
5. Coordinate the connection of systems with exterior underground and overhead utilities and services. Comply with the requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
6. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to the greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Adjust routing of piping, ductwork, utilities, and location of equipment as needed to resolve spatial conflicts between the various trades. Document changes in the indicated routings on the Record Drawings.
7. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
8. Install systems, materials, and equipment to facilitate servicing, maintenance, and repair or replacement of components. As much as practical, connect for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to accessible locations.
9. Install access panel or doors where units are concealed behind finished surfaces.
10. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

1.07 CONTRACTOR'S USE OF SITE

A. Limit the use of Site for Work and storage to those areas designated on the Drawings or approved by the Engineer. Coordinate the use of the premises with the Engineer.

B. Repair or correct any damage to existing facilities, including contamination, caused by the Contractor's personnel, visitors, materials, or equipment.

C. Do not permit alcoholic beverages or illegal substances on the Site. Do not allow persons under the influence of alcoholic beverages or illegal substances to enter or remain on the Site at any time. Persons on Site under the influence of alcoholic beverages or illegal substances will be permanently prohibited from returning to the Site. Criminal or civil penalties may also apply.

D. Park construction equipment in designated areas only and provide spill control measures as discussed in Section 01 50 00 "Temporary Facilities and Controls."

E. Park employees' vehicles in designated areas only.

F. Obtain written permission of the Owner and the adjacent private property Owner before entering privately-owned land outside of the Owner's property, rights-of-way, or easements.

G. Do not allow the use of audio devices, obnoxious, vulgar or abusive language, or sexual harassment in any form. These actions will cause immediate and permanent removal of the offender from the premises. Criminal or civil penalties may apply.

H. Require Workers to wear clothing that is inoffensive and meets safety requirements. Do not allow sleeveless shirts, shorts, exceedingly torn, ripped or soiled clothing to be worn on the project.

I. Do not allow firearms or weapons of any sort to be brought on to the Site under any conditions. No exception is to be made for persons with concealed handgun permits. Remove any firearms or weapons and the person possessing these firearms or weapons permanently and immediately from the Site.

1.08 ACCESS TO THE SITE

A. Maintain access to the facilities at all times. Do not obstruct roads, pedestrian walks, or access to the various buildings, structures, stairways, or entrances. Provide safe temporary walks or other structures to allow access for normal operations during construction.

B. Provide adequate and safe access for inspections. Leave ladders, bridges, scaffolding and protective equipment in place until inspections have been completed. Construct additional safe access if required for inspections.

C. Provide security at the Site as necessary to protect against vandalism and loss by theft.

D. Use State, County, or City roadways for construction traffic only with written approval of the appropriate representatives of each entity. State, County, or City roadways may not all be approved for construction traffic. Obtain written approval to use State, County, City or private roads to deliver pipe and/or heavy equipment to the Site. Copies of the written approvals must be furnished to the Owner as Record Data before Work begins. No additional compensation will be paid because the Contractor is unable to gain access to the easement from public roadways.

1.09 PROPERTY PROVISIONS

A. Make adequate provisions to maintain the flow of storm sewers, sanitary sewers, drains and water courses encountered during the construction. Provide temporary service around the construction or otherwise construct the structure in a manner that the flow is not curtailed. Restore structures which may have been disturbed during construction to their original position as soon as construction in the area is completed.

B. Protect trees, fences, signs, poles, guy wires, and all other property unless their removal is authorized. Restore any property damaged to equal or better condition per Paragraph 1.11 of this Section.

1.10 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. Examine the Site and review the available information concerning the Site. Locate utilities, streets, driveways, fences, drainage structures, sidewalks, curbs, and gutters. Verify the elevations of the structures adjacent to excavations. Report these to the Engineer before beginning construction.

B. Determine if existing structures, poles, piping, or other utilities at excavations will require relocation or replacement. Coordinate Work with Contractor, local utility company and others. Include cost of demolition and replacement, restoration or relocation of these structures in the Cost of Work.

C. Protect buildings, utilities, street surfaces, driveways, sidewalks, curb and gutter, fences, wells, drainage structures, piping, valves, manholes, electrical conduits, and other systems or structures unless they are shown to be replaced or relocated on the Drawings. Restore damage to items to be protected to the satisfaction of the Engineer, utility owner and Owner without additional compensation from the Owner.

D. Carefully support and protect all structures and/or utilities so that there will be no failure or settlement where excavation or demolition endangers adjacent structures and utilities. Do not take existing utilities out of service unless show in the Contract Documents or approved by the Engineer. Notify and cooperate with the utility owner if it is necessary to move services, poles, guy wires, pipelines or other obstructions. Include the cost of relocation and permits required to move existing utilities in the Cost of Work.

E. Protect buildings from damage when handling material or equipment. Protect finished surfaces, including floors, doors, and jambs. Remove doors and install temporary wood protective coverings over jambs.

1.11 DISRUPTION TO SERVICES / CONTINUED OPERATIONS

A. Existing facilities are to continue in service as usual during the construction unless noted otherwise. Owner or utilities must be able to operate and maintain the facilities. Disruptions to existing utilities, piping, process piping, or electrical services shall be kept to a minimum.

1. Do not restrict access to critical valves, operators, or electrical panels.

2. Do not store material or products inside structures.

3. Limit operations to the minimum amount of space needed to complete the specified Work.

4. Maintain storm sewers and sanitary sewers in service at all times. Provide temporary service around the construction or otherwise construct the structure in a manner that the flow is not restricted.

B. Provide a Plan of Action if facilities must be taken out of operation. Plan of Action shall be provided to Owner at least two weeks prior to system shutdown. Contractor must receive written approval from owner prior to commencing any system shutdown activities.

1. Provide a plan for system switchover. Plan shall be for switchover from existing tower to temporary tower, and from temporary tower to new tower.

2. Provide a plan for temporary cooling tower installation and operation.

1.12 FIELD MEASUREMENTS

A. Perform complete field measurements for products required to fit existing conditions prior to purchasing products or beginning construction.

B. Verify property lines, control lines, grades, and levels indicated on the Drawings.

C. Verify pipe class, equipment capacities, existing electrical systems and power sources for existing conditions.

D. Check Shop Drawings and indicate the actual dimensions available where products are to be installed.

E. Include field measurements in Record Drawings.

1.13 DELIVERY AND STORAGE

A. Deliver products and materials to the Site in time to prevent delays in construction.

B. Deliver packaged products to Site in original undamaged containers with identifying labels attached. Open cartons as necessary to check for damage and to verify invoices. Reseal cartons and store properly until used. Leave products in packages or other containers until installed.

C. Deliver products that are too large to fit through openings to the Site in advance of the time enclosing walls and roofs are erected. Set in place, raised above floor on cribs.

D. Assume full responsibility for the protection and safekeeping of products stored at the Site.

E. Store products at locations acceptable to the Engineer and to allow Owner access to maintain and operate existing facilities.

F. Store products in accordance with the Supplier’s storage instructions immediately upon delivery. Leave seals and labels intact. Arrange storage to allow access for maintenance of stored items and for inspection. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

G. Obtain and pay for the use of any additional storage areas as needed for construction. Store products subject to damage by elements in substantial weather-tight enclosures or storage sheds. Provide and maintain storage sheds as required for the protection of products. Provide temperature, humidity control and ventilation within the ranges stated in the Supplier's instructions. Remove storage facilities at the completion of the Project.

H. Protect the pipe interior. Keep all foreign materials such as dirt, debris, animals, or other objects out of the pipe during the Work. Cap or plug ends of installed pipe in an approved manner when pipe is not being installed. Clean or wash out pipe sections that become contaminated before continuing with installation. Take precautions to prevent the pipe from floating or moving out of the proper position during or after laying operations. Immediately correct any pipe that moves from its correct position.

I. Provide adequate exterior storage for products that may be stored out-of-doors.

1. Provide substantial platforms, blocking, or skids to support materials and products above ground; slope to provide drainage. Protect products from soiling or staining.
2. Cover products subject to dislocation or deterioration from exposure to the elements, with impervious sheet materials. Provide ventilation to prevent condensation below covering.
3. Provide surface drainage to prevent erosion and ponding of water.
4. Prevent mixing of refuse or chemically injurious materials or liquids with stored materials.
5. Pipes and conduits stored outdoors are to have open ends sealed to prevent the entrance of dirt, moisture, and other injurious materials. Protect PVC pipe from ultraviolet light exposure.
6. Store light weight products to prevent wind damage.

J. Protect and maintain mechanical and electrical equipment in storage.

1. Provide Supplier's service instructions on the exterior of the package.
2. Service equipment on a regular basis as recommended by the Supplier. Maintain a log of maintenance services. Submit the log as Record Data at the completion of the Project.
3. Provide power to and energize space heaters for all equipment for which these devices are provided.
4. Provide temporary enclosures for all electrical equipment, including electrical systems on mechanical devices. Provide and maintain heat in the enclosures until equipment is energized.

K. Maintain storage facilities. Inspect stored products on a weekly basis and after periods of severe weather to verify that:

1. Storage facilities continue to meet specified requirements.
2. Supplier's required environmental conditions are continually maintained.
3. Surfaces of products exposed to the elements are not adversely affected.

L. Replace any stored item damaged by inadequate protection or environmental controls.

M. Payment may be withheld for any products not properly stored.

1.14 CLEANING DURING CONSTRUCTION

A. Provide positive methods to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from disbursing into the atmosphere. Control dust and dirt from demolition, cutting, and patching operations.

B. Clean the Project as Work progresses and dispose of waste materials, keeping the Site free from accumulations of waste or rubbish. Provide containers on Site for waste collection. Do not allow waste materials or debris to blow around or off of the Site. Control dust from waste materials. Transport waste materials with as few handlings as possible.

C. Comply with codes, ordinances, regulations, and anti-pollution laws. Do not burn or bury waste materials. Remove waste materials, rubbish and debris from the Site and legally dispose of these at public or private dumping areas.

1.15 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching required to complete the Work or to:

1. Uncover Work to provide for installation of new Work or the correction of defective Work.
2. Provide routine penetrations of non-structural surfaces for installation of mechanical, electrical, and plumbing Work.
3. Uncover Work that has been covered prior to observation by the Engineer.

B. Submit written notification to the Engineer in advance of performing any cutting which affects:

1. Work of any other Contractor or the Owner.
2. Structural integrity of any structure or system of the project.
3. Integrity or effectiveness of weather exposed or moisture resistant structure or systems.
4. Efficiency, operational life, maintenance, or safety of any structure or system.
5. Appearance of any structure or surfaces exposed occasionally or constantly to view.

C. The notification shall include:

1. Identification of the Project.
2. Location and description of affected Work.
3. Reason for cutting, alteration, or excavation.
4. Effect on the Work of any separate contractor or Owner.
5. Effect on the structural or weatherproof integrity of the project.
6. Description of proposed Work, including:
    a. Scope of cutting, patching, or alteration.
    b. Trades that will perform the Work.

c. Products proposed for use.

d. Extent of refinishing to be performed.

e. Cost proposal, when applicable.

7. Alternatives to cutting and patching.

8. Written authorization from any separate Contractor whose Work would be affected.

9. Date and time Work will be uncovered or altered.

D. Examine the existing conditions, including structures subject to damage or to movement during cutting or patching.

1. Inspect conditions affecting installation of products or performance of the Work after uncovering the Work.

2. Provide a written report of unacceptable or questionable conditions to the Engineer. The Contractor shall not proceed with Work until Engineer has provided further instructions. Beginning Work will constitute acceptance of existing conditions by the Contractor.

E. Protect the structure and other parts of the Work and provide adequate support to maintain the structural integrity of the affected portions of the Work. Provide devices and methods to protect adjacent Work and other portions of the Project from damage. Provide protection from the weather for portions of the Project that may be exposed by cutting and patching Work.

F. Execute cutting and demolition by methods which will prevent damage to other Work, and will provide proper surfaces to receive installation of repairs.

G. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

H. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to, the removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the modified Work.

I. Restore Work which has been cut or removed. Install new products to provide completed Work per the Contract Documents.

J. Fit Work air-tight to pipes, sleeves, ducts, conduit, and other penetrations through the surfaces. Where fire rated separations are penetrated, fill the space around the pipe or insert with materials with physical characteristics equivalent to fire resistance requirements of penetrated surface.

K. Patch finished surfaces and building components using new products specified for the original installation.

L. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

1. For continuous surfaces, refinish to the nearest intersection.

2. For an assembly, refinish the entire unit.

1.16 PRELIMINARY OCCUPANCY

A. Owner may deliver, install and connect equipment, furnishings, or other apparatus in buildings or other structures. These actions do not indicate acceptance of any part of the building or structure and does not affect the start of warranties or correction periods.

B. Protect the Owner's property after installation is complete.

C. Owner or Engineer may use any product for testing or determine that the product meets the requirements of the Contract Documents. This use does not constitute acceptance by either the Owner or Engineer. These actions do not indicate acceptance of any part of the product and does not affect the start of warranties or correction periods.

1.17 INITIAL MAINTENANCE AND OPERATION

A. Maintain equipment until the Project is accepted by the Owner. Ensure that mechanical equipment is properly maintained as recommended by the Supplier.

B. Do not operate air handling equipment unless filters are in place and are clean. Change filters weekly during construction.

C. Provide maintenance and start-up services prior to acceptance of equipment, per Section 01 75 00 "Starting and Adjusting."

D. Remove and clean screens and strainers in piping systems.

E. Clean insects from intake louver screens.

F. Provide documentation of maintenance and operations when Owner takes over operation and control of the Project.

2.00 PRODUCTS

2.01 MATERIALS

A. Provide materials in accordance with the requirements of the individual Sections.

3.00 EXECUTION

3.01 PERFORMANCE OF WORK

A. Perform the Work per the Supplier's published instructions. Do not omit any preparatory step or installation procedure unless specifically exempted or modified by Change Order, which would be provided by the contractor and approved by the Engineer of Record and the Owner.

END OF SECTION

01 31 13 PROJECT COORDINATION

1.00 GENERAL

1.01 WORK INCLUDED

A. Administer contract requirements to construct the Project. Provide documentation per the requirements of this Section. Provide information as requested by the Engineer or Owner.

1.02 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 “Submittal Procedures.”

1.03 COMMUNICATION DURING THE PROJECT

A. The Engineer is to be the first point of contact for all parties on matters concerning this project.

B. The Engineer will coordinate correspondence concerning:

1. Submittals, including Applications for Payment.
2. Clarification and interpretation of the Contract Documents.
3. Contract modifications.
4. Observation of Work and testing.
5. Claims.

C. The Engineer will normally communicate only with the Contractor. Any required communication with Subcontractors or Suppliers will only be with the direct involvement of the Contractor.

D. Direct written communications to the Engineer at the address indicated at the Pre-construction Conference. Include the following with communications as a minimum:

1. Name of the Owner.
2. Project name.
3. Contract title.
4. Project number.
5. Date.
6. A reference statement.

E. Submit communications on the forms referenced in this Section or in Section 01 33 00 “Submittal Procedures.”

1.04 PROJECT MEETINGS

A. Pre-construction Conference:

1. Attend a pre-construction conference.
2. The location of the conference will be determined by the Engineer.

3. The time of the meeting will be determined by the Engineer but will be after the Notice of Award is issued and not later than 15 days after the Notice to Proceed is issued.
4. The Owner, Engineer, Contractor's project manager and superintendent, representatives of utility companies, and representatives from major Subcontractors and Suppliers may attend the conference.
5. Provide and be prepared to discuss:
    a. Preliminary construction schedule per Section 01 32 16 "Construction Progress Schedule."
    b. Preliminary submittal schedule per Section 01 33 00 "Submittal Procedures."
    c. Schedule of values and anticipated schedule of payments per Section 01 29 00 "Payment Procedures."
    d. List of Subcontractors and Suppliers.
    e. Contractor's organizational chart as it relates to this Project.
    f. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents, contract modifications and payment requests.
    g. Project milestone schedule.

B. Progress Meetings:
1. Attend meetings with the Engineer and Owner.
    a. Meet on a monthly basis or as requested by the Engineer to discuss the Project.
    b. Meet at the Site or other location as designated by the Engineer.
    c. Contractor's superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.
    d. Notify the Engineer of any specific items to be discussed a minimum of 1 week prior to the meeting.
2. Provide information as requested by the Engineer or Owner concerning this Project. Prepare to discuss:
    a. Status of overall project schedule.
    b. Contractor's detailed schedule for the next month.
    c. Anticipated delivery dates for equipment.
    d. Coordination with the Owner.
    e. Status of submittals.
    f. Information or clarification of the Contract Documents.
    g. Claims and proposed modifications to the Contract.
    h. Field observations, problems, or conflicts.
    i. Maintenance of quality standards.

3. Engineer will prepare minutes of meetings. Review the minutes of the meeting and notify the Engineer of any discrepancies within ten days of the date of the meeting memorandum. The minutes will not be corrected after the ten days have expired. Corrections will be reflected in the minutes of the following meeting or as an attachment to the minutes.

C. Pre-submittal and Pre-installation Meetings:

1. Conduct pre-submittal and pre-installation meetings as required in the individual technical Specifications or as determined necessary by the Engineer.

2. Set the time and location of the meetings when ready to proceed with the associated Work. Submit a Notification by Contractor in accordance with Paragraph 1.07 for the meeting 2 weeks before the meeting. Engineer and Owner must approve of the proposed time and location.

3. Attend the meeting and require the participation of appropriate Subcontractors and Suppliers in the meeting.

4. Prepare minutes of the meeting and submit to the Engineer and Owner for review. Owner and Engineer will review the minutes of the meeting and notify the Contractor of any discrepancies within ten days of the date of the meeting memorandum. The minutes will not be corrected after the ten days have expired. Corrections will be reflected in a revised set of meeting minutes.

1.05 REQUESTS FOR INFORMATION

A. Submit Request for Information (RFI) to the Engineer to obtain additional information or clarification of the Contract Documents.

1. Submit a separate RFI for each item on the form provided by the Engineer. Engineer will provide this form to contractors at the Pre-Construction Conference.

2. Attach adequate information to permit a written response without further clarification. Engineer will return requests that do not have adequate information to the Contractor for additional information. Contractor is responsible for all delays resulting from multiple submittals due to inadequate information.

3. A response will be made when adequate information is provided. Response will be made on the RFI form or in attached information.

B. Response to an RFI is given to provide additional information, interpretation, or clarification of the requirements of the Contract Documents, and does not modify the Contract Documents.

C. Engineer will initiate a Contract Modification Request per Paragraph 1.08 if the RFI indicates that a contract modification is required.

D. Use the Project Issues Log to document decisions made at meetings and actions to be taken in Accordance with Paragraph 1.06.

1.06 PROJECT ISSUES LOG

A. Engineer will maintain a project issues log to document key decisions made at meeting and track action on these issues:

1. Review the log prior to each regular meeting.

2. Report actions taken subsequent to the previous progress meeting on items in the log assigned to the Contractor or through the Contractor to a Subcontractor or Supplier to the Engineer. Report on status of progress 1 week prior to each progress meeting established in Paragraph 1.04 to allow Engineer to update the log prior to the Progress meetings.

3. Be prepared to discuss the status at each meeting.

B. Decisions or action items in the log that require a change in the Contract Documents will have the preparation of a contract modification as an action items if appropriate. The Contract Documents can only be changed by a Change Order.

1.07 NOTIFICATION BY CONTRACTOR

A. Notify the Engineer of:

1. Need for testing.

2. Intent to work outside regular working hours.

3. Request to shut down facilities or utilities.

4. Proposed utility connections.

5. Required observation by Engineer or inspection agencies prior to covering Work.

6. Training.

7. Need for Supplemental Instructions.

B. Provide notification a minimum of 2 weeks in advance in order to allow Owner and Engineer time to respond appropriately to the notification.

C. Use “Notification by Contractor” form. Engineer will provide this form to the contractor at the Pre-Construction Conference.

1. A/E will provide an Architect’s Supplemental Instruction (ASI) form to provide any supplemental instructions requested by the contractor.

1.08 REQUESTS FOR MODIFICATIONS

A. Submit a request to the Engineer for any change in the Contract Documents.

1. Use the “Contract Modification Request” (CMR) form provided by the Engineer. Engineer will provide this form to the contractor at the Pre-Construction Conference.

2. Assign a number to the Contract Modification Request when issued.

3. Include with the Contract Modification Request:

a. A complete description of the proposed modification.

b. The reason the modification is requested.

c. A detailed breakdown of the cost of the change (necessary only if the modification requires a change in contract amount). The itemized breakdown is to include:

1). List of materials and equipment to be installed.

2). Man hours for labor by classification.

3). Equipment used in construction.

4). Consumable supplies, fuels, and materials.

5). Royalties and patent fees.

6). Bonds and insurance.

7). Overhead and profit.

8). Field office costs.

9). Home office cost.

10). Other items of cost.

d. Provide the level of detail outline in the paragraph above for each Subcontractor or Supplier actually performing the Work if Work is to be provided by a Subcontractor or Supplier. Indicate appropriate Contractor mark-ups for Work provided through Subcontractors and Suppliers. Provide the level of detail outline in the paragraph above for self-performed Work.

e. Provide a revised schedule indicating the effect on the critical path for the Project and a statement of the number of days the Project may be delayed by the modification.

4. Submit a Contract Modification Request to the Engineer to request a field change.

5. A Contract Modification Request is required for all substitutions or deviations from the Contract Documents.

6. Engineer will evaluate the request for a contract modification.

B. Owner will initiate changes through the Engineer.

1. Engineer will prepare a description of proposed modifications to the Contract Documents.

2. Engineer will use the Contract Modification Request form. Engineer will assign a number to the Contract Modification Request when issued.

3. Return the Contract Modification Request with a Request for Proposal (RFP) to incorporate the requested change. Include a breakdown of costs into materials and labor in detail outline above to allow evaluation by the Engineer.

C. Engineer will issue a Change Order per the General Conditions if a contract modification is appropriate.

1. Modifications to the contract can only be made by a Change Order.

2. Changes in the Project will be documented by a Change Order.

3. Any modifications that require a change can only be approved by Change Order. Changes in Contract Price or Contract Time shall be explicitly detailed in the Change order.
    a. Proposals issued by the Contractor in response to a Contract Modification Request will be evaluated by the Engineer.
    b. If a Change Order is recommended, the Engineer will prepare the Change Order.
    c. The Change Order will be sent to the Contractor for execution with a copy to the Owner recommending approval.
    d. Change Orders can only be approved by the State Contracting Officer, or the Owner's Designated Representative, which are the same.
        1). Work performed on the proposed contract modifications prior to the approval of the Change Order will be performed at the Contractor's risk.
        2). No payment will be made for Work on Change Orders until approved by the Owner's Designated Representative.

D. The Contractor may be informed that the Contract Modification Request is not approved and construction is to proceed in accordance with the Contract Documents.

1.09 RECORD DRAWINGS

A. Maintain at the site one complete record copy of:
    1. Drawings.
    2. Specifications.
    3. Addenda.
    4. Contract modifications/Change Orders.
    5. Approved Shop Drawings and record data.
    6. One set of construction photographs.
    7. Test records.
    8. Clarifications and other information provided in Request for Information responses.
    9. Reference standards.

B. Store documents and Samples in the Contractor's field office.
    1. Documents are to remain separate from documents used for construction. Do not use these documents for construction.
    2. Provide files and racks for the storage of documents.
    3. Provide a secure storage space for the storage of Samples.
    4. Maintain documents in clean, dry, legible conditions, and in good order.
    5. Make documents and Samples available at all times for inspection by the Engineer and Owner.

C. Marking Drawings:

1. Label each document as “Project Record” in large printed letters.
2. Record information as construction is being performed.
    a. Do not conceal any Work until the required information is recorded.
    b. Mark Drawings to record actual construction, including the following:
        1). Depths of various elements of the foundation in relation to finished first floor datum or the top of walls.
        2). Horizontal and vertical locations of underground utilities and appurtenances constructed and existing utilities encountered during construction.
        3). Location of internal utilities and appurtenances concealed in the construction. Refer measurements to permanent structure on the surface. Include the following equipment:
            a). Piping.
            b). Ductwork.
            c). Equipment and control devices requiring periodic maintenance or repair.
            d). Valves, unions, traps, and tanks.
            e). Services entrance.
            f). Feeders.
            g). Outlets.
        4). Changes of dimension and detail.
        5). Changes made by Field Order and Change Order.
        6). Details not on the original Drawings. Include field verified dimensions and clarifications, interpretations, and additional information issued in response to RFIs.
    c. Mark Specifications and Addenda to identify products provided.
        1). Record product name, trade name, catalog number, and each Supplier (with address and phone number) of each product and item of equipment actually installed.
        2). Record changes made by ASI and Change Order.
    d. Mark additional Work or information in erasable pencil.
        1). Use red for new or revised indication.
        2). Use purple for Work deleted or not installed (lines to be removed).
        3). Highlight items constructed per the Contract Documents in yellow.
    e. Submit record documents to Engineer for review and acceptance 30 days prior to final completion of the Project.
        1). Provide two hard copy sets of marked up Drawings, in color on Bond Paper, and 2 CD’s containing electronic PDF files of each drawing sheet. Provide one (1)

copy for distribution to the Owner's PM, and one (1) copy to the A/E and his consultants.

2). Provide two sets of Specifications and 2 CD's containing electronic PDF files and MSWord files of each specification section. Provide one (1) copy for distribution to the Owner's PM, and one (1) copy to the A/E and his consultants.

D. Applications for process payments will not be recommended for payment if record documents are found to be incomplete, not current or not in order. Final payment will not be recommended without complete record documents.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

01 31 13.13 FORMS

1.00 GENERAL

1.01 PROJECT FORMS

A. Use the forms provided by the Engineer for contract administration, applications for payment, submittals, documentation of test results, equipment installation and documentation, and project closeout.

B. A digital copy of the required forms will be provided to the Contractor at the pre-construction conference on a CD.

C. Project Forms are provided in the following pages.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

01 32 16 CONSTRUCTION PROGRESS SCHEDULE

1.00 GENERAL

1.01 REQUIREMENTS

A. Prepare and submit a Progress Schedule for the Work and update the schedule every two weeks for the duration of the Project.

B. Provide schedule in adequate detail to allow Owner to monitor the Work progress, to anticipate the time and amount of Applications for Payment, and to relate submittal processing to sequential activities of the Work.

C. Incorporate and specifically designate the dates of anticipated submission of submittals and the dates when submittals must be returned to the Contractor into the schedule.

D. Assume complete responsibility for maintaining the progress of the Work per the schedule submitted.

E. Take all requirements of Section 01 35 00 “Special Procedures” into consideration when preparing schedule.

1.02 SUBMITTALS

A. Submit Progress Schedules in accordance with Section 01 33 00 “Submittal Procedures.” Submit schedules within the following times:

1. Detailed baseline schedule within 10 days after the Notice of Award. The schedule is to be available at the pre-construction conference. Contractor must provide schedule in PDF form and Microsoft project form to the Owner.

B. Submit Progress Schedules with Applications for Payment. Schedules may be used to evaluate the Applications for Payment. Failure to submit the schedule may cause delay in the review and approval of Applications for Payment.

1.03 SCHEDULE REQUIREMENTS

A. Schedule is to be in adequate detail to:

1. Assure adequate planning, scheduling, and reporting during the execution of the Work.
2. Assure the coordination of the Work of the Contractor and the various Subcontractors and Suppliers.
3. Assist in monitoring the progress of the Work.
4. Assist in evaluating proposed changes to Contract Time and project schedule.
5. Assist the Owner in review of Contractor’s Application for Payment.

B. Provide a 3 week look-ahead schedule at each bi-weekly progress meeting with owner.

C. Provide personnel with 5 years’ minimum experience in scheduling construction work comparable to this Project.

D. Project Schedule shall be in MS Project, with no exceptions. Baseline project file shall be provided to the owner at start of project,

E. Provide the schedule in the form of a time scaled horizontal bar chart which indicates graphically the Work scheduled at any time during the Project. The graph is to indicate:

1. Complete sequence of construction by activity.
2. Identification of the activity by structure, location, and type of Work.
3. Chronological order of the start of each item of Work.
4. The activity start and stop dates.
5. The activity duration.
6. Successor and predecessor relationships for each activity. Group related activities or use lines to indicate relationships.
7. A clearly indicated critical path. Indicate only one critical path on the schedule. The subsystem with the longest time of completion is the critical path where several subsystems each have a critical path. Float time is to be assigned to other subsystems.
8. Project percentage of completion, based on dollar value of the Work included in each activity to the last day of the pay period for each Application for Payment.

F. Submit a separate submittal schedule indicating the dates when the submittals are to be sent to the Engineer and Owner's Representative.

1. List specific dates submittal is to be sent to the Engineer and Owner's Representative.
2. List specific dates submittal must be processed in order to meet the proposed schedule.
3. Allow a reasonable time to review submittals, taking into consideration the size and complexity of the submittal, the submission of other submittals, and other factors that may affect review time.
4. Allow time for re-submission of the submittals for each item. Contractor is responsible for delays associated with additional time required to review incomplete or erroneous submittals and for the time lost when submittals are submitted for products that do not meet specification requirements.

G. Update the schedule at the end of each monthly partial payment period to indicate the progress made on the Project to that date.

1.04 SCHEDULE REVISIONS

A. Submit a written report if the schedule indicates that the Project is more than 14 days behind schedule. The report is to include:

1. Number of days Project is behind schedule.
2. Narrative description of the steps to be taken to bring the Project back on schedule.
3. Anticipated time required to bring the Project back on schedule.
4. Submit a revised schedule indicating the action that the Contractor proposes to take to bring the Project back on schedule.

B. Revise the schedule to indicate any adjustments in Contract Time approved by Change Order.

1. Revised schedule is to be included with Contract Modification Request for which an extension of time is requested.

2. Failure to submit a revised schedule indicates that the modification shall have no impact on the ability of the Contractor to complete the Project on time and that the cost associated with the change of additional plant or work force have been included in the cost proposed for the modification.

C. Updating the project schedule to reflect actual progress is not considered a revision to the project schedule.

D. Applications for Payment will not be recommended for payment without a revised schedule and if required, the report indicating the Contractor's plan for bringing the Project back on schedule.

1.05 FLOAT TIME

A. Define float time as the amount of time between the earliest start date and the latest start date of a chain of activities on the construction schedule.

B. Float time is not for the exclusive use or benefit of either the Contractor or Owner.

C. Contract time cannot be changed by the submission of this schedule. Contract Time can only be modified by approved Change Order.

D. Schedule completion date must be the same as the contract completion date. Time between the end of construction and the contract final completion date is to be indicated as float time.

E. Contractor is responsible for report on float (up to 10%) and to provide an update at monthly meetings on float.

F. Weather days are not built into contractors 10% float allowance. Contractor must document weather day delays with pictures or weather screenshots for verification with Owner.

1.06 MODIFICATION OF THE CONTRACT TIME

A. When a delay defined herein as excusable prevents a contractor from completing the Work within the Contract Time, Contractor is entitled to an extension of time. Owner will make an equitable adjustment and extend the number of days lost because of excusable delay or Weather Days, as measured by Contractor's progress schedule if the task delayed is on the critical path. All extensions of time will be granted in calendar days. In no event will an extension of time be granted for delays that merely extend the duration of non-critical activities, or which only consume float without delaying the project substantial completion date(s). However, all float must be consumed by approved excusable delays to the critical path before any extension of time can be granted.

B. Weather Day is defined as follows:

1. A “Weather Day” is a day on which Contractor’s current schedule indicates Work is to be done, and on which inclement weather and related site conditions prevent Contractor from performing seven (7) continuous hours of Work between the hours of 7:00 a.m. and 6:00 p.m. Further Guidance on a weather day can be found in the Uniform General Conditions (UGSs). Weather delays are excusable delays.

2. When a Weather Day prevents work from proceeding, Contractor shall immediately notify Owner’s Designated Representative (ODR) for confirmation of the conditions. At the end of each calendar month, submit to ODR and A/E a list of Weather Days occurring in that month along with documentation of the impact on critical activities. Based on confirmation by ODR, any time extension granted will be issued by Change Order. If Contractor and Owner cannot agree on the time extension, Owner may issue a Unilateral Change Order for a fair and reasonable time extension.

C. Excusable Delays are listed as follows:

1. Errors, omissions and imperfections in design, which A/E corrects by means of changes in the Drawings and Specifications.

2. Unanticipated physical conditions at the site, which A/E corrects by means of changes to the Drawings and Specifications or for which ODR directs changes in the Work identified in the Contract Documents.

3. Changes in the Work that effect activities identified in the Contractor’s schedule as “critical” to completion of the entire Work, if such changes are ordered by ODR or recommended by the A/E and ordered by the ODR.

4. Suspension of Work for unexpected natural events, civil unrest, strikes or other events which are not within the reasonable control of Contractor.

5. Suspension of Work for convenience of EDR which prevents Contractor from completing the Work within the Contract Time.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

01 32 33 PHOTOGRAPHIC DOCUMENTATION

1.00 GENERAL

1.01 WORK INCLUDED

A. All photographs provided under this section and digital copies of these photographs are to become the property of the Owner. Photographs may not be used for publication, or public or private display without the written consent of the Owner.

B. Cost of Photographic Documentation is to be included in the Contractor Construction Phase fee.

1.02 QUALITY ASSURANCE

A. Provide clear photographs taken with proper exposure. View photographs in the field and take new photographs immediately if photos of an adequate print quality cannot be produced. Provide photographs with adequate quality and resolution to permit enlargements.

1.03 SUBMITTALS

A. Submit photographic documentation of existing site and building conditions prior to NTP and beginning construction.

B. Submit photographic documentation of building and site as hidden items are exposed during demolition.

C. Submit photographic documentation as record data in accordance with Section 01 33 00 “Submittal Procedures.”

D. Submit photographic documentation with each payment application.

2.00 PRODUCTS

2.01 PHOTOGRAPHS

A. Provide photographs in digital format with a minimum resolution of 1280 x 960, accomplished without a digital zoom.

B. Take photographs at locations acceptable to the Engineer.

C. Provide two color prints of each photograph and a digital copy of each photograph taken.

D. Identify each print on back with:

1. Project name.

2. Date, time, location, and orientation of the exposure.

3. Description of the subject of photograph.

E. Submit photograph in clear plastic sheets designed for photographs with monthly parment request. Place only one photograph in each sheet to allow the description on the back to be read without removing the photograph.

F. Provide digital copies of picture on a CD for transfer to Owner.

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

01 33 00 SUBMITTAL PROCEDURES

1.00 GENERAL

1.01 WORK INCLUDED

A. Submit documentation as required by the Contract Documents and as reasonably requested by the Owner and Engineer to:

1. Record the products incorporated into the Project for the Owner.
2. Provide information for operation and maintenance of the Project.
3. Provide information for the administration of the Contract.
4. Allow the Engineer to advise the Owner if products proposed for the Project by the Contractor conform, in general, to the design concepts of the Contract Documents.

B. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the Engineer's review of submittals. Contract modifications can only be approved by Change Order.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. Review and certify all submittals prior to submission.

B. Determine and verify:

1. Field measurements.
2. Field construction requirements.
3. Location of all existing structures, utilities and equipment related to the submittals.
4. Submittals are complete for their intended purpose.
5. Conflicts between the submittals related to the various Subcontractors and Suppliers have been resolved.
6. Quantities and dimensions shown on the submittals.

C. Submit information per the procedures described in this section and the Specifications.

D. Furnish the following submittals:

1. As specified in the Submittal Schedule below.
2. Schedules, data and other documentation as described in detail in this section or referenced in the General Conditions and Contract Documents.
3. Documentation required for the administration of the Contract per Section 01 31 13 "Project Coordination."
4. Construction coordination drawings that show all trades.
5. Shop Drawings required for consideration of a contract modification.
6. Submittals as required in the Specifications.
7. Submittals not required will be returned without Engineer's review.

E. Prior to NTP, Contractor shall submit a schedule/register, organized by specification section, indicating the date submittals will be sent to the Engineer and proposed dates that the product will be incorporated into the Project. Make submittals promptly in accordance with the schedule to cause no delay in the Project. The submittal schedule/register must be approved by the Owner before the first pay application will be accepted.

1. Send submittals to the Engineer allowing for a minimum of 15 days time for delivery, review and marking submittals. Include a minimum of 15 days for review of a resubmission if necessary. Allow adequate time for the submittal review process, ordering, fabrication, and delivery of the product to not delay progress on the Project.
2. Schedule submittal to provide all information for interrelated Work at one time. No review will be performed on submittals requiring coordination with other submittals. Engineer will return submittals for resubmission as a complete package.
3. Contractor shall include the date the submittal was submitted for review, as well as the date the Contractor requests to have the approval finalized, on the submittal register. The Submittal register shall indicate the projected dates for procurement of all included items and shall be updated at least monthly with actual approval and procurement dates.
4. Contractor shall coordinate the Submittal Register with the Work Progress Schedule.

F. Submit information for all of the components and related equipment required for a complete and operational system in the same submittal.

1. Include electrical, mechanical, and other information required to indicate how the various components of the system function.
2. Provide certifications, warranties, and written guarantees with the submittal package for review when they are required.
3. Fabrication or installation of any products prior to the approval of Shop Drawings is done at the Contractor's risk. Products not meeting the requirements of Contract Documents are defective and may be rejected at the Owner's option.

G. Payment will not be made for products for which submittals are required until the submittals have been received. Payment will not be made for products for which Shop Drawings or Samples are required until these are approved by the Engineer. Refer to specification section 01 29 00 "Payment Procedures" for more information on payments.

H. Materials shall not be ordered and work shall not begin without approved submittals.

1.03 QUALITY ASSURANCE

A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Submittals not meeting these criteria will be returned without review.

B. Demonstrate that the proposed products are in full and complete compliance with the design criteria and requirements of the Contract Documents including Drawings and Specifications as modified by Addenda, Field Orders, and Change Orders.

C. Furnish and install products that fully comply with the information included in the submittal.

1.04 SUBMITTAL PROCEDURES

A. Submit an electronic copy of each submittal via email to the address provided by the Engineer.

1. The complete contents of each submittal, including associated drawings product data, etc., shall be submitted in Portable Document Format (PDF.) Submit PDF document with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 papers.

2. Create and submit color PDF documents where color is important to the evaluation of the submittal and / or where comments will be lost if only black and white PDF documents are provided.

B. Transmit all submittals, with a properly completed Submittal Transmittal Form as provided by the Engineer at the Pre Construction Conference.

1. Use a separate transmittal form for each specific product, class of material, and equipment system.

2. Submit items specified in different sections of the Specifications separately unless they are part of an integrated system.

C. Assign a submittal number to the documents originated to allow tracking of the submittal during the review process.

1. Assign the number consisting of a prefix, a sequence number, and a letter suffix. Prefixes shall be as follows:

Prefix	Description	Originator
AP	Application for Payment	Contractor
CO	Change Order	Engineer
CMR	Contract Modification Request	Contractor
CTR	Certified Test Report	Contractor
EIR	Equipment Installation Report	Contractor
FO	Field Order/Supplemental Instructions (ASI)	Engineer
NBC	Notification by Contractor	Contractor
O&M	Operation & Maintenance Manuals	Contractor
PD	Photographic Documentation	Contractor
RD	Record Data	Contractor
RFI	Request for Information	Contractor
RFP	Request for Proposal	Engineer
SAM	Sample	Contractor
SD	Shop Drawing	Contractor
SCH	Schedule of Progress	Contractor

2. Issue sequence numbers in chronological order for each type of submittal.
3. Issue numbers for resubmittals that have the same number as the original submittal followed by an alphabetical suffix indicating the number of times the same submittal has been sent to the Engineer for processing. For example: SD 025 A represents shop drawing number 25 and the letter "A" designates this is the second time this submittal has been sent for review.
4. Clearly note the submittal number on each page or sheet of the submittal.
5. Correct assignment of numbers is essential since different submittal types are processed in different ways.

D. Submit documents with uniform markings.

1. Mark submittals to:
   a. Highlight Contractor's corrections in green.
   b. Highlight items pertinent to the products being furnished in yellow and delete items that are not when the Supplier's standard drawings or information sheets are provided.
   c. Cloud items and highlight in yellow where selections by the Engineer or Owner are required.
   d. Mark dimensions with the prefix FD to indicate field verified dimensions on the Shop Drawings.
   e. Provide an 8-by-3-inch blank space for Contractor's and Engineer's stamp. Contractor may use a digital certification if this is preferred. The certification must bear a digital signature.
2. Define abbreviations and symbols used in Shop Drawings.
   a. Use terms and symbols in Shop Drawings consistent with the Contract Drawings.
   b. Provide a list of abbreviations and their meaning as used in the Shop Drawings.
   c. Provide a legend for symbols used on Shop Drawings.

E. Mark submittals to reference the Drawing number and/or section of the Specifications, detail designation, schedule or location that corresponds with the data submitted. Other identification may also be required, such as layout drawings or schedules to allow the reviewer to determine where a particular product is to be used.

1.05 REVIEW PROCEDURES

A. Shop drawings are reviewed in the order received, unless Contractor request that a different priority be assigned.

B. Mark a submittal as "Priority" to place the review for this submittal ahead of submittals previously delivered. Priority submittals will be reviewed before other submittals for this Project which have been received but not reviewed. Use discretion in the use of "Priority" submittals as this may delay the review of submittals previously submitted. Revise the Schedule of Contractor's Submittals for substantial deviations from the previous schedule.

C. Review procedures vary with the type of submittal as described in Paragraph 1.06.

1.06 SUBMITTAL REQUIREMENTS

A. Shop Drawings are required for those products that cannot adequately be described in the Contract Documents to allow fabrication, erection or installation of the product without additional detailed information from the Supplier.

1. Certify on the Contractor's stamp that the Contractor has reviewed the Shop Drawings and made all necessary corrections such that the products, when installed, will be in full compliance with the Contract Documents. Shop Drawings submitted without this certification will be returned without review.

2. Submit Shop Drawings for:

a. Products indicated in the submittal schedule following this section.

b. When a substitution or equal product is proposed in accordance with Paragraph 1.08 of this Section.

3. Include a complete description of the material or equipment to be furnished. Information is to include:

a. Type, dimensions, size, arrangement, model number, and operational parameters of the components.

b. Weights, gauges, materials of construction, external connections, anchors, and supports required.

c. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components.

d. All applicable standards such as ASTM or Federal specification numbers.

e. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings.

f. Wiring and piping diagrams and related controls.

g. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the submittal that the measurements represent actual dimensions obtained at the Site.

4. Provide all required statements of certification, guarantees, extended service agreements, and other related documents with the Shop Drawing. The effective date of these documents shall be the date of acceptance of the Work by the Owner.

5. Comments will be made on items called to the attention of the Engineer for review and comment. Any marks made by the Engineer do not constitute a blanket review of the submittal or relieve the Contractor from responsibility for errors or deviations from the Contract requirements.

a. Submittals that are reviewed will be returned with one or more of the following designations:

1). Approved: Submittal is found to be acceptable as submitted.

2). Approved as Noted: Submittal is acceptable with corrections or notations made by Engineer and may be used as corrected.

3). Revise and Resubmit: Submittal has deviations from the Contract Documents, significant errors, or is inadequate and must be revised and resubmitted for subsequent review.

4). Not Approved: Products are not acceptable.

b. Drawings with a significant or substantial number of markings by the Contractor may be marked “Approved as Noted” and “Revise and Resubmit.” These drawings are to be revised to provide a clean record of the submittal.

c. Dimensions or other data that do not appear to conform to the Contract Documents will be marked as “At Variance With” (AVW) the Contract Documents or other information provided. The Contractor is to make revisions as appropriate to comply with Contract Documents.

B. Certifications, Warranties and Service Agreements include documents as specified in the Specifications, as shown in the submittal schedule or as follows:

1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications (refer to Section 01 40 00 “Quality Requirements.”).

2. Certification of Local Field Service (CLS): A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300 mile radius of the Site. List names, addresses, and telephone numbers of approved service organizations on or attach it to the certificate.

3. Extended Warranty (EW): A guarantee of performance for the product or system beyond the normal 1 year warranty described in the General Conditions. Issue the warranty certificate in the name of the Owner.

4. Extended Service Agreement (ESA): A contract to provide maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period beyond the warranty period. Issue the service agreement in the name of the Owner.

5. Certification of Adequacy of Design (CAD): A certified letter from the manufacturer of the equipment stating that they have designed the equipment to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter shall state that mechanical and electrical equipment is adequately sized to be fully operational for the conditions specified or normally encountered by the product’s intended use.

C. Submit record data to provide information to allow the Owner to adequately identify the products incorporated into the Project and allow replacement or repair at some future date.

1. Provide record data for all products per the submittal schedule. Record data is not required for items for which Shop Drawings and/or operations and maintenance manuals are required.

2. Provide information only on the specified products. Submit a Contract Modification Request for approval of deviations or substitutions and obtain approval by Field Order or Change Order prior to submitting record data.

3. Provide the same information required for Shop Drawings.

4. Record data will be received by the Engineer, logged, and provided to Owner for the Project record.
    a. Record data may be reviewed to see that the information provided is adequate for the purpose intended. Inadequate drawings may be returned as unacceptable.
    b. Record data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.

D. Submit Operation and Maintenance manuals (O&M) for all equipment, mechanical devices, or components described in the Contract Documents per Section 01 78 23 "Operation and Maintenance Data." Include copies of approved Shop Drawings in the manual.

E. Submit Request for Information (RFI) in accordance with Section 01 31 13 "Project Coordination."

F. Submit a Schedule of Values and Application for Payment (AP) in accordance with Section 01 29 00 "Payment Procedures."

G. Submit Progress Schedules (SCH) in accordance with Section 01 32 16 "Construction Progress Schedule."

H. Submit Certified Test Reports (CTR) from independent testing laboratories in accordance with Section 01 40 00 "Quality Requirements."
    1. Submit test reports for material fabricated for this Project with Shop Drawings for that product.
    2. Submit test reports produced at the point of production for standard production products with the record data for that product.

I. Submit a list of Suppliers and Subcontractors as record data in accordance with Section 01 31 13 "Project Coordination."

J. Submit Equipment Installation Reports (EIR) in accordance with Section 01 75 00 "Starting and Adjusting."

K. Submit Notifications by Contractor (NBC) in accordance with Section 01 31 13 "Project Coordination."

1.07 SUBMITTALS REQUIRED FOR THIS PROJECT

A. Furnish the following Submittals:
    1. Schedules, data and other documentation as described in detail in this section or referenced in the General Conditions.
    2. Documentation required for the administration of the Contract.
    3. Submittals as required in the Specifications.
    4. Record/Product Data is required for the following items:

Section	Description
03 01 30	Maintenance of Cast-In-Place Concrete
03 30 00	Cast-In-Place Concrete

04 20 00	Unit Masonry
05 12 00	Structural Steel Framing
05 21 00	Steel Joist Framing
05 31 00	Steel Decking
05 40 00	Cold Formed Metal Framing
05 50 00	Metal Fabrications
05 51 00	Metal Stairs
05 52 13	Pipe and Tube Railings
06 10 00	Rough Carpentry
06 16 00	Sheathing
06 40 23	Interior Architectural Woodwork
07 01 50	Repair of Roofing
07 21 00	Thermal insulation
07 27 26	Fluid-Applied Membrane Air Barriers
07 42 13	Metal Wall Panels
07 62 00	Sheet Metal Flashing and Trim
07 72 00	Roof Accessories
07 84 46	Fire Resistive Joint Systems
07 92 00	Joint Sealants
08 11 13	Hollow Metal Doors and Frames
08 80 00	Glazing
08 90 00	Louvers
09 22 16	Non-Structural Metal Framing
09 29 00	Gypsum Board
09 30 00	Tiling
09 51 13	Acoustical Panel Ceilings
09 51 13.01	FRP Panel Ceilings
09 65 13	Resilient Base and Accessories
09 65 19	Resilient Tile Flooring
09 68 16	Sheet Carpeting
09 91 00	Architectural Painting
10 11 00	Visual Display Units
10 21 13	Toilet Compartments
10 22 13	Wire Mesh Partitions
10 26 00	Wall and Door Protection

10 28 00	Toilet and Bath Accessories
10 43 10	Signs
10 44 13	Fire Extinguisher Cabinets
10 51 13	Metal Lockers
10 56 13	Metal Storage Shelving
12 36 61	Simulated Stone Countertops
22 00 01	Plumbing Systems
23 05 29	Hangers and Supports for HVAC Piping and Equipment
23 05 53	Identification for HVAC Piping and Equipment
23 05 93	Testing, Adjusting and Balancing
23 07 13	Duct Insulation
23 09 23	BACnet Direct Digital Control Systems for HVAC
23 23 00	Refrigerant Piping
23 31 13	Metal Ducts
23 33 00	Air Duct Accessories
23 34 23	HVAC Power Ventilators
23 37 13	Diffusers, Registers and Grilles
23 74 09	Dedicated Outside Air Systems
23 81 29	Variable Refrigerant Flow HVAC Systems
26 05 10	Common Work Results for Electrical
26 05 19	Low Voltage Electrical Power Conductors and Cables
26 05 23	Control Voltage Electrical Power Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Raceways and Boxes for Electrical Systems
26 05 43	Underground Ducts and Raceways for Electrical Systems
26 05 48	Vibration Controls for Electrical Systems
26 05 53	Identification for Electrical Systems
26 05 73.01	Electrical Power System Studies
26 09 23	Lighting Control Devices
26 22 00	Low Voltage Transformers
26 24 16	Panelboards
26 24 18	Lighting Control Panelboards
26 25 00	Interior Lighting
26 27 26	Wiring Devices

26 28 13	Fuses
26 28 16	Enclosed Switches and Circuit Breakers
26 43 13	Surge Protection Device For Low Voltage Electrical Power Circuits
26 56 00	Exterior Lighting
27 05 26	Grounding and Bonding for Communications
27 05 28	Pathways for Communications Systems
27 05 53	Testing; Identification and Administration
27 11 00	Communications Equipment Room Fittings
27 13 00	Communications Backbone Cabling
27 15 00	Communications Horizontal Cabling
28 31 00	Fire Alarm and Mass Notification System
31 00 00	Earthwork

5. Shop Drawings are required for the following items:

Section	Description
03 01 30	Maintenance of Cast-In-Place Concrete
03 30 00	Cast-In-Place Concrete
04 20 00	Unit Masonry
05 12 00	Structural Steel Framing
05 21 00	Steel Joist Framing
05 31 00	Steel Decking
05 40 00	Cold Formed Metal Framing
05 50 00	Metal Fabrications
05 51 00	Metal Stairs
05 52 13	Pipe and Tube Railings
06 10 00	Rough Carpentry
106 40 23	Interior Architectural Woodwork
07 01 50	Repair of Roofing
07 27 26	Fluid-Applied Membrane Air Barriers
07 42 13	Metal Wall Panels
07 62 00	Sheet Metal Flashing and Trim
07 72 00	Roof Accessories
08 11 13	Hollow Metal Doors and Frames
08 71 00	Finish Hardware
08 90 00	Louvers
09 30 00	Tiling

10 11 00	Visual Display Units
10 21 13	Toilet Compartments
10 22 13	Wire Mesh Partitions
10 26 00	Wall and Door Protection
10 51 13	Metal Lockers
10 56 13	Metal Storage Shelving
12 36 61	Simulated Stone Countertops
14 24 00	Hydraulic Elevators
14 42 00	Wheelchair Lifts
23 09 23	BACnet Direct Digital Control System for HVAC
23 23 00	Refrigerant Piping
23 34 23	HVAC Power Ventilators
23 81 29	Variable Refrigerant Flow HVAC Systems
26 05 43	Underground Ducts and Raceways for Electrical Systems
26 09 23	Lighting Control Devices
26 22 00	Low Voltage Transformers
26 24 16	Panelboards
26 24 18	Lighting Control Panelboards
26 25 00	Interior Lighting
26 27 26	Wiring Devices
26 28 16	Enclosed Switches and Circuit Breakers
26 43 13	Surge Protection Device For Low Voltage Electrical Power Circuits
27 05 26	Grounding and Bonding for Communications
27 05 28	Pathways for Communications Systems
27 11 00	Communications Equipment Room Fittings
27 13 00	Communications Backbone Cabling
27 15 00	Communications Horizontal Cabling
28 31 00	Fire Alarm and Mass Notification System

6. Operations and Maintenance Manuals for:

Section	Description
14 24 00	Hydraulic Elevators
14 42 00	Wheelchair Lifts
22 00 01	Plumbing Systems
23 09 23	BACnet Direct Digital Control System for HVAC
23 34 23	HVAC Power Ventilators

23 81 29	Variable Refrigerant Flow HVAC Systems
26 09 23	Lighting Control Devices
26 22 00	Low Voltage Transformers
26 24 16	Panelboards
26 24 18	Lighting Control Panelboards
26 25 00	Interior Lighting
26 27 26	Wiring Devices
26 28 13	Fuses
26 28 16	Enclosed Switches and Circuit Breakers
26 43 13	Surge Protection Device For Low Voltage Electrical Power Circuits
26 56 00	Exterior Lighting
27 05 26	Grounding and Bonding for Communications
27 05 28	Pathways for Communications Systems
27 11 00	Communications Equipment Room Fittings
27 13 00	Communications Backbone Cabling
27 15 00	Communications Horizontal Cabling
28 31 00	Fire Alarm and Mass Notification System

7. Sample and Manufacturer Literature

Section	Description
04 20 00	Unit Masonry
06 16 00	Sheathing
06 40 23	Interior Architectural Woodwork
07 92 00	Joint Sealants
08 71 00	Door Hardware
08 80 00	Glazing
09 29 00	Gypsum Board
09 30 00	Tiling
09 51 13	FRP Panel Ceilings
09 65 13	Resilient Base and Accessories
09 65 19	Resilient Tile Flooring
09 91 00	Architectural Painting
10 11 00	Visual Display Units
10 21 13	Toilet Compartments
10 22 13	Wire Mesh Partitions
10 28 00	Toilet, Bath and Laundry Accessories

10 43 10	Signs
12 48 13	Entrance Floor Mats and Frames

1.08 REQUESTS FOR DEVIATION

A. Submit requests for deviation from the Contract Documents for any product that does not fully comply with the Contract Documents.

B. Submit request by Contract Modification Request (CMR) per Section 01 31 13 “Project Coordination.” Identify the deviations and the reason the change is requested.

C. Include the amount if cost savings to the Owner for deviations that result in a reduction in cost.

D. A Change Order or Field Order will be issued by the Engineer for deviations approved by the Owner. Deviations from the Contract Documents may only be approved by Change Order or Field Order.

1.09 SUBMITTALS FOR EQUAL NON SPECIFIED PRODUCTS

A. The products of the listed suppliers are to be furnished where Specifications list several manufacturers but do not specifically list “or equal” or “or approved equal” products. Use of any products other than those specifically listed is a substitution and must be approved per Paragraph 1.09.

B. Contractor may submit other manufacturers’ products that are in full compliance with the specification where Specifications list one or more manufacturers followed by the phase “or equal” or “or approved equal.”

1. Submit Shop Drawings of adequate detail to document that the proposed product is equal or superior to the specified product.

2. Prove that the product is equal. It is not the Engineer’s responsibility to prove the product is not equal.

a. Indicate on a point by point basis for each specified feature that the product is equal to the Contract Document requirements.

b. Make a direct comparison with the specified manufacturer’s published data sheets and available information. Provide this printed material with the submittal.

c. The decision of the Engineer regarding the acceptability of the proposed product is final.

3. Provide a typewritten certification that, in furnishing the proposed product as an equal, the Contractor:

a. Has thoroughly examined the proposed product and has determined that it is equal or superior in all respects to the product specified.

b. Has determined that the product will perform in the same manner and result in the same process as the specified product.

c. Will provide the same warranties and/or bonds as for the product specified.

d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the product into the construction and will waive all claims for additional Work which may be necessary to incorporate the product into the Project which may subsequently become apparent.

e. Will maintain the same time schedule as for the specified product.

4. A modification request is not required for any product that is in full compliance with the Contract Documents.

1.10 SUBMITTALS FOR SUBSTITUTIONS

A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product.

B. Submit the following for consideration of approval of a Supplier or product which is not specified:

1. Contract Modification Request for deviation from the Contract Documents per Paragraph 1.08.

2. Prove that the product is acceptable as a substitute. It is not the Engineer's responsibility to prove the product is not acceptable as a substitute.

a. Indicate on a point by point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.

b. Make a direct comparison with the specified Suppliers published data sheets and available information. Provide this printed material with the submittal.

c. The decision of the Engineer regarding the acceptability of the proposed substitute product is final.

3. Provide a written certification that, in making the substitution request, the Contractor:

a. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product.

b. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the Manufacturer of the specified product.

c. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the substituted product into the Project and will waive all claims for additional Work which may be necessary to incorporate the substituted product into the Project which may subsequently become apparent.

d. Will maintain the same time schedule as for the specified product.

C. Pay engineering cost for review of substitutions.

1. Cost for additional review time will be billed to the Contractor for the actual hours required for the review and marking of Shop Drawings by Engineer and in accordance with the rates listed in section 1.13 of this specification.

2. Cost for the additional review shall be paid to the Engineer by the Contractor on a monthly basis.

1.11 WARRANTIES AND GUARANTEES

A. Submit warranties and guarantees required by the Contract Documents with the Shop Drawings and product submittals.

B. Provide additional copies of ALL warranties and guarantees for equipment and include this additional copy in the Operation and Maintenance Manuals. Refer to Section 01 78 23 "Operation and Maintenance Data."

C. Provide a separate manual for warranties and guarantees.

1. Provide a log of all products for which warranties or guarantees are provided, and for all equipment. Index the log by Specification section number on forms provided by the Engineer.

2. Indicate the start date, warranty or guarantee period and the date upon which the warranty or guarantee expires for products or equipment for which a warranty or guarantee is required.

3. Indicate the date for the start of the correction period specified in the General Conditions for each piece of equipment and the date on which the specified correction period expires.

4. Provide a copy of the warranty or guarantee under a tab indexed to the log.

1.12 RESUBMISSION REQUIREMENTS

A. Make all corrections or changes in the submittals required by the Engineer and resubmit until approved.

B. For Shop Drawings:

1. Revise initial drawings or data and resubmit as specified for the original submittal.

2. Highlight in yellow those revisions which have been made in response to the first review by the Engineer.

3. Highlight in blue any new revisions which have been made or additional details of information that has been added since the previous review by the Engineer.

C. Pay for excessive review of Shop Drawings.

1. Excessive review of Shop Drawings is defined as any review required after the original review has been made and the first resubmittal has been checked to see that corrections have been made.

2. Cost for additional review time will be billed to the Contractor by the Engineer for the actual hours required for the review and marking of Shop Drawings by Engineer and in accordance with the rates listed in contract.

3. Pay cost for the additional review to the Engineer on a monthly basis as billed by the Engineer.

4. Need for more than one resubmission or any other delay of obtaining Engineer's review of submittals, will not entitle the Contractor to an extension of Contract Time. All costs associated with such delays shall be at the Contractor's expense.

1.13 ENGINEER'S STANDARD RATES

A. Should it be necessary for the A/E firm to engage in the excessive review of Shop Drawings, the A/E employee's time shall be billed at the following rates:

Hourly Rates	Principal Architect	$ 235.00	Per Hour
	Associate Architect	$ 167.00	Per Hour
	Technical/Draftsman	$ 101.00	Per Hour
	Administrative	$ 76.00	Per Hour

Hourly Rates	Principal Engineer	$ 234.00	Per Hour
	Sr. Proj. Engineer	$ 168.00	Per Hour
	Pr. Engineer	$ 130.00	Per Hour
	CADD	$ 104.00	Per Hour
	Clerical	$ 76.00	Per Hour

1.14 ENGINEER'S DUTIES

A. Review the submittals and return with reasonable promptness.

B. Affix stamp, indicate approval, rejection, and the need for resubmittal.

C. Distribute documents.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

01 40 00 QUALITY REQUIREMENTS

1.00 GENERAL

1.01 DEFINITION OF ROLES

A. Owner's Construction Manager: The Owner's Construction Project Manager shall be the main point of contact for all communications with the Owner and A/E firm. This individual shall be identified at the Pre-Construction conference.

B. Project Superintendent: The Contractor's on-site manager. Shall be the main point of contact for all communications with the Contractor and shall be on-site anytime work is being accomplished.

C. Contractor's Special Inspector: The General Contractor at their expense will hire a third party inspector qualified in construction and certified in code compliance, whom will verify in writing the milestone and/or phase completion. The inspector will inspect and certify that milestone and/or phases, meet building code and project plans/specifications. The third party inspector must be approved by TMD prior to any inspections being performed.

D. Quality Control Manager: The General Contractor at their expense will employ a quality control manager who will ensure the design is constructed in accordance with the plans and all local codes. Additionally, this person will ensure that the project site remains in safe condition for all on-site personnel for the duration of the project. The project superintendent may serve in this role simultaneously with their duties as a project superintendent.

E. Contractor's Construction Testing Agent: The General Contractor at their expense will hire a third party testing agent, as required in subsequent specification sections, that is competent to perform testing of construction materials. This testing inspector will verify in writing the milestone and/or phase completion. The inspector will inspect and certify that project materials fabricated/installed on-site meet project plans/specifications. The third party inspector must be approved by TMD prior to any testing/inspections being performed.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. Control the quality of the Work and verify that the Work meets the standards of quality established in the Contract Documents as well as all applicable laws.

1. Inspect the Work of the Contractor, Subcontractors and Suppliers. Correct defective Work.

2. Inspect products and materials to be incorporated into the Project. Ensure that Suppliers of raw materials, parts, components, assemblies, and other products have adequate quality control system to ensure that quality products are produced. Provide only products that comply with the Contract Documents.

3. Provide all facilities and calibrated equipment required for quality control tests.

4. Provide consumable construction materials of adequate quality to provide a finished product that complies with the Contract Documents.

5. Perform construction material testing as indicated in this and other sections of the Specifications. Schedule the time and sequence of testing with the Owner's Construction Manager. All quality control testing is to be observed by the Owner's Construction Manager or designated representative.
    a. The contractor shall be responsible for securing the services of the third party inspection firm(s) for construction materials testing and/or special inspections in accordance with Chapter 17 of the International Building Code.
    b. The general contractor shall provide the Owner's Construction Manager with a minimum of 7 days advanced notice prior to the need to perform construction materials testing and/or special inspections.
6. Maintain complete inspection and testing records at the Site and make them available to Owner, Engineer and Construction Manager.

1.03 QUALITY ASSURANCE ACTIVITIES BY THE OWNER (NOT APPLICABLE)

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 "Submittal Procedures" and shall include:
    1. Provide Certified Test Reports on materials or products to be incorporated into the Project. Reports are to indicate that material or products are in full compliance with the Contract Documents or indicate that they are not in compliance and describe how they are not in compliance.

1.05 STANDARDS

A. Perform testing per recognized test procedures as listed in the various sections of the Specifications, American Society of Testing Materials (ASTM), or other testing associations. Perform tests in accordance with published procedures for testing issued by these organizations.

1.06 NON-CONFORMING WORK

A. Immediately correct any Work that does not comply with the Contract Documents or submit a written explanation of why the Work is not to be corrected immediately and when corrective action to the Work will be performed.

B. Payment for non-conforming Work shall be withheld until Work is brought into compliance with the Contract Documents.

1.07 THIRD PARTY INSPECTOR

A. Contractor shall be required to retain and pay for the services of a Third Party Inspector (Henceforth referred to as the Quality Control Manager), who will inspect and certify milestone phase completion payment procedures and inspect and certify that work is in compliance with Building Codes and the Contract Documents.

1.08 QUALITY CONTROL PLAN

A. Submit Contractor's Quality Control Plan that identifies personnel, procedures, control, instructions, tests, records, and forms to be used. Construction will be permitted to begin only after acceptance of the Quality Control Plan or acceptance of an interim plan applicable to the particular feature of Work to be started. Work outside of the features of Work included in an accepted interim plan will not be permitted to begin until acceptance of a Quality Control Plan or another interim plan containing the additional features of Work to be started.

B. Content of the Quality Control Plan. The Quality Control Plan shall include, as a minimum, the following to address all construction operations, both on-site and off-site, including work by Subcontractors and Suppliers:

1. A description of the quality control organization, including a chart showing lines of authority and acknowledgement that the quality control staff shall implement the quality control program for all aspects of the Work specified.

2. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a quality control function.

3. A copy of the letter to the Quality Control Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the Quality Control Manager, including authority to stop Work which does not comply with the Contract Documents or will result in Work that does not comply with the Contract Documents. The Quality Control Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the A/E Firms Construction Manager as well the Owner's Designated Representative.

4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of Subcontractors and Suppliers.

5. Control, verification, and acceptance testing procedures for each specific test is to include the test name, specification paragraph requiring test, feature of Work to be tested, test frequency, person responsible for each test, applicable industry testing standards and laboratory facilities to be used for the test.

6. Procedures for tracking phases of quality control, verification, and acceptance tests including documentation.

7. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Indicate how documentation of the verification process for deficiencies will be made.

8. Reporting procedures, including proposed reporting formats.

9. The name of the proposed testing laboratory along with documentation of qualifications, a list of tests that can be performed, and a list of recent projects for which similar testing has been performed with references from those projects.

C. Notification of Changes. After submittal of the Quality Control Plan, the Contractor shall notify the Owner in writing of any proposed changes.

D. Coordination Meeting. After the Pre-Construction Meeting and before start of construction, the Contractor shall meet with the Owner's Designated Representative, Engineer and Engineer's Construction Manager to discuss the Contractor's Quality Control Plan. The Quality Control Plan shall be submitted a minimum of 14 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the Quality Control operations, testing, administration of the system for both on-site and off-site Work, and the interrelationship of Contractor's management and control with the Owner's Quality Assurance. Revise the Quality Management Plan to reflect comments and recommended changes resulting from this meeting.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION

3.01 QUALITY CONTROL PROGRAM

A. Perform quality control observations and testing as required in each section of the Specifications and where indicated on the Drawings.

B. Provide a quality control program that includes the following phases for each definable Work task. A definable Work task is one which is separate and distinct from other tasks, has separate control requirements, may be provided by different trades or disciplines, or may be Work by the same trade in a different environment.

1. Planning Phase: Perform the following before beginning each definable Work task:

a. Review the contract drawings.

b. Review submittals and determine that they are complete in accordance with the Contract Documents.

c. Check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Examine the work area to assure that all required preliminary Work has been completed and complies with the Contract Documents.

e. Examine required materials, equipment, and sample Work to assure that they are on hand, conform to submittals, and are properly stored.

f. Review requirements for quality control inspection and testing.

g. Discuss procedures for controlling quality of the Work. Document construction tolerances and workmanship standards for the Work task.

h. Check that the portion of the plan for the Work to be performed incorporates submittal comments.

i. Discuss results of planning phase with the Construction Manager. Conduct a meeting attended by the Quality Control Manager, the Construction Manager, superintendent, other quality control personnel as applicable, and the foreman responsible for the Work task. Instruct applicable workers as to the acceptable level of workmanship required in order to meet the requirements of the Contract Documents. Document the results of the preparatory phase actions by separate meeting minutes prepared by the Quality Control Manager and attached to the quality control report.

j. Do not move to the next phase unless results of investigations required for the planning phase indicate that requirements have been met.

2. Work Phase: Complete this phase after the Planning Phase:

a. Notify the Construction Manager at least 24 hours in advance of beginning the Work and discuss the review of the planning effort to indicate that requirements have been met.

b. Check the Work to ensure that it is in full compliance with the Contract Documents.

c. Verify adequacy of controls to ensure full compliance with Contract Documents. Verify required control inspection and testing is performed.

d. Verify that established levels of workmanship meet acceptable workmanship standards. Compare with required sample panels as appropriate.

e. Repeat the Work phase for each new crew to work on-site, or any time acceptable specified quality standards are not being met.

3. Follow-up Phase: Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements:

a. Make checks daily and record observations in the quality control documentation.

b. Conduct follow-up checks and correct all deficiencies prior to the start of additional Work tasks that may be affected by the defective Work. Do not build upon nor conceal non-conforming Work.

c. Conduct a review of the Work 1 month prior to the expiration of the correction period prescribed in the General Conditions with the Owner and Construction Manager. Correct defects as noted during the review.

C. Conduct additional planning and Work phases if:

1. The quality of on-going Work is unacceptable.

2. Changes are made in applicable quality control staff, on-site production supervision or work crew.

3. Work on a task is resumed after a substantial period of inactivity.

4. Other quality problems develop.

END OF SECTION

01 42 00 REFERENCES

1.00 GENERAL

1.01 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same mean-ing as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.02 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

1.03 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

2.00 PRODUCTS (NOT USED)

3.00 EXECUTION (NOT USED)

END OF SECTION

01 50 00 TEMPORARY FACILITIES AND CONTROLS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish temporary facilities, including the Contractor's field offices, storage sheds, and temporary utilities needed to complete the work. Refer to specification 011100 "Summary of Work" for more information on temporary utilities.

B. The contractor shall be responsible for arranging and paying for all utilities during construction until final completion or when Owner takes beneficial occupancy, whichever comes first. In no case shall the Owner pay for utilities between NTP and Substantial Completion.

C. Furnish temporary heating and cooling system for the buildings once finishes begin being applied if the permanent system is not operational. Contractor is responsible for locating and installing this system.

D. Furnish, install, and maintain temporary project identification signs. Provide temporary on-site informational signs to identify key elements of the construction facilities. Do not allow other signs to be displayed.

E. Cost for Temporary Facilities and Controls as described in this section and provided by Suppliers and Subcontractors as described in this section are to be included in the Cost of Work. Contractor efforts are included in the Contractor's fee for Construction Phase Services.

1.02 QUALITY ASSURANCE

A. Testing: Inspect and test each service before placing temporary utilities in use. Arrange for all required inspections and tests by regulatory agencies, and obtain required certifications and permits for use.

1.03 DELIVERY AND STORAGE

A. Arrange transportation, loading, and handling of temporary buildings and sheds.

1.04 JOB CONDITIONS

A. Locate buildings and sheds at the Site as indicated or as approved by the Owner.

B. Prepare the Site by removing debris and performing demolition needed to clear a space adequate for the structures.

C. Contractor is responsible for temporary restrooms facilities. If contractor chooses to have a temporary facility, contractor shall pay for the utilities used by temporary facilities during construction.

D. Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in the performance of the Work.

E. Maintain, expand as required, and modify temporary services and facilities as needed throughout the progress of the Work.

F. Operate temporary facilities in a safe and efficient manner.

1. Restrict loads on temporary services or facilities to within their designed or designated capacities.
2. Provide sanitary conditions. Prevent public nuisance, or hazardous conditions from developing or existing at the Site.
3. Prevent freezing of pipes, flooding, or the contamination of water.
4. Maintain site security and protection of the facilities.

1.05 OPTIONS

A. Construction offices may be prefabricated buildings on skids or mobile trailers.

B. Storage sheds may be prefabricated buildings on skids or truck trailers.

2.00 PRODUCTS

2.01 SIGN MATERIALS

A. Provide new or used signs, wood or metal with structure and framing in sound condition. Materials are to be structurally adequate and suitable for the indicated finish.

B. Temporary sign

2.02 TEMPORARY STORAGE BUILDINGS

A. Furnish storage buildings of adequate size to store any materials or equipment delivered to the Site that might be affected by weather.

2.03 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities at the Site from the commencement of the Project until project conclusion. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority.

B. Use these sanitary facilities. Do not use rest rooms within existing or Owner - occupied buildings.

3.00 EXECUTION

3.01 LOCATION AND DESIGN OF CONSTRUCTION SIGNAGE

A. Locate construction signage in location shown on architectural site plan. Construction signage shall be as shown in Figure 1 below.

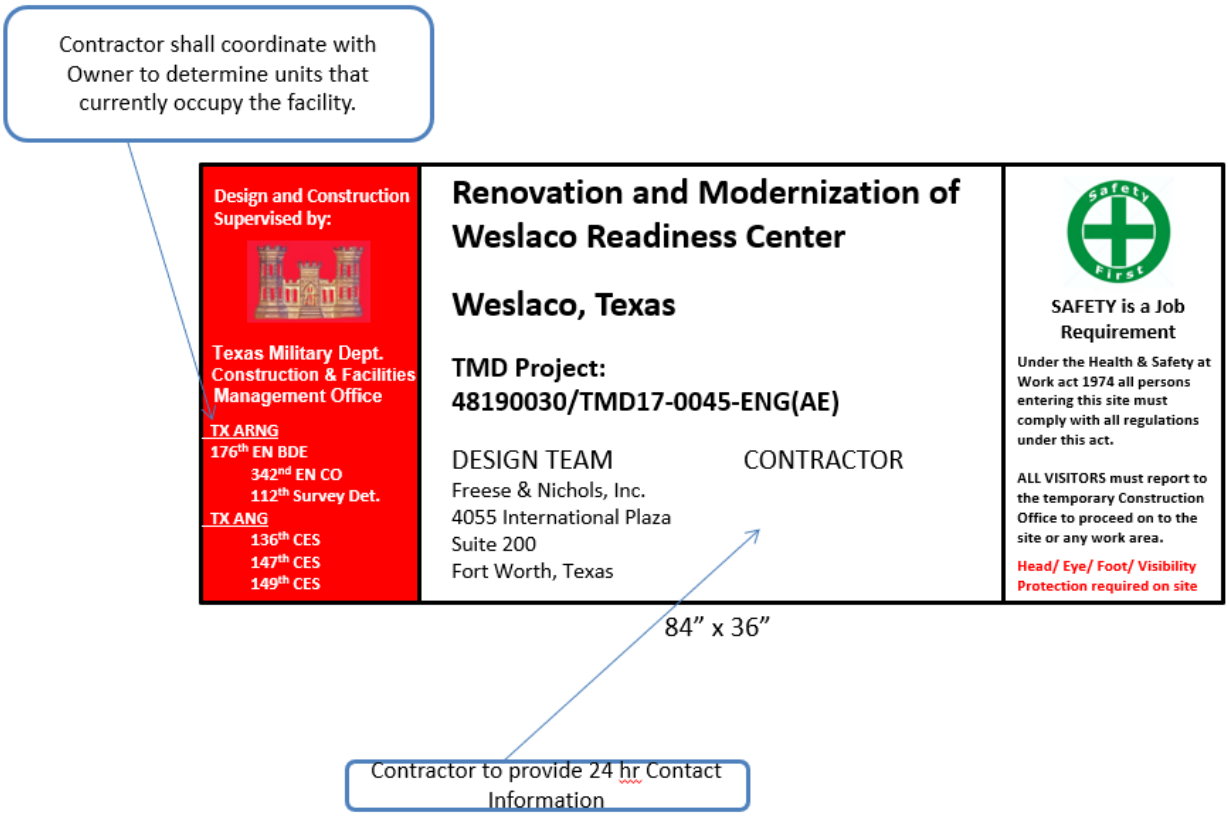


Figure 1. Temporary Construction Signage Example

3.02 LOCATION OF TEMPORARY FACILITIES

A. Locate all temporary facilities in areas approved by the Owner. Construct and install signs at locations approved by the Owner. Install informational signs so they are clearly visible.

3.03 TEMPORARY LIGHTING

A. Provide portable flood lights at any time that Work will be performed outside the structure at night. Provide adequate lighting to provide sufficient light at any location Work is being performed.

B. Work outside the hours or 7:00 a.m. to 6:00 p.m. will not normally be permitted. Obtain prior authorization from the Owner and Engineer for any night Work.

C. Provide Security light for the building entrance and secure parking areas at night.

3.04 CONSTRUCTION FENCE

A. Install and maintain a construction fence around the construction site and/or around the storage yard as indicated. Fence must be a minimum 6 feet high and may be wood picket or chain link construction. Provide gates with padlocks.

3.05 REMOVAL OF TEMPORARY FACILITIES

A. Remove temporary buildings, sheds, and utilities at the conclusion of the Project and restore the Site to original condition or finished in accordance with the Drawings.

B. Remove informational signs upon completion of construction.

C. Remove project identification signs, framing, supports, and foundations upon completion of the Project.

END OF SECTION

01 60 00 PRODUCT REQUIREMENTS

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide products for this Project that comply with the requirements of this section. Specific requirements of the detailed equipment specification govern in the case of a conflict with the requirements of this Section.

B. Comply with applicable specifications and standards.

C. Comply with size, make, type, and quality specified or as modified per Section 01 31 13 “Project Coordination.”

1.02 QUALITY ASSURANCE

A. Design Criteria:

1. Assume responsibility for the design of the products to include structural stability and operational capability.

2. Design mechanical and electrical components for all loads, currents, stresses, and wear imposed by start-up and normal operations of the equipment without deformation, failure, or adversely affecting the operation of the unit. Mechanical and electrical components specified for equipment are specified as the minimum acceptable for the equipment.

B. Coordination:

1. Provide coordination of the entire Project, including verification that structures, piping, and equipment components to be furnished and installed for this Project are compatible.

2. Determine that the equipment furnished for this Project is compatible with the Contract Document requirements and with the equipment and materials furnished by others.

3. Electrical components provided for equipment shall comply with all provisions of the Contract Documents.

C. Adaptation of Equipment:

1. Drawings and Specifications are prepared for the specified products. Make modifications to incorporate the products into the Project at no cost to the Owner, if a substitution for a product is requested and approved in accordance with Section 01 31 00 “Project Management and Coordination.”

2. Do not provide a product with a physical size that exceeds the available space. Consideration may be given to the acceptance of these products or equipment if the Contractor assumes all costs necessary to incorporate the item and the Engineer approves such revisions.

3. Coordinate electrical requirements for the products to be installed in the Project, including revisions in electrical equipment components wiring and other factors necessary to incorporate the component.

1.03 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 “Submittal Procedures,” and shall include:

1. Certificates of Adequacy of Design, as described in Section 01 33 00 “Submittal Procedures.”

2. Equipment Installation Reports per Section 01 75 00 “Starting and Adjusting.”

3. Other documentation as required by detailed equipment specifications.

1.04 STANDARDS

A. The applicable industry standards referenced in the Specifications shall apply as if written here in its entirety.

B. Except where otherwise indicated, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction.

1.05 GUARANTEES AND WARRANTIES

A. Guarantee and or Warranty products furnished by the Contractor under this Contract against:

1. Faulty or inadequate design.

2. Improper assembly or erection.

3. Defective workmanship or materials.

4. Leakage, breakage, or other failure.

B. Guarantee and or Warranty the products installed under this Contract, including products furnished by the Owner, against leakage, breakage, or other failure due to improper assembly or erection and against improper installation of the equipment. The guarantee and or Warranty period shall be as defined in the General Conditions. Individual specification sections may have more stringent warranty requirements than stated in the General Conditions. The most stringent warranty will be required in the event of any difference in the two aforementioned locations.

2.00 PRODUCTS

2.01 MATERIALS

A. Design, fabricate, assemble, deliver and install according to normally accepted engineering and shop practices, except where a higher standard of quality is required by the Contract Documents.

B. Manufacture like parts of duplicate units to standard sizes and gages. Like parts are to be interchangeable.

C. Two or more items of the same kind are to be identical and made by the same Supplier.

D. Provide products suitable for the intended service.

E. Adhere to the equipment capacities, sizes, and dimensions indicated by the Contract Documents.

F. Do not use products for any purpose other than that for which it is designed.

G. Provide new products unless previously used products are specifically allowed in the Contract Documents.

H. Equipment shall not have been in service at any time prior to delivery, except as required by tests.

I. Materials shall be suitable for service conditions.

2.02 ELECTRIC MOTORS

A. Unless otherwise required by the detailed equipment specifications, motors furnished with equipment shall comply with the following requirements:

1. Motors shall be designed and applied in compliance with NEMA, ANSI, IEEE, and AFBMA standards and the NEC for the specific duty imposed by the driven equipment.

2. Where frequent starting occurs, motors shall be designed for frequent starting duty equivalent to the duty service required by the driven equipment.

3. Unless recognized and defined by the standards and codes for intermittent duty as a standard industry practice, motors shall be rated for continuous duty at 40 C ambient. Motor temperature rise above 40 C ambient on continuous operation at nameplate horsepower shall not exceed the NEMA limit.

4. Motors shall be designed to start with appropriate starter or variable speed drive.

5. Motor bearing life shall be based upon the actual operating load conditions imposed by the driven equipment.

6. Motors shall be sized for the altitude at the location where the equipment is to be installed.

7. Motors with 1.0 service factor shall not be loaded more than 87 percent of the nameplate horsepower. Motors with a 1.15 service factor shall not be loaded more than 100 percent of the nameplate horsepower.

8. Where the detailed specifications call for encapsulated motor windings, the following process shall be used:

   a. After stator assembly, the stator assembly shall be sealed vacuum-pressure impregnation (VPI) of epoxy resin. The stator shall receive two VPI treatments, each treatment consisting of a dip followed by an oven bake. After the final cure, the stator assembly shall receive a final (third) coating of a durable epoxy varnish to further protect against dust, moisture, and a chemical degradation. The windings shall comply with the latest applicable provisions of NEMA MG1.

9. Motors shall have a clamp-type grounding terminal inside the motor conduit box.

10. Motors with external conduit boxes shall have oversized conduit boxes.

11. Maximum starting current shall be per NEMA MG1, Class H.

12. Efficiency shall be per NEMA MG1 for Premium efficiency motors.

13. Minimum insulation shall be Type F.
14. Motors shall be random wound with copper coils.
15. Motors located in a hazardous location shall be rated for the appropriate classification.

B. It is intended that the Supplier use his standard motor on integrally constructed motor driven equipment such as appliances, hand tools, etc., which would otherwise require redesign of the complete unit in order to provide a motor having the specified features.

C. Unless otherwise required by the detailed equipment specifications, motors within the horsepower ranges indicated below shall be rated and constructed as follows:

1. Below 1/2 HP:
    a. 115-volt, 60-Hz, 1-phase.
    b. Dripproof in clean and dry locations; TEFP in all other locations.
    c. Permanently lubricated sealed bearings.
    d. Built-in manual-reset thermal protector; or furnished with integrally mounted stainless steel enclosed manual motor-overload switch.
2. 1/2 to 1 HP:
    a. 230/460-volt, 60-Hz, 3-phase.
    b. Dripproof in clean and dry locations; TEFC in all other locations.
    c. Permanently lubricated sealed bearings.
3. 1-1/2 HP and Above:
    a. 230/460-volt, 60-Hz, 3-phase.
    b. Dripproof in clean and dry locations; TEFC in all other locations.
    c. Oil or grease lubricated anti-friction or oil lubricated sleeve bearings.
    d. Vertical motors shall have 15 year average life thrust bearings.

D. Motors with horsepower ratings of 15 horsepower or greater shall be provided with space heaters to operate on 120-volt single-phase service.

2.03 EQUIPMENT APPURTENANCES

A. Cover belt or chain drives, fan blades, couplings, and other moving or rotating parts on all sides by a safety guard.

1. Fabricate safety guards from 16 USS gage or heavier galvanized or aluminum-clad sheet steel or 1/2-inch mesh galvanized expanded metal.
2. Design guards for easy installation and removal.
3. Provide galvanized supports and accessories for each guard.
4. Provide stainless steel bolts and hardware.
5. Provide safety guards in outdoor locations designed to prevent the entrance of rain and dripping water.

2.04 SPECIAL TOOLS AND ACCESSORIES

A. Furnish tools, instruments, lifting and handling devices, and accessories necessary for proper maintenance and adjustment that are available only from the Product Vendor or are not commonly available.

2.05 INSULATION OF PIPING

A. Insulate all piping on or related to equipment as required to prevent freezing under any condition. Insulate piping per the Supplier's written instruction or per Section 23 07 19 "HVAC Piping Insulation" whichever is more stringent.

3.00 EXECUTION

3.01 INSTALLATION

A. Assume responsibility for proper installation, start-up and making the necessary adjustments so that the equipment is placed in proper operating condition per Section 01 75 00 "Starting and Adjusting."

3.02 LUBRICATION

A. Lubricate all products provided or installed for this Project, including products furnished by the Owner, per the Supplier's written recommendations until the product is accepted by the Owner.

END OF SECTION

01 73 29 CUTTING AND PATCHING

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements and limitations for cutting and patching of Work.

1.02 SUBMITTALS

A. Submit written request in advance of cutting or alteration, which affects:

1. Structural integrity of any element of Project.
2. Efficiency, maintenance, or safety of any operational element.
3. Visual qualities of sight exposed elements.
4. Work of Owner or separate contractor.

B. Include in request:

1. Identification of Project.
2. Location and description of affected work.
3. Necessity for cutting or alteration.
4. Description of proposed work, and Products to be used.
5. Alternatives to cutting and patching.
6. Effect on work of Owner or separate contractor.
7. Date and time work will be executed.

2.00 PRODUCTS

2.01 MATERIALS

A. Primary Products: Those required for original installation.

B. Product Substitution: For any proposed change in materials, submit request for substitution.

3.00 EXECUTION

3.01 EXAMINATION

A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

B. After uncovering existing Work, inspect conditions affecting performance of work.

C. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

3.03 CUTTING AND PATCHING

A. Using a wet concrete saw, cut concrete floors to demolish or remove concrete or to remove or install electrical conduit, plumbing piping or any other system or device. Do not use jack hammers to demolish concrete flooring. Dust control is a crucial component of this effort. Obtain and comply with dust control procedures of the Owner.

B. Execute cutting, fitting, and patching to complete Work.

C. Fit Products together, to integrate with other work.

D. Uncover work to install ill-timed work.

E. Remove and replace defective or non-conforming work.

F. Provide openings in the Work for penetration of mechanical and electrical work.

G. Protect the structure and other parts of the work and provide adequate support to maintain the structural integrity of the affected portions of the work. Provide devices and methods to protect adjacent work and other portions of the project from damage. Provide protection from the weather for portions of the project that may be exposed by cutting and patching work.

H. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs.

I. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

J. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to, the removal of piping, ductwork, and other items made obsolete by the modified work. The Owner desires to retain ownership of any removed salvageable scrap metal. At the Owner's Representative's discretion, transport any removed salvageable scrap metal to the Owner's onsite salvage location. Refer to 01 74 19 "CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT".

K. Restore work which has been cut or removed. Install new products to provide completed work per the Contract Documents. Patch/repair all penetrations in fire rated partitions (regardless of whether it opening is a result of demolition or existing conditions) and all penetrations, flaws or defects resulting from demolition activities.

L. Fit work air-tight to pipes, sleeves, ducts, conduit, and other penetrations through the surfaces. Where fire rated separations are penetrated, fill the space around the pipe or insert with materials with physical characteristics equivalent to fire resistance requirements of penetrated surface.

M. Patch finished surfaces and building components using new products specified for the original installation.

N. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

1. For continuous surfaces, refinish to the nearest intersection.
2. For an assembly, refinish the entire unit.

3.04 PERFORMANCE

A. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.

B. Restore Work with new products in accordance with requirements of Contract Documents.

C. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetration through surfaces.

D. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION

01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

1.00 GENERAL

1.01 BACKGROUND INFORMATION

A. Diversion of Construction and Demolition (C&D) debris from disposal in a landfill is a Department of Defense (DoD) requirement presented in a Feb 01, 2008 DoD Integrated Solid Waste Management Policy Memorandum and reiterated in Executive Order13514, dated October 8, 2009. An effort to divert 60% of C&D waste by recycling or reuse of building materials is laid out in these documents. Disposal (landfilling) of this material should be considered as the last resort in lieu of finding suitable markets for the reuse of C&D debris.

1.02 GENERAL INFORMATION

A. C&D materials must be tracked and documented by:

1. AMOUNT (in tons) of disposed and diverted materials
2. COST of disposal and diversion of materials, including labor costs
3. DESCRIPTION of the material
4. LOCATION of where it was taken for reuse recycling or disposal

B. Documents such as manifests, landfill tickets or bills of lading will be maintained and provided for each type of C&D debris category. Management of all materials will be individually addressed prior to deconstruction activities in a Waste Management Plan (WMP) developed for the site and approved by the ADG project manager.

1.03 MANAGEMENT

A. Develop and implement a waste management program. Take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor is responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling accrue to the Contractor. Appropriately permit firms and facilities used for recycling, reuse, and disposal for the intended use to the extent required by federal, state, and local regulations. Also, provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

1.04 SUBMITTALS

A. Engineer approval is required for submittals. The following shall be submitted:

1. SD- Preconstruction Submittals

a. Waste Management Plan

2. SD- Closeout Submittals

a. Records

3. Submit solid waste report with each payment application

1.05 MEETINGS

A. Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Engineer and Owner's Representative to discuss the proposed Waste Management Plan and to develop a mutual understanding relative to the details of waste management. The requirements for this meeting may be fulfilled during the pre-construction meeting. At a minimum, environmental and waste management goals and issues shall be discussed at the following additional meetings:

1. Sub pre-work meeting.
2. Preconstruction Pre-demolition meeting.
3. Regular site meetings.
4. Work safety meetings.

1.06 WASTE MANAGEMENT PLAN

A. A waste management plan shall be submitted within 15 days after contract award and not less than 10 days before the preconstruction pre-demolition meeting. The plan shall demonstrate how the project waste diversion goal shall be met and shall include the following:

1. Name of individuals on the Contractor's staff responsible for waste prevention and management.
2. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.
3. Description of the regular meetings to be held to address waste management.
4. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of wastes.
5. Characterization, including estimated types and quantities, of the waste to be generated.
6. Name of subcontractors or individuals who will be receiving materials for reclamation and landfills proposed for materials deemed to be unsuitable for recycling/reuse.

7. List of specific waste materials that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Recycling facilities that will be used shall be identified by name, location, and phone number, including a copy of the permit or license for each facility.
8. Identification of materials that cannot be recycled/reused with an explanation or justification, to be approved by the Engineer.
9. Description of the means by which any waste materials identified above will be protected from contamination.
10. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).
11. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

B. Revise and resubmit Plan as required by the Texas AGD Project Manager. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Distribute copies of the Waste Management Plan to each subcontractor, and the Texas AGD Project Manager and discuss at the preconstruction meeting.

1.07 RECORDS

A. Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. The record logs will document the actual revenues, rebates, savings, tax credits or other incentives received by the contractor. The records shall be made available to the AGD Project Manager during construction, and a copy of the records shall be submitted with the close out documents upon completion of the construction. After review, the contractor shall remit payment from the accrued amount directly to the Texas AGD Recycling Program.

1.08 PAYMENT

A. No separate payment will be made for work covered under this section. Payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor, and payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations are the Contractor's responsibility. All costs associated with this section must be included in the contract price.

1.09 COLLECTION & ACCUMULATION OF SOURCE SEPARATED MATERIALS

A. Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in a manner that maximizes recyclability and salvagability of identified materials. Provide the necessary containers, bins and storage areas to facilitate effective waste management and clearly and appropriately identify them. Provide materials for barriers and enclosures around recyclable material storage areas which are nonhazardous and recyclable or reusable. Locate out of the way of construction traffic. Provide adequate space for pick-

up and delivery and convenience to subcontractors. Recycling and waste bin areas are to be kept neat and clean, and recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials. Clean contaminated materials prior to placing in collection containers. Use cleaning materials that are nonhazardous and biodegradable. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with government.

B. Waste products and materials that are recyclable shall be separated from trash and sorted as described below into appropriately marked separate containers and then transported to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Owner and in compliance with waste management procedures. Except as otherwise specified in other sections of the specifications, final disposition of materials shall be in accordance with the following:

    1. Reuse.

        a. First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Sale or donation of waste suitable for reuse shall be considered.

    2. Recycle.

        a. Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling. All fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site shall be recycled. Arrange for timely pickups from the site or deliveries to recycling facilities in order to prevent contamination of recyclable materials.

    3. Waste.

        a. Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

C. Mercury Containing Light Bulb Disposal Coordination: Contact Leon McCowan, TXMF RCRA Waste Manager, via email at leon.c.mccowan.nfg@mail.mil or phone at (512) 782-5382, a minimum of five weeks in advance of anticipated light bulb disposal to coordinate proper disposal of all mercury-containing light bulbs. Provide the best estimated quantity of bulbs needing to be recycled, size of the bulbs (2ft, 4ft, 8ft), type of bulbs, the site address and the POC for the delivery of approved RCRA waste disposal boxes. All mercury-containing light bulbs must be properly packaged per the instruction included with the RCRA waste boxes.

2.00 PRODUCTS [NOT USED]

3.00 EXECUTION [NOT USED]

END OF SECTION

01 74 23 FINAL CLEANING

1.00 GENERAL

1.01 This section specifies administrative and procedural requirements for final cleaning at Substantial Completion, as well as touch up for final inspection.

1.02 WORK INCLUDED

A. Perform a thorough cleaning of the Site, buildings, or other structures prior to Owner occupancy of the buildings, and prior to Final Completion. Leave the Project clean and ready for occupancy.

1.03 SUBMITTALS

A. Provide data for maintenance per Section 01 78 23 “Operation and Maintenance Data.”

1.04 QUALITY CONTROL

A. Use experienced workmen or professional cleaners for final cleaning.

2.00 PRODUCTS

2.01 MATERIALS

A. Furnish the labor and products needed for cleaning and finishing as recommended by the Manufacturer of the surface material being cleaned.

B. Use cleaning products only on the surfaces recommended by the Supplier.

C. Use only those cleaning products which will not create hazards to health or property and which will not damage surfaces.

3.00 EXECUTION

3.01 FINAL CLEANING

A. Thoroughly clean the entire Site.

1. Remove construction debris, boxes, and trash from the Site.
2. Remove construction storage sheds and field offices.
3. Restore grade to match surrounding condition and remove excess dirt.
4. Sweep all drives and parking lots clean of dirt and debris. Use water truck or hose down paved site to like new appearance.
5. Remove temporary erosion control measures and establish suitable ground cover.

B. Clean floors in the construction area or areas affected by construction and inspect for damage.

1. Remove oil, grease, paint drippings, and other contaminants from floors, then mop repeatedly until thoroughly clean. Replace damaged flooring.

2. Clean resilient flooring with an approved cleaner and provide one coat liquid floor polish as recommended by the flooring Supplier. Polish to a buffed appearance with powered floor buffer.

3. Vacuum all carpets with powered floor sweeper to remove dirt and dust. Remove glue or other substances from nap of carpet.

C. Clean wall surfaces to remove dirt or scuff marks. Remove excess adhesive along top edges of wall base. Remove adhesive from surfaces of vinyl wall coverings.

D. Align tile to fit properly in grid and replace cracked or damaged tile. Remove smear marks and other dirt from tile and clean surface of grid system.

E. Spot paint nicks and other damage. If spot-painting does not blend into the existing color and texture of the surrounding surfaces, repaint wall from inside corner to inside corner. Touch up damaged surfaces on factory finished equipment using special paint furnished by the Manufacturer.

F. Remove dirt, oil, grease, dust and other contaminants from floors, equipment and apparatus in mechanical and electrical rooms with vacuum.

G. Clean permanent filters and replace disposable filters on heating, ventilating, and air conditioning systems. Clean ducts, blowers, and coils if units were operated without filters during construction.

H. Clean roof areas of debris; flush roof drainage systems with water until clear.

I. Broom clean exterior paved surfaces and rake clean other surfaces of the grounds.

J. Clean and polish all electrical equipment and exposed conduits. Remove paint overspray. Provide a blemish free appearance on all exposed equipment and conduits.

END OF SECTION

01 75 00 STARTING AND ADJUSTING

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide step-by-step procedures for starting provided systems, including equipment, pumps and processes.

B. Provide pre-start up inspections by equipment manufacturers.

C. Provide instruction and demonstration of operation, adjustment, and maintenance of each system and the component parts.

D. Place each system in service and operate the system to prove performance and to provide for initial correction of defects in workmanship, calibration, and operation.

E. Provide for initial maintenance and operation.

F. Cost for Starting and Adjusting provided by Suppliers and Subcontractors as described in this section are to be included in the Cost of Work.

1.02 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Submittal Procedures,” and shall include:

1. Equipment Installation Reports per Section 01 33 00 “Submittal Procedures.”

2. Equipment Start-up Reports per Section 01 33 00 “Submittal Procedures.”

3. Operation and Maintenance Manuals per Section 01 78 23 “Operation and Maintenance Data.”

1.03 STANDARDS

A. Comply with any standards associated with the testing or startup of equipment, as listed in the various sections of the Specifications.

1.04 SPECIAL JOB CONDITIONS

A. Do not start or test any apparatus until the complete unit has been installed and thoroughly checked.

B. A representative of the Supplier shall be in attendance of tests and start-up procedures when required by these Specifications.

2.00 PRODUCTS

2.01 TESTING INSTRUMENTATION

A. Furnish any instrumentation or other testing devices needed to conduct tests.

3.00 EXECUTION

3.01 SERVICES OF SUPPLIER'S REPRESENTATIVES

A. The Supplier's representative for inspection, supervision of installation, equipment startup and training must be an experienced and competent technical (not sales) representative of the manufacturer or Supplier.

B. Perform installation, adjustment, and testing of the equipment under the direct supervision of the Supplier's representative where specified.

C. The Supplier's representative is to instruct the Owner or his authorized personnel on operational procedures and maintenance requirements.

D. Include the cost of the services of the Supplier's representative in the equipment price.

3.02 INSPECTION AND START UP

A. Inspect equipment with Owner's Designated Representative prior to placing any equipment or system into operation. Make adjustments as necessary for proper operation.

1. Check for adequate and proper lubrication.
2. Determine that parts or components are free from undue stress from structural members, piping or anchorage.
3. Adjust equipment for proper balance and operations.
4. Determine that vibrations are within acceptable limits.
5. Determine that equipment operates properly under full load conditions.
6. Determine that the equipment is in true alignment.

B. Have the Supplier's representative present when the equipment is placed in operation.

1. The Representative is to be on-site as often as necessary for proper and trouble free operation.
2. Ensure that the proper procedure is employed in start up of systems.

C. Provide Equipment Installation Reports for Equipment on the form indicated by Engineer.

1. Certify that the equipment and related appurtenances have been thoroughly examined and approved for start-up and operation.
2. Include the date when Owner's personnel were instructed in the proper operation and maintenance of the equipment in the report.

3.03 STARTING REQUIREMENTS

A. Refer to the individual sections of the specifications for specific start up procedures.

3.04 INITIAL OPERATION

A. Start, test, and place equipment and systems into operation for 30 days to allow the Owner and Engineer to observe the operation and overall performance of the equipment and to determine that controls function as intended.

B. Equipment which operates on a limited or part-time basis shall be operated in the presence of the Engineer to demonstrate that controls function as specified.

C. Perform acceptance test as specified in individual specification sections. Demonstrate that equipment and systems meet the specified performance criteria.

D. Unless specifically stated otherwise in the individual equipment specifications, equipment and systems are not substantially complete until the end of this initial operation period. If an exception to this requirement is specifically noted in an individual equipment specification, the exception shall only apply to that particular piece of equipment and not to the remaining components provided under the Project.

3.05 OPERATOR TRAINING

A. Provide instruction and demonstration of the care and operation of the equipment to the Owner's personnel. Instruction is to include classroom and hands-on training.

B. Provide training in adequate detail to ensure that the trainees who complete the program will be qualified and capable of operating and maintaining the equipment, products, and systems provided.

C. Provide audio-video recording of all Training session by a professional videographer. Submit qualifications of videographer for approval prior to contracting videographer. Provide legal releases or pay additional fees required to allow training by the manufacturer to be recorded.

D. Schedule for training is to be approved by Owner.

1. Schedule training and start-up operations for no more than one piece of equipment or system at a time.

2. Owner may require re-scheduling of training if operations personnel are not available for training on a scheduled date.

3. Provide a minimum of 2 weeks' notice if training must be rescheduled.

4. Training is to be limited to 24 hours per week.

5. Time required for training is to be considered in the development of the Project schedule.

E. Schedule and coordinate training for equipment, products, or systems which depend upon other equipment or systems for proper operation so that trainees can be made familiar with the operation and maintenance of the entire operating system.

F. Conduct a training course for the equipment products and systems provided for the Project. Training is to be adequate to meet the training objectives described above. Details for training will be established in the project specifications for that equipment. Cost for training and start up will be included in the Cost of Work for each equipment package.

3.06 INITIAL MAINTENANCE

A. Maintain equipment until the Project is accepted by the Owner.

1. Insure that mechanical equipment is properly greased, oiled, or otherwise cared for as recommended by the Supplier.

2. Operate air handling equipment only when filters are in place and are clean. Change filters weekly during construction.

B. Service equipment per the Supplier's instructions immediately before releasing the equipment to the Owner.

1. Replace replaceable filters and clean permanent filters associated with air handling units or other packaged equipment.

2. Remove and clean screens at strainers in piping systems.

3. Clean insects from intake louver screens.

END OF SECTION

01 78 23 OPERATION AND MAINTENANCE DATA

1.00 GENERAL

1.01 WORK INCLUDED

A. Prepare three (3) complete and detailed Operation and Maintenance Manuals for each type and model of equipment or product furnished and installed under this Contract.

B. Prepare the manuals in the form of an instruction manual for the Owner. The manual is to be suitable for use in providing operation and maintenance instruction as required by Section 01 75 00 “Starting and Adjusting.”

C. Provide complete and detailed information specifically for the products or systems provided for this Project. Include the information required to operate and maintain the product or system.

D. Manuals are to be in addition to any information packed with or attached to the product when delivered. This information is to be taken from the product and provided as an attachment to the manual.

E. Cost for O&M Manuals provided by Suppliers and Subcontractors as described in this section are to be included in the Cost of Work. Contractor efforts are included in the Contractor’s fee for Construction Phase Services.

1.02 SUBMITTALS

A. Submit manuals in accordance with Section 01 33 00 “Submittal Procedures.”

1.03 GUARANTEES

A. Provide copies of the Manufacturer’s warranties, guarantees, or service agreements in accordance with Section 01 70 00 “Execution and Closeout Requirements.”

2.00 PRODUCTS

2.01 MATERIALS

A. Print manuals on heavy, first quality paper.

1. Paper shall be 8-1/2 x 11 paper.

a. Reduce drawings and diagrams to 8-1/2 x 11 paper size.

b. When reduction is not practical, fold drawings and place each separately in a clear, super heavy weight, top loading polypropylene sheet protector designed for ring binder use. Provide a typed identification label on each sheet protector.

2. Punch paper for standard three-ring binders with a 13/32” diameter punch.

B. Place manuals in Wilson Jones 385 Line D-Ring Dublock Presentation Binders.

1. Binders are to have clear front, back, and spine covers.

2. Sheet lifters are to be provided.

3. Minimum size is 2-inch capacity. Maximum size is 3-inch capacity.

C. Provide tab indexes for each section of the manual.

1. Indexes are to be constructed of heavy-duty paper with a reinforced binding edge and punched with 9/32-inch holes to fit the binders.

2. Index is to have clear insertable tabs for a typed insert.

2.02 ELECTRONIC MANUAL FORMAT

A. Manual contents to be provided on compact disc (CD).

1. Minimum CD storage capacity is 700 MB.

2. CD to have read/write capability.

B. Provide individual electronic files for each manual.

1. Maximum file size is 5MB. If manual is greater than maximum allowable file size, provide individual files for each major section of manual.

2. Acceptable file types for written documents are Portable Document File (PDF) or Microsoft Word formats. Acceptable file types for drawing files are PDF formats. All files shall be compatible with the latest software version available.

3. Filename shall identify the plant site, plant area, equipment manufacturer, and date equipment placed in service. i.e. WWTP-PC1-Manufacturer-200503.pdf.

4. Each electronic file shall contain a table of contents at the beginning of the file which includes hypertext links or bookmarks to navigate the file contents per section/chapter.

5. Scanned images of written documents are not acceptable. Document must allow character selection. Text within a file shall be transferable to other documents.

6. Drawing files shall have the ability to turn on/off drawing layers within the file.

7. Submit a preliminary version of the electronic format of the manual for review prior to requesting substantial completion. Upon approval of the preliminary submittal, the Contractor shall provide three copies of the electronic manual to the Owner.

3.00 EXECUTION

3.01 MANUAL ORGANIZATION AND CONTENTS

A. Provide a Table of Contents listing each section of the manual for each product or system.

1. Identify each product or system using the nomenclature shown in the Contract Documents.

2. Assign a number and letter to each section in the manual.

a. Assign a number to each product or system. The number is to correspond to the Owner's equipment numbering system or other system designated by the Engineer.

b. A cross reference is to be provided for the Owner's numbering system and designations for equipment indicated in the Contract Documents.

c. The letter assigned will represent the part of the manual, consistent with the manual contents as required by Paragraphs 3.02, 3.03, and 3.04.

3. Provide index tabs for each section in the manual.

4. The designation on each index tab is to correspond to the number and letter assigned in the Table of Contents.

B. Include only the information that pertains to the product described. Annotate each sheet to:

1. Clearly identify the specific product or component installed.

2. Clearly identify the data applicable to the installation.

3. Delete reference to inapplicable information.

C. Supplement manual information with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.

D. Identify each manual by placing a printed cover sheet in the front cover of the binder and as the first page in the manual. The first page is to be placed in a clear polypropylene sheet protector. The information on first page and the cover page are to include:

1. Name of Owner.

2. Project Name.

3. Volume number.

4. The Table of Contents for that volume.

E. Insert the Table of Contents into the spine of each manual.

F. Manuals for several products or systems may be provided in the same binder.

1. Sections for each product or system must be included in the same binder.

2. Sections must be in numerical order from volume to volume.

G. Correlate the data into related groups when multiple binders are used.

H. Fill binders to only three-fourths of its indicated capacity to allow for addition of materials to each binder by the Owner.

3.02 EQUIPMENT AND SYSTEMS MANUAL CONTENT

A. Manual shall provide the following information:

1. A description of the unit and component parts.

2. Operating instructions for startup, normal operations, regulation, control, shutdown, emergency conditions, and limiting operating conditions.

3. Maintenance instructions including assembly, installation, alignment, adjustment, and checking instructions.

4. Lubrication schedule and lubrication procedures. Include a cross reference for recommended lubrication products.

5. Troubleshooting guide.

6. Schedule of routine maintenance requirements.
7. Description of sequence of operation by the Control Manufacturer.
8. Warnings for detrimental maintenance practices.
9. Parts lists including:
    a. Part numbers for ordering new parts.
    b. Assembly illustrations showing an exploded view of the complex parts of the product.
    c. Predicted life of parts subject to wear.
    d. List of the Manufacturer's recommended spare parts, current prices with effective date and number of parts recommended for storage.
    e. Directory of a local source of supply for parts with company name, address, and telephone number.
    f. Complete nomenclature and list of commercial replacement parts.
10. Outline, cross section and assembly drawings, engineering data, test data, and performance curves.
11. Control schematics and point to point wiring diagrams prepared for field installation, including circuit directories of panel boards and terminal strips.
12. List of identification nameplates installed on equipment and valve identification per the Contract Documents.
13. Other information as may be required by the individual sections of the Specifications.
14. Copies of approved submittals related to equipment in O&M manuals.

3.03 ELECTRICAL AND ELECTRONICS SYSTEMS MANUAL

A. Manual shall provide the following information:
    1. A description of the systems and component parts.
    2. Control schematics and point to point wiring diagrams prepared for field installation. Include circuit directories of panel boards and terminal strips and as installed color coded wiring diagrams.
    3. Operating procedures, maintenance procedures, and the Manufacturer's printed operating and maintenance instructions.
    4. List of the Manufacturer's recommended spare parts, current prices with effective date, and number of parts recommended for storage.
    5. Other information as may be required by the individual sections of the Specifications.
    6. Final balancing reports for mechanical systems.
    7. Other information as may be required by the individual sections of the Specifications.

3.04 LIST OF SERVICE ORGANIZATIONS

A. Provide a directory of authorized service organizations with company name, address, telephone number, e-mail address and the contact person for warranty repair.

END OF SECTION

01 91 13 GENERAL COMMISSIONING REQUIREMENTS

1.00 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:

1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion

C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

D. The Commissioning Authority is employed by Owner.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Plumbing Systems:

1. Water heaters.
2. Recirculation pumps.

C. HVAC System, including:

1. Major and minor equipment items.
2. Piping systems and equipment.
3. Ductwork and accessories.
4. Terminal units.
5. Control system.
6. Sound control devices.
7. Vibration control devices.

8. Variable frequency drives.

D. Electrical Systems:

1. Lighting controls other than manual switches.

E. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 RELATED REQUIREMENTS

A. Section 01 33 00 Submittal Procedures

B. Section 01 40 00 Quality Requirements

C. Section 23 05 93 Testing, Adjusting, and Balancing For HVAC

D. Section 23 09 23 BACNET Direct Digital Control Systems For HVAC

E. Section 23 81 29 Variable Refrigerant Flow HVAC Systems

1.04 REFERENCE STANDARDS

A. ASSOCIATED AIR BALANCE COUNCIL (AABC) ACG Commissioning Guideline (2005) Commissioning Guideline

B. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Guideline 0 - The Commissioning Process.

C. ASHRAE Guideline 1.1 - The HVAC Commissioning Process.

1.05 SUBMITTALS

A. See Section 01 30 00 – Submittal Procedures, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.

2. Submit one copy to the Commissioning Authority, not to be returned.

3. Make commissioning submittals on time schedule specified by Commissioning Authority.

4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.

5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.

B. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

C. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:

1. Manufacturer's product data, cut sheets, and shop drawings.

2. Manufacturer's installation instructions.
3. Startup, operating, and troubleshooting procedures.
4. Fan and pump curves.
5. Factory test reports.
6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

2.00 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F (0.3 degree C) and resolution of plus/minus 0.1 degree F (0.05 degree C).
2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
3. Calibration: According to the manufacturer’s recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

3.00 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.

1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

1. Commissioning will be phased (by floors, for example) to minimize the total construction time.

D. Basis of Design Documentation (BOD): Detailed documentation of the functional requirements of the project; descriptions of the systems, components, and methods chosen to meet the design intent; assumptions underlying the design intent.

1. Basis of Design Documentation is to be prepared by Architect.

E. Commissioning Schedule:

1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.

2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.

3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.

4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.

1. No sampling of identical or near-identical items is allowed.

2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.

3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:

a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.

b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.

c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."

d. Serial number of installed unit.

e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.

f. Sensor and actuator calibration information.

4. Prefunctional Checklists will be developed and provided post-bid. The Commissioning Authority has the authority to modify these and will furnish final versions as applicable.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.

1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.

3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.

4. If any Checklist line item is not relevant, record reasons on the form.

5. Contractor may independently perform startup inspections and/or tests, at his option.

6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.

7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.

1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in the Contract Documents.

2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.

3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in the Contract Documents or not.

4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:

1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.

1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.
2. Use the standard form provided with copies submitted to Owner and Contractor.
3. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
4. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
6. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:

1. Functional test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.

2. Examples of Functional Testing:

a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).

b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.

c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.

d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

G. Factory Tests: Commissioning Authority and Contractor are responsible for coordinating testing of equipment at the factory by factory personnel, to ensure compliance with commissioning requirements.

H. Field Tests By Others: Where Functional Tests are indicated as to be performed by others not subject to the Contract Documents, those tests are not subject to these commissioning requirements.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:

1. Verify that sensor location is appropriate and away from potential causes of erratic operation.

2. Verify that sensors with shielded cable are grounded only at one end.

3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F (0.1 degree C) of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:

1. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.

1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer’s resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:

1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F (0.2 degree C).

4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg (340 Pa).
6. Flow Rate, Air: 10 percent of design.
7. Flow Rate, Water: 4 percent of design.
8. Flow Rate, Steam: 3 percent of design.
9. AHU Wet Bulb and Dew Point: 2.0 degrees F (1.1 degrees C).
10. Hot Water Coil and Boiler Water Temperature: 1.5 degrees F (0.8 degrees C).
11. Cooling Coil, Chilled and Condenser Water Temperatures: 0.4 degrees F (0.2 degree C).
12. Combustion Flue Temperature: 5.0 degrees F (2.8 degrees C).
13. Oxygen and CO2 Monitors: 0.1 percentage points.
14. CO Monitor: 0.01 percentage points.
15. Natural Gas and Oil Flow Rate: 1 percent of design.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.

1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:

1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
    a. Major equipment.
    b. Life-safety-critical equipment.
    c. Prefunctional Checklist execution.
3. Randomly test at least 20 percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
4. If 5 percent of the units in the first sample fail, test another 20 percent of the remaining identical units.
5. If 5 percent of the units in the second sample fail, test all remaining identical units.
6. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:

1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority’s request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
2. Other points will be monitored by the Commissioning Authority using dataloggers.
3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.

4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
5. Graphical output is desirable and is required for all output if the system can produce it.
6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 23 - Operations and Maintenance Data

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION

DIVISION 3
CONCRETE

03 01 30 MAINTENANCE OF CAST-IN-PLACE CONCRETE

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Removal of deteriorated concrete and subsequent replacement and patching.
2. Floor joint repair.
3. Epoxy crack injection.
4. Corrosion-inhibiting treatment.

1.03 UNIT PRICES

A. General: Unit prices include the cost of preparing existing construction to receive the work indicated.

B. Concrete Removal and Replacement or Patching: Work will be paid for by the cubic foot computed on the basis of rectangular solid shapes approximating the actual shape of concrete removed and replaced with average depths, widths, and lengths, measured to the nearest inch. Contractor to establish allowance for 25 cubic feet of concrete spall repair.

C. Epoxy Crack Injection: Work will be paid for by the linear foot of crack injected. Contractor to establish allowance for 350 linear feet of concrete crack repair.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

B. Samples: Cured samples for each exposed product and for each color and texture specified, in manufacturer's standard size appropriate for each type of work.

C. Samples for Initial Selection: Cured samples for each exposed product and for each color and texture specified.

1. Include sets of patching-material Samples in the form of briquettes, at least 3 inches long by 1-1/2 inches wide representative of the range of concrete colors on the building. Document each Sample with product, mix, and or other information necessary to replicate it.

2. Have each set of Samples contain a close color range of at least three Samples of different mixes of materials that match the variations in existing, adjacent concrete when cured and dry.

D. Samples for Verification: Cured samples for each exposed product and for each color and texture specified.

1. Include Samples of each required type, color, and texture of patching material in the form of patches in drilled holes or sawed joints in sample concrete representative of the range of concrete colors on the building.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers and manufacturers.

B. Material Certificates: For each type of portland cement and aggregate supplied for mixing or adding to products at Project site.

C. Product Test Reports: For each manufactured bonding agent, cementitious patching mortar, joint-filler, and crack injection adhesive, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Field quality-control reports.

E. Maintenance Program: Submit before work begins.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Each manufactured bonding-agent, cementitious patching-mortar, joint-filler, and crack-injection-adhesive manufacturer shall employ factory-trained technical representatives who are available for consultation and Project-site inspection and assistance at no additional cost.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer to apply packaged patching-mortar materials, epoxy crack injection materials, and corrosion-inhibiting treatments.

C. Maintenance Program: Prepare a written plan for maintenance of cast-in-place concrete, including each phase or process, protection of surrounding materials during operations, and control of debris and runoff during the Work. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer’s written instructions for minimum and maximum temperature requirements and other conditions for storage.

B. Store cementitious materials off the ground, under cover, and in a dry location.

C. Store aggregates covered and in a dry location; maintain grading and other required characteristics and prevent contamination.

1.09 FIELD CONDITIONS

A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.

1. Use only Class A epoxies when substrate temperatures are below or are expected to go below 40 F within 8 hours.

2. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below 60 F within 8 hours.

3. Use only Class C epoxies when substrate temperatures are above and are expected to stay above 60 F for 8 hours.

B. Cold-Weather Requirements for Cementitious Materials: Comply with the following procedures:

1. When air temperature is below 40 F, heat patching-material ingredients and existing concrete to produce temperatures between 40 and 90 F.

2. When mean daily air temperature is between 25 and 40 F, cover completed Work with weather-resistant insulating blankets for 48 hours after repair or provide enclosure and heat to maintain temperatures above 32 F within the enclosure for 48 hours after repair.

3. When mean daily air temperature is below 25 F, provide enclosure and heat to maintain temperatures above 32 F within the enclosure for 48 hours after repair.

C. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 F and above.

2.00 PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations: Obtain each color, grade, finish, type, and variety of product from single source with resources to provide products of consistent quality in appearance and physical properties.

B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

2.02 BONDING AGENTS

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Manufactured product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. BASF Construction Chemicals - Building Systems; Emaco P24.
    b. Euclid Chemical Company (The), an RPM company; Duralprep A.C.
    c. Kaufman Products, Inc.; Surepoxy HM EPL.
    d. Sika Corporation, Construction Product Division; Armatec 110 EpoCem.
    e. Sto Corp., Concrete Restoration Division; Sto Bonding and Anti-Corrosion Agent.

B. Epoxy Bonding Agent: ASTM C881, Type II or Type V and free of VOCs.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. BASF Construction Chemicals - Building Systems.
    b. ChemCo Systems.
    c. Dayton Superior Corporation.
    d. Euclid Chemical Company (The); an RPM company.
    e. Kaufman Products, Inc.
    f. Sika Corporation; Construction Product Division.
    g. Sto Corp., Concrete Restoration Division.
    h. Unitex.
    i. US SPEC; Division of US MIX Products Company.
    j. W. R. Meadows, Inc.

C. Mortar Scrub Coat: Mix consisting of 1 part portland cement and 1 part fine aggregate complying with ASTM C144 except 100 percent passing a No. 16 sieve.

2.03 PATCHING MORTAR

A. Patching Mortar, General:
1. Only use patching mortars that are recommended by manufacturer for each applicable horizontal, vertical, or overhead use orientation.
2. Color and Aggregate Texture: Provide patching mortar and aggregates of colors and sizes necessary to produce patching mortar that matches existing, adjacent, exposed concrete. Blend several aggregates if necessary to achieve suitable matches.
3. Coarse Aggregate for Patching Mortar: ASTM C33, washed aggregate, Size No. 8, Class 5S. Add to patching-mortar mix only as permitted by patching-mortar manufacturer.

B. Job-Mixed Patching Mortar: 1 part portland cement and 2-1/2 parts fine aggregate complying with ASTM C144, except 100 percent passing a No. 16 sieve.

C. Cementitious Patching Mortar: Packaged, dry mix for repair of concrete.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Construction Chemicals - Building Systems.

b. CGM, Incorporated.

c. Dayton Superior Corporation.

d. Euclid Chemical Company (The); an RPM company.

e. Fox Industries, Inc.

f. Kaufman Products, Inc.

g. Sika Corporation; Construction Product Division.

h. Sto Corp.; Concrete Restoration Division.

i. Unitex.

j. US SPEC; Division of US MIX Products Company.

k. W. R. Meadows, Inc.

2. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C109.

D. Rapid-Strengthening, Cementitious Patching Mortar: Packaged, dry mix, ASTM C928 for repair of concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Construction Chemicals - Building Systems.

b. CGM, Incorporated.

c. Dayton Superior Corporation.

d. Euclid Chemical Company (The); an RPM company.

e. Fox Industries, Inc.

f. Kaufman Products, Inc.

g. Sika Corporation; Construction Product Division.

h. Sto Corp.; Concrete Restoration Division.

i. Unitex.

j. US SPEC; Division of US MIX Products Company.

k. W. R. Meadows, Inc.

2. Compressive Strength: Not less than 1000 psi within 3 hours when tested according to ASTM C109.

E. Polymer-Modified, Cementitious Patching Mortar: Packaged, dry mix for repair of concrete and that contains a latex additive as either a dry powder or a separate liquid that is added during mixing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AQUAFIN, Inc.

b. BASF Construction Chemicals - Building Systems.

c. CGM, Incorporated.

d. Cortec Corporation.

e. Dayton Superior Corporation.

f. Euclid Chemical Company (The); an RPM company.

g. Fox Industries, Inc.

h. Kaufman Products, Inc.

i. Sika Corporation; Construction Product Division.

j. Sto Corp.; Concrete Restoration Division.

k. US SPEC; Division of US MIX Products Company.

l. W. R. Meadows, Inc.

2. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C109.

2.04 JOINT FILLER

A. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of at least 80 according to ASTM D2240.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Masterfill 300i.

b. ChemCo Systems; CCS Grout, Control Joint or Control Joint - HB.

c. Dayton Superior Corporation; PoxyFil (J-52).

d. Euclid Chemical Company (The), an RPM company; Euco 700 or 800.

e. Kaufman Products, Inc.; Surepoxy Flexijoint.

f. Metzger/McGuire; MM-80 or Edge-Pro XL.

g. Sika Corporation, Construction Product Division; Sikadur 51 NS or Sikadur 51 SL.

h. Unitex; Pro-Flex or Pro-Flex Gel.

i. US SPEC, Division of US MIX Products Company; SR 50 - EJF.

j. W. R. Meadows, Inc.; Sealtight Rezi-Weld Flex.

B. Polyurea Joint Filler: Two-component, semirigid, 100 percent solids, polyurea resin with a Type A Shore durometer hardness of at least 80 according to ASTM D2240.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ASTC Polymers; Penetron 3003.

b. BASF Construction Chemicals - Building Systems; Masterfill 400 CT or TF-100.

c. ChemCo Systems; CCS Grout, Control Joint or Polyurea SWL.

d. Dayton Superior Corporation; Joint Fill.

e. Euclid Chemical Company (The), an RPM company; Euco Qwikjoint 200.

f. Metzger/McGuire; Spal-Pro RS 88 or Spal-Pro 2000.

C. Color: Matching existing joint filler.

2.05 EPOXY CRACK-INJECTION MATERIALS

A. Epoxy Crack-Injection Adhesive: ASTM C881, Type IV at structural locations and where indicated, Type I at other locations; free of VOCs.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Construction Chemicals - Building Systems.

b. ChemCo Systems.

c. Dayton Superior Corporation.

d. Euclid Chemical Company (The); an RPM company.

e. Kaufman Products, Inc.

f. Sika Corporation; Construction Product Division.

g. Sto Corp.; Concrete Restoration Division.

h. Unitex.

i. US SPEC; Division of US MIX Products Company.

j. W. R. Meadows, Inc.

2. Capping Adhesive: Product manufactured for use with crack injection adhesive by same manufacturer.

3. Color: Provide epoxy crack-injection adhesive and capping adhesive that will blend with existing, adjacent concrete and will not stain concrete surface.

2.06 OTHER MATERIALS

A. Corrosion-Inhibiting Treatment: Waterborne solution of alkaline corrosion-inhibiting chemicals for concrete-surface application that penetrates concrete by diffusion and forms a protective film on steel reinforcement.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cortec Corporation; MCI 2020 Series.

b. Euclid Chemical Company (The), an RPM company; Duralprep 3020.

c. Evonik Degussa Corporation; Protectosil CIT.

d. Fox industries, Inc.; FX-361 Migratory Corrosion Inhibitor.

e. Sika Corporation, Construction Product Division; Sika FerroGard 903.

f. Sto Corp., Concrete Restoration Division; Sto Migratory Corrosion Inhibitor CR247.

B. Portland Cement: ASTM C150, Type I, II, or III unless otherwise indicated.

2.07 MIXES

A. General: Mix products, in clean containers, according to manufacturer's written instructions.

1. Do not add water, thinners, or additives unless recommended by manufacturer.

2. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.

3. Do not mix more materials than can be used within time limits recommended by manufacturer. Discard materials that have begun to set.

B. Mortar Scrub Coat: Mix dry ingredients with enough water to provide consistency of thick cream.

C. Dry-Pack Mortar: Mix patching-mortar dry ingredients with just enough liquid to form damp cohesive mixture that can be squeezed by hand into a ball but is not plastic.

D. Concrete: Comply with Section 03 30 00 "Cast-in-Place Concrete."

3.00 EXECUTION

3.01 EXAMINATION

A. Notify Architect 7 days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.

B. Locate areas of deteriorated or delaminated concrete using hammer or chain-drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries. At columns and walls make boundaries level and plumb unless otherwise indicated.

C. Pachometer Testing: Locate at least three reinforcing bars using a pachometer, and drill test holes to determine depth of cover. Calibrate pachometer using depth of cover measurements, and verify depth of cover in removal areas using pachometer.

D. Perform surveys as the Work progresses to detect hazards resulting from concrete-maintenance work.

3.02 PREPARATION

A. Ensure that supervisory personnel are on-site and on duty when concrete maintenance work begins and during its progress.

B. Preparation for Removal of Deteriorated Concrete: Examine construction to be repaired to determine best methods to safely and effectively perform concrete maintenance work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.

1. Verify that affected utilities have been disconnected and capped.

2. Inventory and record the condition of items to be removed for reinstallation or salvage.
3. Provide and maintain shoring, bracing, and temporary structural supports as required to preserve stability and prevent unexpected or uncontrolled movement, settlement, or collapse of construction being demolished and construction and finishes to remain.

C. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from concrete maintenance work.

1. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
2. Use only proven protection methods appropriate to each area and surface being protected.
3. Provide barricades, barriers, and temporary directional signage to exclude public from areas where concrete maintenance work is being performed.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of concrete maintenance work.
5. Contain dust and debris generated by concrete maintenance work and prevent it from reaching the public or adjacent surfaces.
6. Use water-mist sprinkling and other wet methods to control dust only with adequate, approved procedures and equipment that ensure that such water will not create a hazard or adversely affect other building areas or materials.
7. Protect floors and other surfaces along haul routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate removal and dismantling work from other areas of the building.
9. Protect adjacent surfaces and equipment by covering them with heavy polyethylene film and waterproof masking tape. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
10. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
11. Dispose of debris and runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

D. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is in working order.

1. Prevent solids such as aggregate or mortar residue from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from concrete maintenance work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

E. Concrete Removal:

1. Provide shoring, bracing, and supports as necessary. Strengthen or add new supports when required during progress of removal work. Do not overload structural elements with debris.

2. Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.

3. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.

4. Remove additional concrete if necessary to provide a depth of removal of at least 1/2 inch over entire removal area.

5. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least a 3/4-inch clearance around bar.

6. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.

7. Provide surfaces with a fractured profile of at least 1/8 inch that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level unless otherwise directed.

8. Thoroughly clean removal areas of loose concrete, dust, and debris.

F. Reinforcing-Bar Preparation: Remove loose and flaking rust from reinforcing bars by high-pressure water cleaning, abrasive blast cleaning, needle scaling or wire brushing until only tightly adhered light rust remains.

1. Where section loss of reinforcing bar is more than 25 percent or 20 percent in two or more adjacent bars, cut bars and remove and replace. Remove additional concrete as necessary to provide at least 3/4-inch clearance at existing and replacement bars. Splice replacement bars to existing bars according to ACI 318 by lapping, welding, or using mechanical couplings.

G. Preparation of Floor Joints for Repair: Saw-cut joints full width to edges and depth of spalls, but not less than 3/4 inch deep. Clean out debris and loose concrete; vacuum or blow clear with compressed air.

H. Surface Preparation for Corrosion-Inhibiting Treatment: Clean concrete to remove dirt, oils, films, and other materials detrimental to treatment application.

1. Use low-pressure water cleaning, detergent scrubbing or sand blasting.

2. Allow surface to dry before applying corrosion-inhibiting treatment.

3.03 APPLICATION

A. General: Comply with manufacturer’s written instructions and recommendations for application of products, including surface preparation.

B. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to reinforcing bars and concrete by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry 2 to 3 hours before applying second coat. Allow to dry before placing patching mortar or concrete.

C. Epoxy Bonding Agent: Apply to reinforcing bars and concrete by brush, roller, or spray according to manufacturer's written instructions, leaving no pinholes or other uncoated areas. Place patching mortar or concrete while epoxy is still tacky. If epoxy dries, recoat before placing patching mortar or concrete.

D. Mortar Scrub Coat for Job-Mixed Patching Mortar and Concrete: Dampen repair area and surrounding concrete 6 inches beyond repair area. Remove standing water and apply scrub coat with a brush, scrubbing it into surface and thoroughly coating repair area. If scrub coat dries, recoat before placing patching mortar or concrete.

E. Slurry Coat for Cementitious Patching Mortar: Wet substrate thoroughly and then remove standing water. Scrub a slurry of neat patching mortar into substrate, filling pores and voids.

F. Placing Patching Mortar: Place as follows unless otherwise recommended in writing by manufacturer:

1. Provide forms where necessary to confine patch to required shape.
2. Wet substrate and forms thoroughly and then remove standing water.
3. Pretreatment: Apply specified bonding agent and mortar scrub coat or slurry coat as recommended by manufacturer.
4. General Placement: Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
5. Vertical Patching: Place material in lifts of not more than 1 inch nor less than 1/8 inch or as recommended by manufacturer. Do not feather edge.
6. Overhead Patching: Place material in lifts of not more than 1 inch nor less than 1/8 inch or as recommended by manufacturer. Do not feather edge.
7. Consolidation: After each lift is placed, consolidate material and screed surface.
8. Multiple Lifts: Where multiple lifts are used, score surface of lifts to provide a rough surface for placing subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
9. Finishing: Allow surfaces of lifts that are to remain exposed to become firm and then finish to a surface matching adjacent concrete.
10. Curing: Wet-cure cementitious patching materials, including polymer-modified cementitious patching materials, for not less than 7 days by water-fog spray or water-saturated absorptive cover.

G. Dry-Pack Mortar: Use for deep cavities. Place as follows unless otherwise recommended in writing by manufacturer:

1. Provide forms where necessary to confine patch to required shape.
2. Wet substrate and forms thoroughly and then remove standing water.
3. Pretreatment: Apply specified bonding agent and mortar scrub coat or slurry coat as recommended by manufacturer.
4. Place dry-pack mortar into cavity by hand, and compact tightly into place. Do not place more material at a time than can be properly compacted. Continue placing and compacting until patch is approximately level with surrounding surface.
5. After cavity is filled and patch is compacted, trowel surface to match profile and finish of surrounding concrete. A thin coat of patching mortar may be troweled into the surface of patch to help obtain required finish.
6. Wet-cure patch for not less than 7 days by water-fog spray or water-saturated absorptive cover.

H. Concrete: Place according to Section 03 30 00 “Cast-in-Place Concrete” and as follows:

1. Pretreatment: Apply epoxy-modified, cementitious bonding and anticorrosion agent to reinforcement and concrete substrate.
2. Standard Placement:
    a. Use vibrators to consolidate concrete as it is placed.
    b. At unformed surfaces, screed concrete to produce a surface that when finished with patching mortar will match required profile and surrounding concrete.
3. Wet-cure concrete for not less than 7 days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
4. Fill placement cavities with dry-pack mortar and repair voids with patching mortar. Finish to match surrounding concrete.

I. Floor-Joint Repair: Cut out deteriorated concrete and reconstruct sides of joint with patching mortar as indicated on Drawings. Install joint filler in nonmoving floor joints where indicated and as follows:

1. Depth: Install joint filler to a depth of at least 3/4 inch. Use fine silica sand no more than 1/4 inch deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.
2. Top Surface: Install joint filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

J. Epoxy Crack Injection:

1. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond, and clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
2. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.

3. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch thick by 1 inch wider than crack.
4. Inject cracks wider than 0.003 inch to a depth of 8 inches.
5. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
6. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.

K. Corrosion-Inhibiting Treatment: Apply by brush, roller, or airless spray in two coats at manufacturer's recommended application rate. Remove film of excess treatment by high-pressure washing before patching treated concrete.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified testing agency approved by TMD to perform tests and inspections.

B. Perform the following tests and inspections:

1. Packaged, Cementitious Patching Mortar: Three randomly selected sets of samples for each type of mortar required, tested according to ASTM C928.
2. Job-Mixed Patching Mortar: Three randomly selected sets of samples for each type of mortar required, tested for compressive strength according to ASTM C109.
3. Concrete: As specified in Section 03 30 00 "Cast-in-Place Concrete."
4. Joint Filler: Core-drilled samples to verify proper installation.
    a. Testing Frequency: One sample for each 100 feet of joint filled.
    b. Where samples are taken, refill holes with joint filler.
5. Epoxy Crack Injection: Core-drilled samples to verify proper installation.
    a. Testing Frequency: One sample for each 100 feet of crack injected.
    b. Where samples are taken, refill holes with epoxy mortar.

C. Product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

03 30 00 CAST-IN-PLACE CONCRETE

1.00 GENERAL

1.01 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, curing and finishes.

1.02 DEFINITIONS

A. Cementitious Materials: Portland cement alone or as specifically allowed in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.03 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

1. Mix design: For each concrete mix, complete the form “Concrete Mix Design” and one of the following forms: “Documentation of Average Strength – Field Strength Test Record” or “Documentation of Average Strength – Trial Mixtures.”

a. Submit mix design supporting documentation and calculations as required.

B. Steel Reinforcement Shop Drawings for record purposes only: Details of fabrication, bending, and placement, prepared according to ACI 315, “Details and Detailing of Concrete Reinforcement.” Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

C. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Curing materials.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Epoxy joint filler.
10. Joint-filler strips.
11. Repair materials.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction and the Engineer, qualified according to ASTM C1077 and ASTM E329 to conduct the testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.06 STANDARDS

A. Mixing, sampling, placing, curing and testing of concrete, and the materials used shall be in compliance with the latest revisions of the following standards, unless otherwise noted in the Contract Documents. The Contractor shall maintain one copy of each of the applicable standards at the construction field office.

1. American Concrete Institute (ACI) Standards:

ACI 117	Specifications for Tolerances for Concrete Construction and Materials
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavy-weight, and Mass Concrete
ACI 214	Recommended Practice for Evaluation of Strength Test Results
ACI 223	Standard Practice for Use of Shrinkage Compensating Concrete
ACI 301	Specification for Structural Concrete for Buildings
ACI 302	Guide for Concrete Floor and Slab Construction
ACI 304	Guide for Measuring, Mixing, Transporting & Placing Concrete
ACI 304.2R	Placing Concrete by Pumping Methods
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 308	Standard Practice for Curing Concrete
ACI 309	Guide for Consolidation of Concrete

ACI 318	Building Code Requirements for Reinforced Concrete

2.00 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Products: Subject to compliance with requirements, provide one of the products specified.

3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.

b. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.

c. Structural 1, B-B, or better, mill oiled and edge sealed.

d. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 inch by 3/4 inch, minimum.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.

2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or waterproofing.

2.03 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

B. Plain-Steel Welded Wire Fabric: ASTM A1064, fabricated from as-drawn steel wire into flat sheets.

1. Provide only in locations specifically allowed.

2.04 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A615, Grade 60. Cut bars true to length with ends square and free of burrs.

C. Epoxy-Coated Joint Dowel Bars: ASTM A775; with ASTM A615, Grade 60, plain-steel bars.

D. Zinc Repair Material: ASTM A780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

2.05 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I or I/II.

1. Fly Ash: ASTM C618, Class C or F.

B. Normal-Weight Aggregate: ASTM C33, uniformly graded, of the size scheduled and as follows:

1. Class: Moderate weathering region, but not less than 3M.

2. ASTM C33 Size Number: 4 or 467.
3. ASTM C33 Size Number: 5, 56 or 57.

C. Normal-Weight Aggregate for Slab-on-Grade: ASTM C33, combined gradations as follows:
1. 8 to 18 percent for 1-1/2 inch stone.
2. 8 to 22 percent for 3/4-inch or 1-inch stone.
3. 8 to 15 percent for #30 and #50 sieve.
4. 0 to 4 percent on top size sieve.
5. 1-1/2 to 5 percent on the #100 sieve.

D. Water: Potable and complying with ASTM C94.

2.06 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C260.

C. Water-Reducing Admixture: ASTM C494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C494, Type F or G.

E. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

F. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Products:
a. Catexol 1000CL; Axim Concrete Technologies.
b. MCI 2000 or MCI 2005; Cortec Corporation.
c. DCI or DCI-S; W. R. Grace & Co., Construction Products Div.
d. Rheocrete 222+; Master Builders, Inc.
e. FerroGard-901; Sika Corporation.

2.07 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E1745, Class A. Include manufacturer’s recommended adhesive or pressure-sensitive tape.
1. Available Products:
a. Fortifiber Corporation; Moistop Ultra 15.
b. Raven Industries Inc.; Vapor Block 15.
c. Reef Industries, Inc.; Griffolyn Type-105.
d. Stego Wrap (15-mil) Vapor Barrier; STEGO INDUSTRIES LLC.

e. Husky Yellow Guard; 15-mil Vapor Barrier

2.08 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products:

a. Cimfilm; Axim Concrete Technologies.

b. Finishing Aid Concentrate; Burke Group, LLC (The).

c. Spray-Film; ChemMasters.

d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.

e. Sure Film; Dayton Superior Corporation.

f. Eucobar; Euclid Chemical Co.

g. Vapor Aid; Kaufman Products, Inc.

h. Lambco Skin; Lambert Corporation.

i. E-Con; L&M Construction Chemicals, Inc.

j. Confilm; Master Builders, Inc.

k. Waterhold; Metalcrete Industries.

l. Rich Film; Richmond Screw Anchor Co.

m. SikaFilm; Sika Corporation.

n. Finishing Aid; Symons Corporation.

o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.

B. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, 18 to 22 percent solids.

1. Products:

a. Klear Kote WB II 20 percent; Burke Chemicals.

b. Safe-Cure & Seal 20; ChemMasters.

c. Conspec 21; Conspec Marketing & Manufacturing Co., Inc.

d. Diamond Clear VOX; Euclid Chemical Co.

e. SureCure Emulsion; Kaufman Products Inc.

f. Glazecote Sealer-20; Lambert Corporation.

g. Dress & Seal WB; L&M Construction Chemicals, Inc.

h. Vocomp-20; W. R. Meadows, Inc.

i. Metcure 0800; Metalcrete Industries.

j. Cure & Seal 200E; Nox-Crete Products Group, Kinsman Corporation.

k. Rich Seal 18 percent E; Richmond Screw Anchor Co.

l. Kure-N-Seal W; Sonneborn, Div. of ChemRex, Inc.

m. Florseal W.B.; Sternson Group.

n. Cure & Seal 18 percent E; Symons Corporation.

o. Seal Cure WB STD; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.

p. Hydro Seal 800; Unitex.

q. Starseal 0800; Vexcon Chemicals, Inc.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

1. Products:

a. Klear-Kote Cure-Sealer-Hardener, 30 percent solids; Burke Group, LLC (The).

b. Polyseal WB; ChemMasters.

c. UV Safe Seal; Lambert Corporation.

d. Lumiseal WB Plus; L&M Construction Chemicals, Inc.

e. Vocomp-30; W. R. Meadows, Inc.

f. Metcure 30; Metalcrete Industries.

g. Vexcon Starseal 1315; Vexcon Chemicals, Inc.

2.09 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber, or ASTM D1752, cork or self-expanding cork.

B. Epoxy Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D2240.

C. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Zinc Rich Primer: Aluminum surfaces which contact or are embedded in concrete shall be coated with zinc rich primer. Primer shall be Tneme-Zinc.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C109.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.

1. Cement Binder: ASTM C150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C109.

2.11 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases according to the provisions of ACI 318.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Performance Requirements:

Class	Location	28-Day Compressive Strength (psi)	Slump (in.)	Aggregate Size (Max./ ASTM C33)
A	Foundations	4000	4	1” / 57
B	Drilled shafts	3000	6	1-1/2” / 467
C	Elevated slabs	3000	5	1” / 57
D	Building frame members	4000	5	1” / 57
E	Paving and Driveways	4000	4	1” / 57
F	Sidewalks	3000	4	1” / 57

1. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with initial slump of 2 to 4 inches.

D. Slab-on-Grade: Proportion normal-weight concrete mix as follows:

1. Paste Fraction: 25 to 38 percent by volume.

a. Paste fraction is the ratio of paste volume to the total mix volume.

b. Paste is defined as the cementitious materials + entrained air + water.

2. Mortar Fraction: 55 to 57 percent by volume.

a. Mortar Fraction is the ratio of Mortar to the total mix volume.

b. Mortar is defined as the Paste + W.

c. Where W (fine aggregate) is that portion of the combined aggregates passing the #8 sieve.

3. Coarseness Factor: 50 to 75 percent.

a. Coarseness Factor is defined as: Q / (Q + I).

b. Where Q (coarse aggregate) is the percentage of the combined aggregate greater than 3/8 inch and I (intermediate aggregate) is the percentage of the combined aggregate between the 3/8-inch and #8 sieves.

4. Workability Factor: 32 to 42 percent.

a. Workability factor is defined as: W / (Q + I + W).

E. Suspended Slabs: Proportion lightweight structural concrete mix as follows:

1. Maximum air dry unit weight: 115 lb./cu. ft. plus or minus 3 lb./cu. ft. as determined by ASTM C567.

F. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements.

G. Maximum Water-Cementitious Materials Ratio: 0.47 for concrete required to have low water permeability.

H. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.

I. Maximum Water-Cementitious Materials Ratio: 0.40 for corrosion protection of steel reinforcement in concrete exposed to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater, or spray from these sources.

J. Maximum Water-Cementitious Materials Ratio: 0.47 for concrete subject to moderate sulfate exposure.

K. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete subject to severe or very severe sulfate exposure.

L. Air Content: Add air-entraining admixture at manufacturer’s prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.

1. Exterior Concrete: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
    a. Air Content: 5.5 percent for 1-1/2-inch nominal maximum aggregate size.
    b. Air Content: 6 percent for 1-inch nominal maximum aggregate size.
    c. Air Content: 6 percent for 3/4-inch nominal maximum aggregate size.

M. Do not air-entrain concrete intended for trowel-finish interior floors and interior suspended slabs. Do not allow entrapped air content to exceed 3 percent.

N. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

O. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (super-plasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to ACI 315, "Details and Detailing of Concrete Reinforcement."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 F, reduce mixing and delivery time to 60 minutes with or 45 minutes without set retarding admixtures.
2. Batch tickets shall be required for each truck and shall be in accordance with ASTM C94, Section 16. Each delivery ticket must show plainly the amount of water, in gallons, that can be added to the mixer truck at the Site without exceeding the maximum water cement ratio approved for that mix design. Amount of water added must be in proportion to contents of truck.

3.00 EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. For concrete surfaces exposed to view: Class A, 1/8 inch.
2. For concrete surfaces to receive a rubbed finish: Class A, 1/8 inch.
3. For concrete surfaces to receive plaster, stucco or wainscoting: Class B, 1/4 inch.
4. For concrete surfaces not exposed to view: Class D, 1 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer’s written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.

3.03 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

1. At least 70 percent of 28-day design compressive strength.

2. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

E. Where aluminum anchors, aluminum shapes, or aluminum electrical conduits are embedded in concrete, paint aluminum contact surfaces with zinc rich primer. Allow the paint to thoroughly dry before placing the aluminum in contact with the concrete.

3.04 VAPOR RETARDERS

A. Place, protect, and repair vapor-retarder sheets according to ASTM E1643 and manufacturer's written instructions.

B. Granular fill below the vapor retarder shall be smoothed and free of protrusions that might damage or rupture the polyethylene film. Completely cover porous fill with film. Lap film not less than 6 inches at all joints, with the top placed in the direction of concrete spreading. Use pressure-sensitive tape at all laps of vapor barrier. Lap reinforcement directly over film before placing concrete, taking precautions to prevent film punctures. Carefully cut film around pipes and wiring outlets, and then apply pressure sensitive tape around these protrusions to insure maximum barrier effectiveness.

3.05 STEEL REINFORCEMENT

A. General: Comply with ACI 315, "Details and Detailing of Concrete Reinforcement" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.06 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with early entry dry-cut power saws within 2 hours of finishing operations. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 92 00 “Joint Sealants,” are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery or at the Site unless prior approval has been provided by the Engineer and only as allowed by ACI 301 and the approved mix design.

1. If high-range water-reducing admixtures are allowed, do not add water to concrete after adding admixtures to the mix.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete Work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 F and not more than 80 F at point of placement.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.08 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

1. Apply to concrete surfaces not exposed to view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

C. Rubbed Finish: Apply the following to smooth-formed finished concrete:

1. Smooth-Rubbed Finish: Not later than 1 day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part Portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part Portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.09 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:

a. 1/8 inch.

E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after Work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on the Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.11 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./ft^2/hr. before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:

   a. Water.

   b. Continuous water-fog spray.

   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12-inch, and sealed by waterproof tape or adhesive. Cure for not less than 7 days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.

2. Do not apply to concrete that is less than 7 days old.

3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least 6 months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least two inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2-inch in any dimension in solid concrete but not less than 1-inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency approved by TMD to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite Samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite Sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite Sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C143; one test at point of placement for each composite Sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231, pressure method, for normal-weight concrete; ASTM C173, volumetric method, for structural lightweight concrete; one test for each composite Sample, but not less than one test for each day's pour of each concrete mix.
5. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 F and below and when 80 F and above, and one test for each composite Sample.
6. Compression Test Specimens: ASTM C31; cast and laboratory cure one set of four 6-by-12-inch or six 4-by-8-inch cylinder specimens for each composite Sample.
    a. Cast and field cure one set of four 6-by-12-inch or six 4-by-8-inch cylinder specimens for each composite Sample.
    b. 4-by-8-inch cylinders may be used if maximum aggregate size is less than or equal to 1 inch.
7. Compressive-Strength Tests: ASTM C39; provide one strength test at 7 days and one at 28 days.
    a. A compressive-strength test shall be the average compressive strength from two 6-by-12-inch or three 4-by-8-inch specimens obtained from same composite Sample and tested at age indicated.

C. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Engineer.

END OF SECTION

Concrete Mix Design

Project Name: _____

FNI Project Number: _____

Project Location: _____

Owner: _____

General Contractor: _____

Mix Number / Class: _____

A. Mix Design:

Cement	=	_____	lb/yd³
Fly Ash	=	_____	lb/yd³
Other Cementitious Material: _____	=	_____	lb/yd³
Fine Aggregate	=	_____	lb/yd³
Course Aggregate	=	_____	lb/yd³
Water	=	_____	lb/yd³
Water Reducing Admixture	=	_____	oz/yd³
High Range Water Reducer	=	_____	oz/yd³
Air Entraining Admixture	=	_____	oz/yd³
Other Admixture: _____	=	_____	oz/yd³
Slump	=	_____	inches
Gross Weight	=	_____	lb/yd³
Air Content	=	_____	percent
Water/Cement Ratio	=	_____	

B. Materials:

	Source	ASTM	Type	Remarks
Cement				
Fly Ash				
Other Cementitious Material: _____				
Fine Aggregate				
Coarse Aggregate				
Water				
Water Reducer				
High Range Water Reducer				
Air Entraining				
Other Admixture: _____				

C. Determination of Average Strength Required ($f_{cr'}$):

1. Test Records Available:

A. Summary of Test Records (Provide Supporting Documentation):

Test Group No.	No. of Consecutive Tests	Specified Strength (psi)	Standard Deviation (psi)
		Average Standard Deviation:	

B. Standard Deviation Modification Factor (ACI 30 1, Table 4.2.3.3.a): ___.

C. Standard Deviation Used: ___.

D. Average Compressive Strength Required: ___.

2. Test Records Not Available:

A. Average Compressive Strength Required (ACI 30 1, Table 4.2.3.3.b, if required): ___.

D. Documentation of Required Average Compressive Strength (Check One):

1. Field Strength:

A. Field Strength Test Records (ACI 30 1, Table 4.2.3.3.a): ___.

a. *Complete Attachment A.

2. Trial Mixtures:

A. Trial Mixtures (ACI 301, Table 4.2.3.3.b, if required): ___.

a. *Complete Attachment B.

I, _____ certify that the above information is correct and all gradations, cement certifications and test results are located at our place of business for review by the Engineer.

Name: _____ Date: _____

Title: _____

Company: _____

_____

_____

Attachment A

Documentation of Required Average Strength – Field Strength Records

(ACI 301, 4.2.3.4.a)

A. Summary of Test Records (Provide Supporting Documentation):

Test Record No.	No. of Tests in Record	Duration of Record (days)	Water-Cementitious Materials Ratio	Average Strength (psi)

B. Interpolation used? _____.

1. Provide an interpolation calculation or plot of strength versus proportions.

C. Submit the following data for each mix:

1. Brand, type and amount of cement.
2. Brand, type and amount of each admixture.
3. Source of each material used.
4. Amount of water.
5. Proportions of each aggregate material per cubic yard.
6. Gross weight per cubic yard.
7. Measured slump.
8. Measured air content.
9. Results of consecutive strength tests.

Attachment B

Documentation of Required Average Strength – Trial Mixtures

(ACI 301, 4.2.3.4.b)

A. Summary Of Test Record(s):

Trial Mix No.	7-Day Tests		28-Day Tests		Water-Cementitious Materials Ratio	Slump (in)	Air Content (percent)	Temperature (F)
	No. of Test Cylinders	Strength (psi)	No. of Test Cylinders	Strength (psi)				

B. Maximum water-cementitious materials ratio _____.

1. Provide an interpolation calculation or plot of strength versus water-cementitious materials ratio.

C. Submit the following data for each mix:

1. Brand, type and amount of cement.
2. Brand, type and amount of each admixture.
3. Amount of water used in trial mixes.
4. Proportions of each aggregate material per cubic yard.
5. Gross weight per cubic yard.
6. Measured slump.
7. Measured air content.
8. Compressive strength developed at 7 days and 28 days, from not less than three test cylinders cast for each 7-day and 28-day test.

END OF ATTACHMENTS

DIVISION 4
MASONRY

04 20 00 UNIT MASONRY

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

B. Related Sections:

1. Section 03 30 00 “Cast-In-Place Concrete” for installing dovetail slots for masonry anchors.
2. Section 05 50 00 “Metal Fabrications” for furnishing steel lintels and shelf angles for unit masonry.
3. Section 07 62 00 “Sheet Metal Flashing and Trim” for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
4. Section 08 90 00 “Louvers and Vents”

1.03 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.05 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Clay Masonry Unit Test: For each type of unit required, according to ASTM C67 or ASTM C140 for compressive strength.

2. Grout Test (Compressive Strength): For each mix required, according to ASTM C1019.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Samples for Verification: For each type and color of the following:

1. Exposed CMUs.

2. Facebrick.

3. Pigmented and colored-aggregate mortar. Make samples using same sand and mortar ingredients to be used on Project.

4. Weep holes and vents.

5. Accessories embedded in masonry.

1.07 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties and material test reports substantiating compliance with requirements.

b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.

c. For exposed brick, include test report for efflorescence according to ASTM C67.

d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.

3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.

4. Grout mixes. Include description of type and proportions of ingredients.

5. Reinforcing bars.

6. Reinforcing bar positioners.

7. Grout screen.

8. Joint reinforcement.

9. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients in accordance with ASTM C 270 and C 476.

1. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.

2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 F (4 C) and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

2.00 PRODUCTS

2.01 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

A. Regional Materials: CMUs shall be manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

2. Provide bullnose units for outside corners unless otherwise indicated.

C. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1). ACM Chemistries; RainBloc.

2). BASF Aktiengesellschaft; Rheopel Plus.

3). Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

D. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.

2. Density Classification: Normal weight unless otherwise indicated.

3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

4. Exposed Faces: Provide standard colors and texture for owner's selection for dumpster enclosure.

2.03 MASONRY LINTELS

A. General: Provide one of the following:

B. Masonry Lintels: Built-in-place masonry lintels made from lintel block CMUs with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured. As indicated, extend reinforcing beyond edges of opening using knock-out blocks and grout screen.

2.04 BRICK

A. Regional Materials: Brick shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: Facing brick complying with ASTM C216.

1. Products: Subject to compliance with requirements, provide one of the following:

2. Grade: SW.

3. Type: FBX.

4. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C67.

5. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
6. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 11-5/8 inches (295 mm) long.
7. Application: Use where brick is exposed unless otherwise indicated.
8. Color and Texture: As selected by Owner and Architect (Provide standard colors and texture for selection by Owner).

2.05 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Davis Colors; True Tone Mortar Colors.
   b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
   c. Solomon Colors, Inc.; SGS Mortar Colors.

D. Colored Cement Product: Packaged blend made from Portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Colored Portland Cement-Lime Mix
      1). Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
      2). Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
      3). Lafarge North America Inc.; Eaglebond Portland & Lime.
      4). Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
   b. Colored Masonry Cement
      1). Capital Materials Corporation; Flamingo Color Masonry Cement.
      2). Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
      3). Essroc, Italcementi Group; Brixment-in-Color.
      4). Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
      5). Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
      6). Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
      7). National Cement Company, Inc.; Coosa Masonry Cement.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.

3. Pigments shall not exceed 10 percent of Portland cement by weight.

E. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18 mm) sieve.

3. White-Mortar Aggregates: Natural white sand or crushed white stone.

4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C404.

G. Water: Potable.

2.06 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Hot-dip galvanized, carbon steel.

2. Exterior Walls: Stainless steel.

3. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.

4. Wire Size for Cross Rods: 0.187-inch (4.76-mm)diameter.

5. Wire Size for Veneer Ties: 0.187-inch (4.76-mm) diameter.

6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.

7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch (4.76-mm) diameter, stainless-steel continuous wire.

2.07 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M; with ASTM A153/A153M, Class B-2 coating.

2. Stainless-Steel Sheet: ASTM A666, Type 304.

3. Stainless-Steel Bars: ASTM A276 or ASTM A666, Type 304.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Provide two by three (2x3) self-adhered membrane behind all wall ties at 16” O.C.E.W.

D. Weeps to sit on flashing below and not on mortar bed.

E. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units.

2. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).

F. Wire: Fabricate from 1/4-inch (6.35-mm)] diameter hot-dip galvanized steel wire. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.187-inch (4.76-mm) diameter, hot-dip galvanized steel wire.

a. Partition Top anchors: 0.105-inch (2.66-mm) thick metal plate with 3/8-inch (9.5-mm) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

G. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

2. Contractor’s Option: Unless otherwise indicated, provide any of the following types of anchors:

3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    a. Basis of Design: Hohmann and Barnard, Inc.: HB-213.
    b. Products: Subject to compliance with requirements, provide one of the following:
        1). Dayton Superior Corporation, Dur-O-Wal Division; .
        2). Heckmann Building Products Inc.
        3). Wire-Bond; .
        4). Hohmann & Barnard, Inc..
    c. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch (4.76-mm) diameter, hot-dip galvanized steel wire.
4. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83 mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.
    a. Products: Subject to compliance with requirements, provide one of the following:
        1). Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
        2). ITW Buildex; Scots long life Teks.

2.08 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed steel bolts complying with ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with ASTM A563/A563M hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153/A153M, Class C; of dimensions indicated.

B. Post installed Anchors: Only allowed where specifically indicated.

2.09 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
    1. Stainless Steel: ASTM A240/A240M, Type 304, 0.016 inch (0.40 mm) thick.
    2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
    3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
    4. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.

5. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches (76 mm) into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
6. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
7. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
8. Metal Expansion-Joint Strips: Fabricate from copper to shapes indicated.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
   a. Basis of Design: Hohmann & Barnard, Inc.: Flex-Flash. (See Section 04 81 50)
   b. Products: Subject to compliance with requirements, provide one of the following:
      1). DuPont; Thru-Wall Flashing.
      2). Hohmann & Barnard, Inc.; Flex-Flash.
      3). Hyload, Inc.; Hyload Cloaked Flashing System.
      4). Mortar Net USA, Ltd.; Total Flash.
2. Solder and Sealants for Sheet Metal Flashings: Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
3. Solder for Copper: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from urethane or PVC.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).

C. Weep/Vent Products: Use one of the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
   a. Products: Subject to compliance with requirements, provide one of the following:

1). Advanced Building Products Inc.; Mortar Maze weep vent.

2). Blok-Lok Limited; Cell-Vent.

3). Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.

4). Heckmann Building Products Inc.; No. 85 Cell Vent.

5). Hohmann & Barnard, Inc.; Quadro-Vent.

6). Wire-Bond; Cell Vent.

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Subject to compliance with requirements, provide the following:

a. Wire-Bond; Core Lock Rebar Positioner.

E. Grout Screen: Screen designed to fit in mortar bed joints and prevent grout from falling through block core while maintaining positive bond in mortar joint. Screen constructed of non-corrosive 1/4-inch square polypropylene monofilament screening.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Wire-Bond: Grout Stop.

b. Hohmann & Barnard, Inc.: MGS – Mortar/Grout Screen.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. Manufacturer to confirm compatibility of masonry cleaner and water repellant sealer.

1. Basis of Design: ProSoCo, Inc., Sure Klean 600.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Diedrich Technologies, Inc.

b. EaCo Chem, Inc.

c. ProSoCo, Inc.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Use Portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S or Type N.
4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
5. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Mix and provide standard colors for Owner's selection.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix and provide standard colors for Owner's selection.

F. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C143/C143M.

G. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

2. Verify that foundations are within tolerances specified.

3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

G. Provide informal water test on cavity after approximately 4 courses of masonry have been laid above flashing where masonry locations occur.

H. Provide weather proof barrier on the face of the interior substrate masonry.

I. Through-wall membrane should extend up 12" above finish floor and behind sheathing at the base of the wall and go into the sheathing.

J. The through-wall flashing above the head of lintels should be terminated with termination bar with mastic.

3.03 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross-section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).

2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).

3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.

2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.

6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.

7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).

2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).

3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).

4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next. No walking joints will be permitted.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond or bond pattern indicated on Drawings; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs except at CMU provide 8 inches.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches (100 mm) except at CMU provide 8 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. At intersection of reinforced masonry walls, corners and tees, at least 50 percent of the masonry units at the interface shall interlock.

E. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

F. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

G. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

I. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

J. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.

3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 46 “Fire Resistive Joint Systems”.

3.05 MORTAR BEDDING AND JOINTING

A. Lay hollow brick as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.

2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.

3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.

4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Lay structural-clay tile as follows:

1. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.

2. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch (6- to 10-mm) thick joints.

3. Where epoxy-mortar pointed joints are indicated, rake out setting mortar to a uniform depth of 1/4 inch (6 mm) and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch (19 mm) or more in width.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.06 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. (0.25 sq. m) of wall area spaced not to exceed 16 inches (406 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.

a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.

b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

D. Parge cavity face of backup wythe in a single coat approximately 3/8 inch (10 mm) thick. Trowel face of parge coat smooth.

E. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.07 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.08 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1/2 inch (13 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.

2. Anchor masonry with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.09 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.

2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.

3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Space anchors as indicated, but not more than 18 inches (458 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than one anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.
5. Provide2”x3” membrane behind anchors to seal any holes.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 07 92 00 “Joint Sealants.”

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 “Joint Sealants,” but not less than 3/8 inch (10 mm).

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At multi-wythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and through inner wythe to within 1/2 inch (13 mm) of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (50 mm) on interior face.

3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).

4. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.

5. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 “Joint Sealants” for application indicated.

6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.

7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.

2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in “Miscellaneous Masonry Accessories” Article.

E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.13 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

1. Install reinforcing bar positioners and reinforcing as the wall advances upward. Specified laps and position in the wall shall verified and secured prior to advancing the wall upward.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect’s approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

04 90 10 CLAY MASONRY RESTORATION AND CLEANING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes restoration and cleaning of **brick** as follows:

1. Repairing clay masonry, including replacing damaged units.
2. Cleaning exposed clay masonry surfaces.

B. Related Sections include the following:

1. Division 7 Section "Water Repellents" for water repellents applied to clay masonry.

1.03 DEFINITIONS

A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

B. Medium-Pressure Spray: 400 to 800 psi (2750 to 5500 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

C. High-Pressure Spray: 800 to 1200 psi (5500 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.

B. Cleaning Program: Describe cleaning process in detail, including materials, methods, and equipment to be used and protection of surrounding materials on building and Project site, and control of runoff during operations.

1. If materials and methods other than those indicated are proposed for cleaning work, provide a written description, including evidence of successful use on comparable projects, and a testing program to demonstrate their effectiveness for this Project.

1.05 QUALITY ASSURANCE

A. Restoration Specialist Qualifications: Engage an experienced masonry cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.

B. Chemical Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.

C. Source Limitations: Obtain each type of material for masonry restoration (face brick, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.

D. Mockups: Prepare mockups of restoration and cleaning as follows to demonstrate aesthetic effects and qualities of materials and execution. Prepare mockups on existing walls under same weather conditions to be expected during remainder of the Work.

1. Clean an area approximately 25 sq. ft. (2.3 sq. m) in area for each type of clay masonry and surface condition.

a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions unless cleaners and methods are known to have deleterious effect.

b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons.

B. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

C. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.07 PROJECT CONDITIONS

A. Repoint mortar joints and repair masonry only when air temperature is between and 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least 7 days after completion of work.

B. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing:

1. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F (4 and 49 deg C).

2. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 7 days after repair and pointing.

C. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above.

D. Patch masonry only when air and surface temperatures are between and 55 and 100 deg F (13 and 38 deg C) and are predicted to remain above 55 deg F (13 deg C) for at least 7 days after completion of work. On days when air temperature is predicted to go above 90 deg F (32 deg C), schedule patching work to coincide with time that surface being patched will be in shade or during cooler morning hours.

E. Clean masonry surfaces only when air temperature is 40 deg F (4 deg C) and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.08 SEQUENCING AND SCHEDULING

A. Order replacement materials at earliest possible date, to avoid delaying completion of the Work.

B. Order sand for repointing mortar immediately after approval of mockups. Take delivery of and store at Project site a sufficient quantity of sand to complete Project.

C. Perform masonry restoration work in the following sequence:

1. Remove plant growth.
2. Repair existing masonry, including replacing existing masonry with new masonry materials.
3. Rake out joints that are to be repointed.
4. Point mortar joints.
5. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
6. Remove paint.
7. Clean masonry surfaces.
8. Rake out joints that are to be repointed.
9. Point mortar joints.

D. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units to comply with Part 3 "Masonry Unit Patching" Article. Patch holes in mortar joints to comply with Part 3 "Repointing Masonry" Article.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.

3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 MASONRY MATERIALS

A. Face Brick and Accessories: Provide face brick and accessories, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work.
   1. Provide units with colors, surface texture, size, and shape to match existing brickwork and with physical properties not less than those determined from preconstruction testing of selected existing units.
      a. For existing brickwork that exhibits a range of colors, provide brick that matches that range rather than brick that matches an individual color within that range.
   2. Provide units with colors, surface texture, and physical properties to match Architect's sample. Match existing units in size and shape.
      a. For sample that exhibits a range of colors, provide brick that matches that range rather than brick that matches an individual color within that range.

B. Building Brick: Provide building brick complying with ASTM C 62, of same vertical dimension as face brick, for masonry work concealed from view.
   1. Grade SW where in contact with earth.
   2. Grade SW, MW, or NW for concealed backup.

2.03 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II.
   1. Provide white cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Quicklime: ASTM C 5, pulverized lime.

D. Factory-Prepared Lime Putty: Screened, fully-slaked lime putty, prepared from pulverized lime complying with ASTM C 5.

E. Mortar Sand: ASTM C 144, unless otherwise indicated.
   1. Color: Provide natural sand; of color necessary to produce required mortar color.
   2. For pointing mortar, provide sand with rounded edges.
   3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands, if necessary, to achieve suitable match.

F. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

G. Water: Potable.

2.04 CLEANING MATERIALS

A. Water for Cleaning: Potable.

B. Hot Water: Heat water to a temperature of 140 to 160 deg F (60 to 71 deg C).

C. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.

D. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate (TSPP), 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.

E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents and chelating agents and is specifically formulated for cleaning masonry surfaces.

1. Products:

a. Price Research, Ltd.; Price Marble Cleaner-Gel.

b. ProSoCo; Sure Klean 942 Masonry Cleaner.

F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.

1. Products:

a. Dominion Restoration, Inc.; Bio-Cleanse.

b. Dumond Chemicals, Inc.; Safe n' Easy Architectural Cleaner/Restorer.

c. Price Research, Ltd.; Price Non-Acid Masonry Cleaner.

d. ProSoCo; Enviro Klean Restoration Cleaner.

G. Mild Acidic Cleaner: Manufacturer's standard mildly acidic cleaner containing no hydrochloric, hydrofluoric, or sulfuric acid; or chlorine bleaches.

1. Products:

a. Diedrich Technologies Inc.; Envirorestore 100.

b. Dominion Restoration, Inc.; DR-60 Stone and Masonry Cleaner.

c. Dumond Chemicals, Inc.; Safe n' Easy Heavy Duty Restoration Cleaner.

d. ProSoCo; Sure Klean Light-Duty Restoration Cleaner.

H. Two-Part Chemical Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.

1. Products:

a. ProSoCo; Sure Klean 766 Limestone & Masonry Prewash and Afterwash.

2.05 MISCELLANEOUS MATERIALS

A. Masonry Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry, is vapor- and water permeable, exhibits low shrinkage, and develops high bond strength to all types of masonry.

1. Formulate patching compound used for patching brick in colors and textures to match brick being patched. Provide number of colors needed to enable matching each brick.
2. Formulate patching compound used for patching unglazed terra cotta in colors and textures to match terra cotta being patched.
3. Products:
    a. Cathedral Stone Products, Inc.; Jahn Restoration Mortar.
    b. Edison Coatings, Inc.; Custom System 45.

B. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.

1. Products:
    a. American Building Restoration Products, Inc.; LM 130 Acid Shield.
    b. Diedrich Technologies Inc.; Diedrich Acid Guard.
    c. Price Research, Ltd.; Price Mask.
    d. ProSoCo; Sure Klean Strippable Masking.

C. Masonry Repair Anchors, Expansion Type: Mechanical fasteners designed for masonry veneer stabilization consisting of 1/4-inch- (6-mm-) diameter, Type 304 stainless-steel rod with brass expanding shells at each end and water-shedding washer in the middle. Expanding shells shall be designed to provide positive mechanical anchorage to veneer on one end and backup masonry on the other.

1. Products:
    a. Dur-O-Wal, a Dayton Superior Company; Mechanical Repair Anchors.
    b. Hohmann & Barnard, Inc.; #521RA Repair/Restoration Anchor.

2.06 MORTAR MIXES

A. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and manufacturer's written instructions.

B. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

C. Colored Mortar: Produce mortar of color required by using selected ingredients. Do not alter specified proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.

D. Do not use admixtures of any kind in mortar, unless otherwise indicated.

E. Mortar Proportions: Mix mortar materials in the following proportions:

1. Pointing Mortar for Brick: 1 part portland cement, 2 parts lime, and 6 parts sand.

a. Add mortar pigments to produce mortar colors required.

2. Rebuilding (Setting) Mortar: Same as pointing mortar.

3. Rebuilding (Setting) Mortar: Comply with ASTM C 270, Proportion Specification, Type N, unless otherwise indicated; with cementitious material content limited to portland cement and lime.

2.07 CHEMICAL CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical cleaner manufacturer.

B. Acidic Cleaner Solution for Brick: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical cleaner manufacturer.

3.00 EXECUTION

3.01 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.

1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.

B. Comply with chemical cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
2. Keep wall wet below area being cleaned to prevent streaking from runoff.
3. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

C. Prevent mortar from staining face of surrounding masonry and other surfaces.
1. Cover sills, ledges, and projections to protect from mortar droppings.
2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
3. Immediately remove mortar in contact with exposed masonry and other surfaces.
4. Clean mortar splatters from scaffolding at end of each day.

D. Remove downspouts adjacent to masonry and store during masonry restoration and cleaning. Reinstall when masonry restoration and cleaning is complete.
1. Provide temporary rain drainage during work as indicated to direct water away from building.

3.02 BRICK REMOVAL AND REPLACEMENT

A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
1. When removing single bricks, remove material from center of brick and work toward outside edges.

B. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

C. Notify Owner of unforeseen detrimental conditions including voids, cracks, bulges, and loose masonry units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

D. Remove in an undamaged condition as many whole bricks as possible.
1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
2. Store brick for reuse, as indicated.

3. Deliver cleaned brick not required for reuse to Owner, unless otherwise directed.

E. Clean bricks surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.

F. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.

G. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. (30 g/194 sq. cm per min.). Use wetting methods that ensure that units are nearly saturated but surface is dry when laid. Maintain joint width for replacement units to match existing joints.

1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.

2. Rake out mortar used for laying brick before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.

3.03 MASONRY UNIT PATCHING

A. Patch the following masonry units:

1. Units indicated to be patched.

2. Units with holes.

3. Units with chipped edges or corners.

4. Units with small areas of deep deterioration.

B. Remove and replace existing patches, unless otherwise indicated or approved by Architect.

C. Patching Bricks:

1. Remove loose material from brick surface. Remove additional material so patch will not have feathered edges and will be at least 1/4 inch (6 mm) thick, but not less than recommended by patching compound manufacturer.

2. Mask or remove surrounding mortar joints if patch will extend to edge of brick.

3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.

4. Rinse surface to be patched and leave damp, but without standing water.

5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.

6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.

7. Trowel, scrape, or carve surface of patch to match texture and surface plane of surrounding brick. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.
8. Keep each layer damp for 72 hours or until patching compound has set.

3.04 CLEANING MASONRY, GENERAL

A. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other.

B. Use only those cleaning methods indicated for each masonry material and location.

1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
    a. Equip units with pressure gages.
3. For chemical cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
4. For water spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
5. For high-pressure water spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
6. For heated water spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
7. For steam application, use steam generator capable of delivering live steam at nozzle.

C. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.

D. Removing Plant Growth: Completely remove plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.

E. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.

1. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.
2. Remove paint and calking with alkaline paint remover.
    a. Comply with requirements for paint removal.
    b. Repeat application up to two times if needed.

3. Remove asphalt and tar with solvent-type paint remover.
    a. Apply only to asphalt and tar by brush without prewetting.
    b. Allow paint remover to remain on surface for 10 to 30 minutes.
    c. Rinse off with cold water using low-pressure spray.
    d. Repeat application if needed.

F. Water Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

G. Chemical Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical cleaner manufacturer's written instructions; use brush or spray application methods, at Contractor's option. Do not spray apply at pressures exceeding 50 psi (345 kPa). Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.

H. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
    1. Apply neutralizing agent and repeat rinse, if necessary, to produce tested pH of between 6.7 and 7.5.

I. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.05 CLEANING BRICKWORK

A. Cold-Water Wash: Use cold water applied by high-pressure spray.

B. Cold Water Soak:
    1. Apply cold water by intermittent soaking.
    2. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
    3. Apply water in cycles with at least 30 minutes between cycles.
    4. Continue water application until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
    5. Remove soil and softened surface encrustation from masonry with cold water applied by low-pressure spray.

C. Steam Cleaning: Apply steam at pressures not exceeding 80 psi (550 kPa).

D. Nonacidic Liquid Chemical Cleaning:
    1. Wet masonry with cold water applied by low-pressure spray.
    2. Apply cleaner to masonry by brush[or low-pressure spray. Let cleaner remain on surface for period indicated below:

E. As recommended by chemical cleaner manufacturer.

F. As established by mockup.

G. Two to three minutes.

1. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.

2. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

3.06 REPOINTING MASONRY

A. Rake out and repoint mortar joints to the following extent:

1. All joints in areas indicated.

2. Joints where mortar is missing or where they contain holes.

3. Cracked joints where cracks can be penetrated at least 1/4 inch (6 mm) by a knife blade 0.027 inch (0.7 mm) thick.

4. Cracked joints where cracks are 1/8 inch (3 mm) or more in width and of any depth.

5. Joints where they sound hollow when tapped by metal object.

6. Joints where they are worn back 1/4 inch (6 mm) or more from surface.

7. Joints where they are deteriorated to point that mortar can be easily removed by hand.

8. Joints, other than those indicated as sealant-filled joints, where they have been filled with substances other than mortar.

B. Do not rake out and repoint joints where not required.

C. Rake out joints as follows:

1. Remove mortar from joints to depth of joint width plus 1/8 inch (3 mm), but not less than 1/2 inch (13 mm) or not less than that required to expose sound, unweathered mortar.

2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.

3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as indicated on the Drawings and/or indicated by Owner.

a. Cut out mortar by hand with chisel and mallet. Do not use power-operated grinders without Owner's written approval based on submission by Contractor of a satisfactory quality-control program and demonstrated ability of operators to use tools without damaging masonry. Quality-control program shall include provisions for supervising performance and preventing damage due to worker fatigue.

b. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and mallet. Strictly adhere to written quality-control program. Quality-control program shall include provisions for demonstrating ability of operators to use tools without damaging masonry, supervising performance, and preventing damage due to worker fatigue.

D. Notify Owner of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Point joints as follows:

1. Rinse masonry-joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen masonry-joint surfaces before pointing.

2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch (9 mm) until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch (9 mm). Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing bricks have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar over edges onto exposed masonry surfaces or to featheredge mortar.

4. When mortar is thumbprint hard, tool joints to match original appearance of joints. Remove excess mortar from edge of joint by brushing.

F. Cure mortar by maintaining in thoroughly damp condition for at least 72 hours including weekends and holidays.

1. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.

2. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.

G. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.07 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.

1. Do not use metal scrapers or brushes.

2. Do not use acidic or alkaline cleaners.

B. Wash adjacent woodwork and other nonmasonry surfaces. Use detergent and soft brushes or cloths.

C. Sweep and rake adjacent pavement and grounds to remove masonry debris. Where necessary, pressure wash surfaces to remove mortar, dust, dirt, and stains.

END OF SECTION

DIVISION 5
METALS

05 12 00 STRUCTURAL STEEL FRAMING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Structural steel.

1.03 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

4. Indicate size and location of all lifting, filling, vent and drain holes required for galvanizing. Lifting, filling, vent and drain holes shall be coordinated with the galvanizer.

5. Galvanized items which will receive paint must be designated as such.

C. Welding Certificates:

1. Provide the following welding certificates:

a. Weld Procedure Specifications (WPSs) for all welds indicated in the Contract Documents.

1). If a WPS is not prequalified in accordance with AWS D1.1, then submit a performance qualification record (PQR) for each WPS that is not prequalified.

b. Personnel qualifications for each person performing welding on the Site.

D. Qualification Data: For installer and fabricator.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.

2. Bolts, nuts, and washers including mechanical properties and chemical analysis.

3. Shop primers.

F. Source Quality-Control Test Reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer with a record of successfully performed projects of comparable size and complexity during the previous 5 years.

B. Fabricator Qualifications: A qualified fabricator with a record of successfully performed projects of comparable size and complexity during the previous 5 years.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings," ANSI/AISC 360-05.

2. RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.07 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

2.00 PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

A. As indicated on the Drawings.

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.

1. Material:

a. ASTM A325, unless noted otherwise.

b. ASTM A490, in locations shown or allowed on the Drawings. Do not use ASTM A490 in galvanized or zinc coated applications.

2. Finish:

a. Unless noted otherwise: Plain.

2.03 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.04 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and ANSI/AISC 360

1. Camber structural-steel members where indicated.

2. Identify high-strength structural steel according to ASTM A6/ A 6M and maintain markings until structural steel has been erected.

3. Mark and match-mark materials for field assembly.

4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations, if required.

B. Drawings indicate the design, sections and weights of members. Substitutions shall not be permitted except upon written permission from the Engineer.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill or punch bolt holes perpendicular to metal surfaces.

1. Unless noted otherwise, all holes are AISC standard.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."

1. Slip critical faying surfaces shall be treated according to the RCSC Specification.

2. Slip critical faying surfaces for galvanized members shall be galvanized and roughened with hand wire brush according to the RCSC Specification for a Class C surface.

2.05 SHOP CONNECTIONS

A. Shop connections shall be composed of bolted or welded connections. Combinations of bolted and welded connections on a common shearing face are not allowed.

B. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened bearing type with threads included in the shear plane, unless noted otherwise.

C. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.06 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces to be field welded.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.07 SOURCE QUALITY CONTROL

A. Contractor will engage an independent testing and inspecting agency approved by TMD to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Welded Connections:

1. Full penetration welds and other welds as specified: In addition to 100 percent visual inspection, 10 percent of connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E165.

b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

c. Ultrasonic Inspection: ASTM E164.

d. Radiographic Inspection: ASTM E94.

3.00 EXECUTION

3.01 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Dimensions scaled from the Drawings shall not be used for fabrication, and the Contractor shall determine actual dimensions of the structure.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.03 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and ”Specification for Structural Steel Buildings,” ANSI/AISC 360.

B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

C. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

D. Splice members only where indicated.

E. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, unless noted otherwise.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings," ANSI/AISC 360-05, for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Unless indicated otherwise, beam flanges employing full penetration welds shall have 1-1/4-by-3/16-inch backup plate. Back gouge root pass and weld flush on backside where full penetration is specified.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency approved by TMD to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

C. Welded Connections: Field welds will be 100 percent visually inspected according to AWS D1.1.

1. Full penetration welds and other welds as specified: In addition to 100 percent visual inspection, 10 percent of connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E165.

b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

c. Ultrasonic Inspection: ASTM E164.

d. Radiographic Inspection: ASTM E94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

1. Corrective measures shall be taken when welding is unsatisfactory or indicates inferior workmanship. Chip and grind if the removal of part of the weld or a portion of the base metal is required. Where deposition of additional weld material is necessary, the sides of the area to be welded shall have no less than one to one (1:1) slope to allow room for depositing new material. Correct defective or unsound welds by the removal and replacement of the entire weld using the following procedures:

a. Excessive Convexity: Reduce to size by removal of excess weld metal by grinding.

b. Shrinkage Cracks, Cracks in Base Metal, Craters and Excessive Porosity: Remove defective portions of base and weld material down to sound metal, and deposit additional sound material.

c. Undercutting, Undersize, and Excessive Concavity: Clean and deposit additional weld metal.

d. Overlapping and Incomplete Fusion: Remove and replace the defective portion of the weld.

e. Slag Inclusion: Remove those parts of the welds containing slag. Fill with sound weld metal.

f. Removal of Adjacent Base Metal during Welding: Clean and form full size by depositing weld material.

2. Remove cracked welds throughout their length.

3. Where work performed subsequently to the making of the deficient weld has rendered the weld inaccessible, or has caused new conditions which make connection of the deficiency dangerous or ineffectual, restore the original conditions by removing welds or members, or both before making the necessary corrections. Another option is to compensate for the deficiency with additional work according to the revised design, approved by the Engineer.

4. Cut apart and reweld improperly fitted and misaligned parts.

5. Straighten members distorted by heat of welding using mechanical means or by carefully supervised application of a limited amount of localized heat. Heated areas shall not exceed 1200 degrees Fahrenheit as measured by Tempilsticks. Parts to be heated for straightening shall be free from external stress forces, except when mechanical means are used in conjunction with heat application.

6. If faulty welding or its removal for rewelding damages the base metal so that, in the Engineer's judgment, it is not in accordance with the intent of the Contract Documents, remove and replace the damaged material and compensate for the deficiency in a manner acceptable to the Engineer.

7. Maximum space between pieces or members for fillet welds shall be 1/16 inch. Only effective portion shall be considered in measuring fillet welds.

END OF SECTION

05 50 00 METAL FABRICATIONS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Miscellaneous steel trim including steel edgings.
4. Metal bollards.
5. Loose bearing and leveling plates for applications where they are not specified in other Sections.
6. Stair Nosings.

B. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:

1. Section 03 30 00 “Cast-In-Place Concrete” for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04 20 00 “Unit Masonry” for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 10 22 13 “Wire Mesh Partitions.”

1.03 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 F, ambient; 180 F, material surfaces.

1.04 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, “Structural Welding Code - Steel.”
2. AWS D1.2, “Structural Welding Code - Aluminum.”
3. AWS D1.6, “Structural Welding Code - Stainless Steel.”

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.08 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers’ written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

2.00 PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.02 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A36.

B. Stainless-Steel Sheet, Strip, and Plate: ASTM A240 or ASTM A666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A276, Type 304.

D. Steel Tubing: ASTM A500, cold-formed steel tubing.

E. Steel Pipe: ASTM A53, standard weight (Schedule 40) unless otherwise indicated.

2.03 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

2.04 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
3. Provide stainless-steel fasteners for fastening nickel silver.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanized or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A489.

F. Machine Screws: ASME B18.6.3.

G. Lag Screws: ASME B18.2.1.

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1.

J. Lock Washers: Helical, spring type, ASME B18.21.1.

K. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

L. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

M. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.06 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.07 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.

2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.08 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim as noted.

D. Prime miscellaneous steel trim with zinc-rich primer.

2.09 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

B. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4 inch steel machine bolt.

C. Galvanize bollards.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates as noted.

C. Prime plates with zinc-rich primer.

2.11 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than eight inches unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

3. Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.15 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.16 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

3.00 EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.03 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes three inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes three inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

C. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner will furnish padlocks.

D. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

E. Provide heavy duty reflective tape applied to the bollards.

3.04 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

DIVISION 6
WOOD, PLASTIC & COMPOSITES

06 10 00 ROUGH CARPENTRY

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
    a. Rooftop equipment bases and support curbs.
    b. Wood blocking (all wood blocking to be fire-retardant treated), cants, and nailers.
    c. Wood furring and grounds.
    d. Wood sleepers.
    e. Utility shelving.
    f. Plywood backing panels.

B. Related Requirements:

a. Section 06 16 00 “Sheathing.”

1.03 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers’ Association.
    a. NLGA: National Lumber Grades Authority.
    b. RIS: Redwood Inspection Service.
    c. SPIB: The Southern Pine Inspection Bureau.
    d. WCLIB: West Coast Lumber Inspection Bureau.
    e. WWPA: Western Wood Products Association.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
    a. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
    b. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
    c. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
    d. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Shop Drawings:
    1. Include plans, elevations, sections, and details of wood framing including connections. Provide drawings signed and sealed by the qualified professional engineer responsible for their preparation.

C. LEED Submittals:
    1. Certificates for Credit MR 7: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
        a. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
        b. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that product contains no urea formaldehyde.

D. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.05 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:
    1. Wood-preservative-treated wood.
        a. Fire-retardant-treated wood.
        b. Engineered wood products.
        c. Power-driven fasteners.

d. Powder-actuated fasteners.

e. Expansion anchors.

f. Metal framing anchors.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

2.00 PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship**."**

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

a. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

b. Provide dressed lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal (38-mm actual) thickness or less unless otherwise indicated.

D. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

a. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

a. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

c. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.

d. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.

a. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.

b. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

c. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:

1. Framing for raised platforms.

a. Concealed blocking.

b. Framing for non-load-bearing partitions.

c. Framing for non-load-bearing exterior walls.

d. Roof construction.

e. Plywood backing panels.

2.04 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.

1. Application: All interior partitions.

2. Species:

a. Hem-fir (north); NLGA.

b. Mixed southern pine; SPIB.

c. Spruce-pine-fir; NLGA.

d. Hem-fir; WCLIB, or WWPA.

e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

f. Northern species; NLGA.

g. Eastern softwoods; NeLMA.

h. Western woods; WCLIB or WWPA.

B. Load Bearing Partitions: Construction or No. 2

1. Application: Exterior walls and interior load bearing partitions.

a. Hem fir (north); NLGA.

b. Southern pine; SPIB.

c. Douglas fir larch; WCLIB or WWPA.

d. Mixed southern pine; SPIB.

e. Spruce pine fir; NLGA.

f. Douglas fir south; WWPA.

C. Load Bearing Partitions: 2400f-2.0E.

1. Application: Exterior walls and interior load bearing partitions.

D. Ceiling Joists: Construction or No. 2.

1. Species:

a. Hem fir (north); NLGA.

b. Southern pine; SPIB.

c. Douglas fir larch; WCLIB or WWPA.

d. Douglas fir larch (north); NLGA.

e. Mixed southern pine; SPIB.

f. Spruce pine fir; NLGA.

E. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Application: Exposed interior framing.

a. Species and Grade: As indicated above for load-bearing construction of same type.

b. Species and Grade: Hem-fir (north); No. 1 grade; NLGA.

c. Species and Grade: Southern pine; No. 1 grade; SPIB.

d. Species and Grade: Douglas fir-larch; No. 1 grade; WCLIB or WWPA.

e. Species and Grade: Mixed southern pine; No. 1 grade; SPIB.

f. Species and Grade: Spruce-pine-fir; No. 1 grade; NLGA.

g. Species and Grade: Douglas fir-south; No. 1 grade; WWPA.

2.05 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

a. Nailers.

b. Rooftop equipment bases and support curbs.

c. Cants.

d. Furring.

e. Grounds.

f. Utility shelving.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and the following species:

1. Hem-fir (north); NLGA.

a. Mixed southern pine; SPIB.

b. Spruce-pine-fir; NLGA.

c. Hem-fir; WCLIB or WWPA.

d. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

e. Western woods; WCLIB or WWPA.

f. Northern species; NLGA.

g. Eastern softwoods; NeLMA.

C. For utility shelving, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.

a. Mixed southern pine; No. 1 grade; SPIB.

b. Hem-fir or hem-fir (north); Select Merchantable or No. 1 Common grade; NLGA, WCLIB, or WWPA.

D. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.

a. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.

b. Spruce-pine-fir (south) or spruce-pine-fir; [Construction or No. 2 Common], [Standard or No. 3] Common grade; NeLMA, NLGA, WCLIB, or WWPA.

E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.06 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.07 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

F. Bolts: Steel bolts complying with ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with ASTM A563 (ASTM A563M) hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

a. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or A4).

2.08 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cleveland Steel Specialty Co.

a. KC Metals Products, Inc.

b. Phoenix Metal Products, Inc.

c. Simpson Strong-Tie Co., Inc.

d. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for wood-preservative-treated lumber and where indicated.

E. Stainless-Steel Sheet: ASTM A666, Type 304.

1. Use for exterior locations and where indicated.

F. I-Joist Hangers: U shaped joist hangers with 2-inch long seat and 1-1/4-inch wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.

1. Thickness: 0.062-inch.

G. Bridging: Rigid, V-section, nailless type, 0.050-inch thick, length to suit joist size and spacing.

H. Post Bases: Adjustable socket type for bolting in place with standoff plate to raise post 1-inch above base and with 2-inch minimum side cover, socket 0.062-inch thick, and standoff and adjustment plates 0.108-inch thick.

I. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: 3/4-inch or 1-1/4-inches.

a. Thickness: 0.062-inch.

b. Length: As indicated.

J. Rafter Tie Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050-inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.

K. Wall Bracing: T shaped bracing made for letting into studs in saw kerf, 1-1/8-inches wide by 9/16-inch deep by 0.034-inch thick with hemmed edges.

L. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 0.040-inch thick with hemmed edges.

2.09 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

a. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

3.00 EXECUTION

3.01 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

E. Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.

F. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

H. Do not splice structural members between supports unless otherwise indicated.

I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

a. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.

b. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.

c. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

K. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

L. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.

a. Use copper naphthenate for items not continuously protected from liquid water.

M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

a. Table 2304.9.1, “Fastening Schedule,” in ICC’s International Building Code.

N. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

O. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

2. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.02 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.03 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal (19-by-38-mm actual) size furring vertically at 16 inches (406 mm) o.c.

3.04 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plates and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load bearing partitions [and for load bearing partitions where framing members bearing on partition are located directly over studs]. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2 by 6-inch nominal size wood studs spaced 16-inches o.c. unless otherwise indicated.

a. For interior partitions and walls, provide 2 by 4-inch nominal size wood studs spaced 16 inches o.c. unless otherwise indicated.

b. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs [, except that two studs may be used for interior non-load bearing partitions].

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load bearing partitions, provide double jamb studs and headers not less than 4-inch nominal depth for openings 48-inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.

a. For load bearing walls, provide double jamb studs for openings 60 inches and less in width, and triple jamb studs for wider openings. Provide headers of depth indicated or, if not indicated, according to Table R502.5(1) of Table R502.5(2), as applicable, in ICC's International Residential Code for One and Two Family Dwellings.

D. Provide diagonal bracing in exterior walls, at both walls of each external corner. Use 1 by 4-inch nominal size boards, let in flush with faces of studs.

3.05 CEILING JOIST AND RAFTER FRAMING INSTALLATION

A. Ceiling Joists: Install ceiling joists with crown edge. Face nail to ends of parallel rafters.

B. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.

a. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.

C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.06 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

06 40 23 INTERIOR ARCHITECTURAL WOODWORK

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Plastic-laminate cabinets.
2. Closet and utility shelving.

B. Related Sections include the following:

1. Section 06 10 00 “Rough Carpentry” for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
2. Section 12 36 61 “Simulated Stone Countertops”

1.03 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.04 ACTION SUBMITTALS

A. Product Data: For wood paneling system high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material cabinet hardware and accessories handrail brackets and finishing materials and processes.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Certificates for Credit MR 7: Chain-of-custody certificates indicating that interior architectural woodwork complies with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
3. Product Data for Credit IEQ 4.1: For installation adhesives, documentation including printed statement of VOC content.
4. Product Data for Credit IEQ 4.4: For composite wood products and adhesives, documentation indicating that product contains no urea formaldehyde.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for plumbing fixtures faucets and other items installed in architectural woodwork.
3. Apply WI-certified compliance label to first page of Shop Drawings.

D. Samples for Initial Selection:

1. Plastic laminates.

E. Samples for Verification:

1. Lumber and panel products with shop-applied opaque finish, 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (200 by 250 mm) for panels, for each finish system and color, with 1/2 of exposed surface finished.
2. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish with one sample applied to core material and specified edge material applied to one edge.
3. Corner pieces as follows:
    a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
    b. Miter joints for standing trim.
4. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For each type of product, signed by product manufacturer.

C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products and Certified participant in AWI's Quality Certification Program.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in “Project Conditions” Article.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 F (16 and 32 C) and relative humidity between 17 and 50 percent during the remainder of the construction period.

C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.09 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

2.00 PRODUCTS

2.01 WOODWORK FABRICATORS

A. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by an AWI fabricator.

2.02 MATERIALS

A. General: Provide materials that comply with requirements of AWI’s quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Certified Wood: Interior architectural woodwork shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, “FSC Principles and Criteria for Forest Stewardship.”

C. Wood Products: Comply with the following:

1. Moisture Resistant Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde and FSC certified.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:

a. Arborite; Division of ITW Canada, Inc.

b. Formica Corporation.

c. Nevamar Company, LLC; Decorative Products Div.

d. Wilsonart International; Div. of Premark International, Inc.

2.03 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section “Door Hardware.”

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135degrees of opening.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, solid metal 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

E. Catches: Magnetic catches, BHMA A156.9, B03141.

F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

G. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.

2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.

3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.

4. Keyboard Slides: Grade 1HD-100; for computer keyboard shelves.

5. Trash Bin Slides: Grade 1HD-200; for trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.04 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content. Adhesives, General: Adhesives shall not contain urea formaldehyde.

B. VOC Limits for Installation Adhesives: Installation adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.

2. Multipurpose Construction Adhesives: 70 g/L.

3. Contact Adhesive: 250 g/L.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

2.05 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).

2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

D. Complete fabrication, including assembly**,** finishing**,** and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.06 PLASTIC-LAMINATE CABINETS

A. Grade: Premium.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.

2. Post formed Surfaces: Grade HGP.

3. Vertical Surfaces: Grade HGS.

4. Edges: Grade HGS.

D. Materials for Semi-exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS..

a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch (0.460-mm) minimum thickness, matching laminate in color, pattern, and finish.

b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

2. Drawer Sides and Backs: Solid-hardwood lumber.

3. Drawer Bottoms: Hardwood plywood.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by laminate manufacturer’s designations.

G. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.07 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

2.08 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches (2400 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.

2. Install wall railings on indicated metal brackets securely fastened to wall framing.

3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.

2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.

3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.

4. Calk space between backsplash and wall with sealant specified in Section 07 92 00 "Joint Sealants."

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

J. Refer to Division 09 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

2.09 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

DIVISION 7
THERMAL AND MOISTURE PROTECTION

07 01 50 REPAIR OF ROOFING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cutting, patching for installation of mechanical and electrical equipment.

1.03 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, and details.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Include certificate that Installer is approved by warrantor of existing roofing system.

2. Include certificate that Installer is licensed to perform asbestos abatement.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Contractor shall contract with the Warrantee holder of the existing roof to coordinate the cutting of penetrations and the repair of roof to maintain the Warrantee. The contractor shall be responsible for paying for roof work required.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Reroofing Conference: Conduct conference at Project Site.

1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing system manufacturer's representative; roofing Installer, including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing, including installers of roof deck, roof accessories, and roof-mounted equipment.

2. Coordinate work activities daily with Owner so Owner can place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.

3. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.

1.07 WARRANTY

A. Existing Warranties: Install new roof curbs, flashings, pipe and equipment supports and other roof accessories, cut, remove, replace, patch and repair materials and surfaces so as not to void the existing roof system warranties. Ensure that the existing roof system warranties are maintained without any exceptions or exclusions. The existing roof is under warranty until 2041.

1. The roofing manufacturer /warrantor is:

The Garland Company, Inc.
3800 East 91st Street
Cleveland, OH 44105
(800) 321-9336

B. Any penetrations due to installation of new equipment or patching of roof due to moving or the demolition of existing equipment are to be reviewed and approved by existing roofing company holding the warranty. Contractor shall not perform any work on the roof until a written approval to proceed is obtained from the roofing company holding the warranty. Details to be approved by roofing company before any work is performed. A copy of the letter giving the notice to proceed along with details for curbs or other work to be submitted to owner, owner's representative, owner's inspector and architect.

2.00 EXECUTION

2.01 PREPARATION

A. Shut off rooftop utilities and service piping before beginning the Work.

B. Protect existing roofing system that is not to be involved in the repair.

1. Loosely lay 1-inch- (25-mm-) minimum thick, expanded polystyrene (EPS) insulation over existing roofing in areas indicated. Loosely lay 15/32-inch (12-mm) plywood or OSB panels over EPS. Extend EPS past edges of plywood or OSB panels a minimum of 1 inch (25 mm).

2. Limit traffic and material storage to areas of existing roofing that have been protected.

3. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.

C. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

D. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

E. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing roofing system components that are to remain.

2.02 DISPOSAL

A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

1. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION

07 19 00 WATER REPELLENTS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:

1. Clay brick masonry.

2. Concrete unit masonry.

B. Related Requirements:

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's printed statement of VOC content.

2. Include manufacturer's standard colors.

3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

B. Samples: For each type of water repellent and substrate indicated, 12 by 12 inches (300 by 300 mm) in size, with specified water-repellent treatment applied to half of each Sample.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Certificates: For each type of water repellent.

C. Preconstruction Test Reports: For water-repellent-treated substrates.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. Mockups: Prepare mockups of each required water repellent on each type of substrate required to demonstrate aesthetic effects for preconstruction testing, and to set quality standards for materials and execution.

1. Locate mockups on masonry sample panels.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing of water repellents on field mockups.

1. In addition to verifying performance requirements, use mockups to verify manufacturer's written instructions for application procedure and optimum rates of product application to substrates.

2. Propose changes to materials and methods to suit Project.

3. Notify Architect 7 days in advance of the dates and times when mockups will be tested.

1.08 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.

2. Building has been closed in for not less than 30 days before treating wall assemblies.

3. Ambient temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C) and will remain so for 24 hours.

4. Substrate is not frozen and substrate-surface temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C).

5. Rain or snow is not predicted within 24 hours.

6. Not less than 7 days have passed since surfaces were last wet.

7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: [5 years from date of Substantial Completion.

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Performance: Water repellents shall meet the following performance requirements as determined by preconstruction] testing on substrates representing those indicated for this Project.

1. Clay Brick: ASTM C67.

2. Concrete Unit Masonry: ASTM C 140.

B. Water-Vapor Transmission: Comply with one or both of the following:

1. Maximum 10 percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E96/E96M.

2. Minimum 80 percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D1653.

C. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E514/E514M.

D. Durability: Maximum 5 percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G154 compared to water-repellent-treated specimens before weathering.

2.02 PENETRATING WATER REPELLENTS

A. Silane, Penetrating Water Repellent: Clear, containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.

1. Basis of Design: BASF Corporation, Master Protect H 1000.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation, Master Protect H 1000

b. Pecora Corporation, KlereSeal 910-W/920-W

c. Tnemec Inc., Chemprobe Prime-A-Pell 200

d. Diedrich Technologies, 333 Omegaseal

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.

2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.

3. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.

B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions**.**

1. Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E1857 and Section 04 20 00.

2. Clay Brick Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM D5703 and Section 04 90 00.

C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover and protect adjoining and nearby surfaces of hollow metal doors and frames, steel overhead doors, aluminum storefront doors and frames, windows, glass and louvers, if there is a possibility of water repellant being deposited on surfaces. Cover live vegetation.

D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.03 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply a first and second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.04 FIELD QUALITY CONTROL

A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:

1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project Site will be taken, identified, sealed, and certified in presence of Contractor.

2. Testing agency will perform tests for compliance of water-repellent material with product requirements.

3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project Site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect.

B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.

1. Notify Architect 7 days in advance of the dates and times when surfaces will be tested.

2. Reapply water repellent until coverage test indicates complete coverage.

3.05 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION

07 21 00 THERMAL INSULATION

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Spray-applied Foam insulation (with Intumescent Coating).

B. Related Sections:

1. Section 07 84 46 “Fire Resistive Joint Systems” for insulation installed as part of a perimeter fire-resistive joint system.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.

1.04 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.05 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Envelope Preconstruction meeting shall be held with all of the subcontractors responsible for erecting the envelope related materials as well as product technical representatives.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.

3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

2.00 PRODUCTS

2.01 POLYISOCYANURATE FOAM-PLASTIC BOARD

A. Polyisocyanurate Board, Foil Faced: ASTM C1289, foil faced, Type I, Class 2.

1. Design Basis: Thermax Sheathing by Dow.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville, AP Foil Faced.

b. Firestone Building Products, Enverge CI.

c. Rmax, Thermasheath 3.

3. Thickness: 1 1/2 inch

4. Minimum R value: 8

2.02 GLASS-FIBER BLANKET INSULATION (R-19)

A. Design Basis: Johns Manville, Unfaced Batts.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.

2. Guardian Building Products, Inc.

3. Knauf Insulation.

4. Owens Corning.

C. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

D. Thickness: 6 inches.

E. Unfaced, Glass-Fiber Blanket Insulation: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

2.03 SPRAY-APPLIED FOAM INSULATION (WITH INTUMESCENT COATING)

A. Self-Supported, Spray-Applied Rigid Polyurethane Foam Insulation System:

1. Design Basis: Demilec Heatlok XT.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Demilec, Arlington, TX.
3. Thickness: 1 inch
4. Minimum R-Value: 6.7

B. Water Based Intumescing coating:

1. Design Basis: Blazelok TBX
2. Manufacturers: Thermal Product Research Corp.
3. Physical Properties:
    a. Surface Burning Characteristics (ASTM E 84): Class I. Flame Spread Index <25, Smoke Developed Index <50.
    b. Reference Heatlok® XT Technical Data Sheet (TDS) for wet and dry mil thickness
    c. Flash Point: None
    d. Volatility/VOC: < 50 g/L
    e. Non-toxic, drain safe, water based, non-fuming.
    f. Color: White / Grey
        1). Do not add tint
        2). Wait minimum 24 hours prior to top coating with quality latex paint. Verify dryness with moisture meter. (Dry to touch, 2 to 3 hours depending on temperature and humidity.

2.04 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Products: Subject to compliance with requirements, provide the following:
    a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.

b. Gemco; Spindle Type.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.

3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

1. Products: Subject to compliance with requirements, provide the following:

a. AGM Industries, Inc.; TACTOO Adhesive.

b. Gemco; Tuff Bond Hanger Adhesive.

3.00 EXECUTION

3.01 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.04 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Attach boards mechanically to framing channels, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 “Unit Masonry.”

3.05 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer’s written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation according to manufacturer’s written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.06 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches (1219 mm) up either side of partitions.

3.07 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.08 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

07 27 26 FLUID-APPLIED MEMBRANE AIR BARRIERS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes fluid-applied vapor-retarding membrane air barriers at new openings and infill of existing openings in the exterior multi-wythe load bearing masonry wall

B. Related Requirements:

1.03 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.2: For air-barrier products, documentation including printed statement of VOC content.

C. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

2. Include details of interfaces with other materials that form part of air barrier.

1.06 INFORMATIONAL SUBMITTALS

A. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

B. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.

2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

2.00 PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

B. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.

C. Low-Emitting Materials: Air barriers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.02 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations**,** tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E783 or ASTM E2357.

2.03 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: synthetic polymer membrane.

1. Basis of Design: Tremco, ExoAir 230.

2. Products: Subject to compliance with requirements, provide one of the following:

a. Synthetic Polymer Membrane

1). Carlisle Coatings & Waterproofing Inc.; Barritech VP.

2). Grace, W. R., & Co. - Conn.; Perm-A-Barrier VP.

3). Henry Company; Air-Bloc.

4). Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight VP.

5). Tremco Incorporated, an RPM company; ExoAir 230.

3. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E2178.

b. Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m) ; ASTM E96/E96M.

c. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.

2.04 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

C. Counterflashing Strip: Modified bituminous, 40-mil (1.0-mm) thick, self-adhering sheet consisting of 32 mils (0.8 mm) of rubberized asphalt laminated to an 8-mil (0.2-mm) thick, cross-laminated polyethylene film with release liner backing.

D. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0187 inch (0.5 mm) thick, and Series 300 stainless-steel fasteners.

E. Modified Bituminous Transition Strip: Vapor retarding, 40 mils (1.0 mm) thick, smooth surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil (0.1-mm) thick polyethylene film with release liner backing.

F. Joint Sealant: ASTM C920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 07 92 00 “Joint Sealants.”

G. Termination Mastic: Air-barrier manufacturer’s standard cold fluid-applied elastomeric liquid; trowel grade.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.

3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.

4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D4258 before coating surfaces.

1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches (75 mm) along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.04 TRANSITION STRIP INSTALLATION

A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

2. Install modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.

1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
2. Adhesive-Coated Transition Strip: Roll firmly to enhance adhesion.
3. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches (150 mm) o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
4. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

I. Seal top of through-wall flashings to air barrier with an additional 6-inch (150-mm) wide, modified bituminous strip.

J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.05 FLUID AIR-BARRIER MEMBRANE INSTALLATION

A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.

1. Apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.

1. Vapor-Retarding Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil (1.0-mm) dry film thickness.

C. Apply strip and transition strip a minimum of 1 inch (25 mm) onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches (75 mm) onto each surface according to air-barrier manufacturer's written instructions.

D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.06 FIELD QUALITY CONTROL

A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air-barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed, if applicable.
7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.

9. Strips and transition strips have been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

B. Tests: As determined by Owner's testing agency from among the following tests:

1. Quantitative Air-Leakage Testing: Air-barrier assemblies will be tested for air leakage according to ASTM E783.
2. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 30 lbf/sq. in. (207 kPa) according to ASTM D4541 for each 600 sq. ft. (56 sq. m) of installed air barrier or part thereof.

C. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.07 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

07 62 00 SHEET METAL FLASHING AND TRIM

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Flashings at new roof curbs, penetrations and equipment supports.

1.03 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.

4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, eave, including gutter, fascia, fascia trim, approximately 10 feet (3.0 m) long, including supporting construction cleats, seams, attachments, underlayment, and accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.09 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Coordinate the work in this section with Section 07 01 50 Repair of Roofing. Ensure that the existing roof system warranties are maintained without any exceptions or exclusions.

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:

a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As indicated by manufacturer's designations.

3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

2.03 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

1. Carlisle Coating and Waterproofing
2. Grace Construction Products
3. Metal-fab manufacturing
4. Owens Corning
5. Thermal Stability: ASTM D1970; stable after testing at 240 deg F (116 deg C) or higher.
6. Low-Temperature Flexibility: ASTM D1970; passes after testing at minus 20 deg F (29 deg C) or lower.

B. Slip Sheet: Rosin-sized building paper, 3 lb./100 sq. ft. (0.16 kg/sq. m)minimum.

2.04 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metalor manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metalor manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C920, elastomeric polyurethanepolymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D1187.

F. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.05 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

I. Do not use graphite pencils to mark metal surfaces.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.03 INSTALLATION, GENERAL

A. General: Anchor sheet metal and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
3. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
4. Torch cutting of sheet metal flashing and trim is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 “Joint Sealants.”

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.04 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.05 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer’s written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

07 72 00 ROOF ACCESSORIES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Equipment supports.
3. Pipe supports.
4. Preformed flashing sleeves.

B. Related Sections:

1. Section 07 01 50 “Repair of Roofing”
2. Section 07 62 00 “Sheet Metal Flashing and Trim”.

1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Coordinate the work in this section with Section 07 01 50 Repair of Roofing. Ensure that the existing roof system warranties are maintained without any exceptions or exclusions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on samples of size to adequately show color.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.

3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

B. Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.07 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.08 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

2.00 PRODUCTS

2.01 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.

1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
2. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 (AZM150) coated.

C. Aluminum Sheet: ASTM B209 (ASTM B209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.

2. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

D. Aluminum Extrusions and Tubes: ASTM B221 (ASTM B221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

E. Copper Sheet: ASTM B370, manufacturer's standard temper.

F. Stainless-Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.

2.02 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 1, thickness as indicated.

C. Glass-Fiber Board Insulation: ASTM C726, thickness as indicated.

D. Polyisocyanurate Board Insulation: ASTM C1289, thickness as indicated.

E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

G. Underlayment:

1. Felt: ASTM D226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

2. Polyethylene Sheet: 6-mil (0.15-mm) thick polyethylene sheet complying with ASTM D4397.

3. Slip Sheet: Building paper, 3-lb./100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

H. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

I. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

J. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.03 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AES Industries, Inc.

b. Curbs Plus, Inc.

c. Custom Solution Roof and Metal Products.

d. Greenheck Fan Corporation.

e. LM Curbs.

f. Metallic Products Corp.

g. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.

h. Pate Company (The).

i. Roof Products, Inc.

j. Safe Air of Illinois.

k. Thybar Corporation.

l. Vent Products Co., Inc.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Aluminum sheet, 0.090 inch (2.28 mm) thick.

1. Finish: Clear anodic.

D. Construction:

1. Insulation: Factory insulated with 1-1/2-inch (38-mm) thick glass-fiber board insulation.

2. Liner: Same material as curb, of manufacturer’s standard thickness and finish.

3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.

4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.

5. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.

6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.

7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
8. Security Grille: Provide where indicated.

2.04 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom. 10’-0” o.c., 2’-0” at each level change and transitions or intersections.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AES Industries, Inc.
   b. Curbs Plus, Inc.
   c. Custom Solution Roof and Metal Products.
   d. Greenheck Fan Corporation.
   e. LM Curbs.
   f. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
   g. Pate Company (The).
   h. Roof Products, Inc.
   i. Thybar Corporation.
   j. Vent Products Co., Inc.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Aluminum sheet, 0.090 inch (2.28 mm) thick.

1. Finish: Clear anodic.

D. Construction:

1. Fabricate equipment supports to minimum height of 12 inches (300 mm) unless otherwise indicated.
2. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.
3. Security Grille: Provide where indicated.

2.05 PIPE SUPPORTS

A. Pipe Supports: Adjustable-height, extruded-aluminum tube, filled with urethane insulation; 2 inches (50 mm) in diameter; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, and extruded-aluminum carrier assemblies; suitable for quantity of pipe runs and sizes.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Thaler Metal USA Inc.

2. Pipe Support Height: As indicated on Drawings.

3. Roller Assembly: With stainless-steel roller, sized for supported pipes.

4. Pipe Support Flashing: Manufacturer's standard **in**sulated sleeve flashing with integral base flange; aluminum sheet, 0.063 inch (1.60 mm) thick.

5. Finish: Manufacturer's standard.

2.06 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and slotted metal collar.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Custom Solution Roof and Metal Products.

b. Thaler Metal USA Inc.

2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.

3. Diameter: As indicated.

4. Finish: Manufacturer's standard.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.

3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.

4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum or stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.

3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.

F. Security Grilles: Weld bar intersections and**,** using tamper-resistant bolts, attach the ends of bars to structural frame or primary curb walls.

G. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.

H. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.03 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 91 13 “Exterior Painting” and Section 09 91 23 “Interior Painting.”

C. Clean exposed surfaces according to manufacturer’s written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

07 84 46 FIRE RESISTIVE JOINT SYSTEMS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For fire-resistive joint system sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For fire-resistive joint system sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, “Approval of Firestop Contractors,” or been evaluated by UL and found to comply with UL’s “Qualified Firestop Contractor Program Requirements.”

B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer’s products per specified requirements. Manufacturer’s willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:

1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

2. Fire-resistive joint systems are identical to those tested per testing standard referenced in “Fire-Resistive Joint Systems” Article. Provide rated systems complying with the following requirements:

a. Fire-resistive joint system products bear classification marking of qualified testing agency.

b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:

1). UL in its “Fire Resistance Directory.”

D. Preinstallation Conference: Conduct conference at Project site.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer’s written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.07 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

2.00 PRODUCTS

2.01 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E1966 or UL 2079:

1. Joints include those installed in or between fire-resistance-rated walls floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.

3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Grace Construction Products.

b. Hilti, Inc.

c. Johns Manville.

d. 3M Fire Protection Products.

e. Tremco, Inc.; Tremco Fire Protection Systems Group.

f. USG Corporation.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.

1. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.

2. Manufacturers: Subject to compliance with requirements**,** provide products by one of the following:

a. Grace Construction Products.

b. Johns Manville.

c. 3M Fire Protection Products.

d. Tremco, Inc.; Tremco Fire Protection Systems Group.

e. USG Corporation.

D. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

E. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.

2. Sealant Primers for Nonporous Substrates: 250 g/L.

3. Sealant Primers for Porous Substrates: 775 g/L.

F. Low-Emitting Materials: Fire-resistive joint system sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.

2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.03 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words “Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage.”
2. Contractor’s name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer’s name.
6. Installer’s name.

3.05 FIELD QUALITY CONTROL

A. Inspecting Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION

07 92 00 JOINT SEALANTS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Latex joint sealants.

B. Related Sections:

1. Section 07 84 46 “Fire Resistive Joint Systems” for sealing joints in fire-resistance-rated construction.
2. Section 08 80 00 “Glazing” for glazing sealants.
3. Section 09 29 00 “Gypsum Board” for sealing perimeter joints.
4. Section 09 30 00 “Tiling” for sealing tile joints.

1.03 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer’s written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

a. Each kind of sealant and joint substrate indicated.

3. Notify Architect 7 days in advance of dates and times when test joints will be erected.

4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

1). For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.

6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.04 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.

2. Laboratory Test Reports for Credit IEQ 4: For sealants and sealant primers used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Samples for Verification: For each kind and color of joint sealant required, provide samples with joint sealants in 1/2-inch (13-mm) wide joints formed between two 6-inch (150-mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

E. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.

2. Joint-sealant manufacturer and product name.

3. Joint-sealant formulation.

4. Joint-sealant color.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

G. Field-Adhesion Test Reports: For each sealant application tested.

H. Warranties: Sample of special warranties.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

E. Preinstallation Conference: Conduct conference at Project site.

1.07 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 F (5 C).

2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.08 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

2.00 PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Liquid-Applied Joint Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

E. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

F. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 ELASTOMERIC JOINT SEALANTS

A. Low-Modulus Nonacid-Curing Silicone Sealant, Type I:

1. Products:

a. Dow Corning; 790.

b. GE Silicones; Silpruf

c. Pecora Corporation; 890.

d. Sonneborn Building Products Div., ChemRex Inc.; Omniseal.

2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 25.

4. Additional Movement Capability: Capable of 100 percent movement in extension and 50 percent movement in compression when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719.

5. Exposure: Use NT (nontraffic).

6. Substrates: Uses M, G, A, and, as applicable to joint substrates indicated, O.

7. Nonstaining to porous substrates when testing per ASTM C 1248 for substrates indicated.

B. Medium-Modulus Neutral-Curing Silicone Sealant, Type 2:

1. Products:

a. Dow Corning; 791.

b. Tremco; Spectrem 2.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Exposure: Use NT (nontraffic).
5. Substrates: Uses M, G, A, and, as applicable to joint substrates indicated, O.
6. Nonstaining to porous substrates when testing per ASTM C 1248 for substrates indicated.

C. Mildew-Resistant Silicone Sealant, Type 3:

1. Products:
   a. Dow Corning; 786 Mildew Resistant.
   b. GE Silicones; Sanitary 1700.
   c. Pecora Corporation; 898 Silicone Sanitary Sealant.
   d. Tremco; Tremsil 600 White.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Exposure: Use NT (nontraffic).
5. Application Temperature Range: -35 to 140 degrees Fahrenheit.
6. Substrates: Uses G, A, and, as applicable to joint substrates indicated, O.

D. Multicomponent Nonsag Urethane Sealant, Type 4:

1. For joints not subject to traffic and requiring additional movement capability, provide the following:
   a. Products:
      1). Pecora Corporation; Dynatrol II.
      2). Sika Corporation; Sikaflex - 2c NS.
      3). Tremco; Dymeric 240 FC.
   b. Type and Grade: M (multicomponent) and NS (nonsag).
   c. Class: 25.
   d. Additional Movement Capability: 50 percent movement in extension and 50 percent in compression when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719.
   e. Exposure: Use NT (nontraffic).
   f. Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
2. For joints not subject to traffic, Type 5:
   a. Products:
      1). Bostik Inc.; Chem-Calk 500.

2). Tremco; DYmeric.

b. Type and Grade: M (multicomponent) and NS (nonsag).

c. Class: 25.

d. Exposure: Use NT (nontraffic).

e. Substrates: Uses M, G**,** A, and, as applicable to joint substrates indicated, O.

E. Single-Component Nonsag Urethane Sealant, Type 6:

1. For joints subject to traffic and not subject to traffic, provide the following:

a. Products:

1). Sika Corporation; Sikaflex - 1a.

2). Sonneborn Building Products Div., ChemRex Inc.; NP 1.

b. Type and Grade: S (single component) and NS (nonsag).

c. Class: 25.

2. Exposure: Use NT (nontraffic).

3. Substrates: Uses M, G, A, and, as applicable to joint substrates indicated, O.

4. For joints not subject to traffic, provide the following:

a. Products:

1). Bostik Inc.; Chem-Chalk 900.

2). Pecora Corporation; Dynatrol I.

3). Tremco; DyMonic.

b. Type and Grade: S (single component) and NS (nonsag).

c. Class: 25.

d. Exposure: Use NT (nontraffic).

e. Substrates: Uses M, A, and, as applicable to joint substrates indicated.

F. Single-Component Pourable Urethane Sealant, Type 7

1. Products:

a. Bostik Inc.; Chem-Calk 950.

b. Pecora Corporation; NR-201.

c. Sonneborn Building Products Div., ChemRex Inc.; SL 1.

2. Type and Grade: S (single component) and P (pourable).

3. Class: 25.

4. Exposure: Use T (traffic) and NT (nontraffic).

5. Substrates: Uses M, G, A, and, as applicable to joint substrates indicated, O.

2.03 LATEX JOINT SEALANTS

A. Latex Sealant: ASTM C 834.

1. Products:

a. Bostik Inc.; Chem-Calk 600.

b. Pecora Corporation; AC-20.

c. Sonneborn Building Products Div., ChemRex, Inc.; Sonolac.

d. Tremco; Tremflex 834.

2.04 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; AC-20 or FTR AIS-919.

b. USG Corporation; SHEETROCK Acoustical Sealant.

2.05 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type: C O, or B.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.06 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.

    b. Masonry.

    c. Unglazed surfaces of ceramic tile.

    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.

    b. Glass.

    c. Porcelain enamel.

    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.

2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.

3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.

4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.04 FIELD QUALITY CONTROL

A. Contractor to provide field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.

b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

a. Whether sealants filled joint cavities and are free of voids.

b. Whether sealant dimensions and configurations comply with specified requirements.

c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 JOINT SEALANT SCHEDULE

A. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
1. Control and Expansion Joints in Cast-in-Place Concrete: Type 1, 5, 6 sealant.
2. Control and Expansion Joints in Unit Masonry: Type 1,5,6 sealant.
3. Joints between Metal Panels: 1, 5 sealant.
4. Joints between Different Materials Listed above: Type 1, 5, 6 sealant.
5. Perimeter Joints between Materials Listed above and Frames of Doors and Windows: Type 1, 5, 6 sealant.
6. Control and Expansion Joints in Ceiling and Overhead Surfaces: Type 1, 5, 6 sealant.

B. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
1. Control and Expansion Joints on Exposed Interior Surfaces of Exterior Walls: Type 1, 5, 6 sealant.
2. Perimeter Joints of Exterior Openings Where Indicated: Type 1, 5 sealant.
3. Tile Control and Expansion Joints: Type 4, 6 sealant.

4. Vertical Control Joints on Exposed Surfaces of Interior Unit Masonry and Concrete Walls and Partitions: Type 1, 5, 6 sealant.
5. Perimeter Joints between Interior Wall Surfaces and Frames of Interior Doors, Windows, and Elevator Entrances: Type 1, 5, 6 sealant.
6. Joints between Plumbing Fixtures and Adjoining Walls, Floors, and Counters: Type 4, 7 sealant.

END OF SECTION

DIVISION 8
OPENINGS

08 11 13 HOLLOW METAL FRAMES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes hollow-metal work.

B. Related Requirements:

1. Section 08 71 00 “Door Hardware” for door hardware for hollow-metal doors.
2. Section 08 14 16 “Flush Wood Doors” for interior wood doors.

1.03 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.04 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification:

1. For each type of exposed finish required, prepared on samples of not less than 3 by 5 inches (75 by 127 mm).
2. For "Frames" subparagraphs below, prepare samples approximately 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:
    a. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

F. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.07 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch (102-mm) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld International, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Deansteel.
5. de La Fontaine Industries.
6. DKS Steel Door & Frame Sys. Inc.
7. Door Components, Inc.
8. Fleming-Baron Door Products.
9. Gensteel Doors Inc.
10. Greensteel Industries, Ltd.
11. Megamet Industries, Inc.
12. MPI Group, LLC (The).
13. National Custom Hollow Metal.
14. North American Door Corp.
15. Republic Doors and Frames.
16. Shanahans Manufacturing Ltd.
17. Steelcraft; an Ingersoll-Rand company.
18. Steward Steel; Door Division.
19. Stiles Custom Metal, Inc.
20. Titan Metal Products, Inc.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.02 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.03 INTERIOR FRAMES

A. Construct interior frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Frames: SDI A250.8, Level 3. Physical Performance: Level A according to SDI A250.4.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.

b. Thickness: 1-3/4 inches (44.5 mm).

c. Face: Metallic-coated cold-rolled steel sheet, minimum thickness of 0.053 inch (1.3 mm).

d. Edge Construction: Model 2, Seamless.

e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).

b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.04 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.

2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.

3. Post installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch (9.5-mm) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.05 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A101008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A101011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A6653M, Commercial Steel (CS), Type B.

E. Frame Anchors: ASTM A8879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A101008M or ASTM A101011M, hot-dip galvanized according to ASTM A1153M, Class B.

F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A1153M.

G. Grout: ASTM C476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C1143M.

H. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 08 80 00 “Glazing.”

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.06 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer’s plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
        1). Two anchors per jamb up to 60 inches (1524 mm) high.
        2). Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3). Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
        4). Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
        1). Three anchors per jamb up to 60 inches (1524 mm) high.
        2). Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3). Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
        4). Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
    c. Post installed Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

7. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 45 - degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

C. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.

3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

4. Provide loose stops and moldings on inside of hollow-metal work.

5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.07 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.08 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

1. Manufacturer's representative shall visit the site once a week during the installation process to assure a uniform, quality, watertight barrier is provided. The manufacturer's representative shall provide the Owner with a report including photographs for documentation of in place work from each site visit during the duration of the installation.

2. Manufacturer and Contractor to inspect product upon final completion to assure work is free of defects, voids and/or gaps.

3. Contractor shall verify and repair any defects in surfaces that are to receive the dampproofing material prior to installation. The Contractor is to inspect the wall after installation to determine if there are any defective gaps or open material bridging that would not allow the damp proofing to perform as recommended by the manufacturer. Fill all remaining voids with compatible sealer as recommended by manufacturer to create a watertight barrier on the surface of the wall substrate.

4. Refer to Specification Section 01 33 10 Mock up Submittal for additional mock up requirements.

5. Refer to Specification Section 04 81 50 for flexible embed flashing material.

6. All wall penetrations including but not limited to, windows, doors and louvers shall be installed, flashed and water tested prior to the installation of the exterior veneer, so as to provide a watertight envelope perimeter.

7. Provide AAMA 501.2 water testing for all wall openings.

8. Provide wood nailers along perimeter of jambs and sill of window frames.

9. Provide stainless steel angles at the jambs of the hollow metal door frames with integral membrane flashing.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    a. At fire-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post installed expansion anchors.
    a. Floor anchors may be set with power-actuated fasteners instead of post installed expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Glazing: Comply with installation requirements in Section 08 80 00 “Glazing” and with hollow-metal manufacturer’s written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer’s written instructions.

E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer’s written instructions.

F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END SECTION

08 14 16 FLUSH WOOD DOORS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.

B. Related Requirements:

1. Section 08 11 13 “Hollow Metal Frames” for door frames.
2. Section 08 80 00 “Glazing” for glass view panels in flush wood doors.
3. Section 09 91 00 “Architectural Painting for field finishing doors.

1.03 PREINSTALLATION MEETINGS

1.04 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Fire-protection ratings for fire-rated doors.

C. Samples for Verification:

1. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
    a. Provide Samples for each species of veneer and solid lumber required.
    b. Provide Samples for each color, texture, and pattern of plastic laminate required.
    c. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.
2. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.05 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.08 WARRANTY

A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.

b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Dallas Door

B. Construction Specialties

C. Eggers Industries

D. Marlite

E. Marshfield DoorSystems, Inc

F. Mohawk Flush Doors, Inc.

G. VT Industries Inc.

H. Source Limitations: Obtain flush wood from single manufacturer.

2.02 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. WDMA I.S.1-A Performance Grade: Heavy Duty

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

4. Pairs: Provide formed-steel edges and astragals with intumescent seals.

a. Finish steel edges and astragals with baked enamel

D. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2.

2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.

b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.

c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

a. Screw-Holding Capability: 475 lbf (2110 N) per WDMA T.M.-10.

2.03 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.

2. Species: Match existing

3. Cut: Match existing Note to Specifier: “Pleasing” option in “Match between Veneer Leaves” Subparagraph below is available only with Grade B veneers.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balancematch.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical and Top Edges: Same species as faces or a compatible species - edge Type A.
8. Core: Particleboard Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

2.04 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer’s standard wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces.
   2. Profile: Match existing. Note to Specifier: Retain subparagraph below if required.
   3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer’s standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer’s standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed for paint**]** finish; and approved for use in doors of fire-protection rating indicated.

D. Metal Louvers:
   1. Blade Type: Vision-proof, inverted V.

E. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.
   1. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish.

2.05 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 “Glazing.”
3. Louvers: Factory install louvers in prepared openings.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 “Finish Hardware Installation Instructions: Install doors to comply with manufacturer’s written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

B. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
    a. Comply with NFPA 80 for fire-rated doors.
    b. 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.

3.03 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

08 71 00 FINISH HARDWARE

1.00 GENERAL

1.01 SUMMARY

A. Section includes furnishing and installation of door hardware for doors specified in “Hardware Sets” and required by actual conditions. Including screws, bolts, expansion shields, electrified door hardware, and other devices for proper application of hardware.

B. Where items of hardware are not specified and are required for intended service, such omission, error or other discrepancy shall be submitted to Architect fourteen calendar days prior to bid date for clarification by addendum.

C. Products supplied but not installed under this Section:

1. Final replacement of cylinder cores to be installed by Owner.

D. Refer to Division 1 Price and Payment Procedures for alternates that may affect work of this Section.

E. Related Divisions:

1. Division 8 Doors and Windows
2. Division 13 Special Construction

1.02 REFERENCES

A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI):

1. ANSI/BHMA A156.1 Butts & Hinges (2006)
2. ANSI/BHMA A156.3 Exit Devices (2008)
3. ANSI/BHMA A156.4 Door Controls – Closers (2008)
4. ANSI/BHMA A156.5 Auxiliary Locks (2010)
5. ANSI/BHMA A156.6 Architectural Door Trim (2010)
6. ANSI/BHMA A156.7 Template Hinge Dimensions (2009)
7. ANSI/BHMA A156.8 Door Controls – Overhead Stops and Holders (2010)
8. ANSI/BHMA A156.13 Mortise Locks & Latches (2005)
9. ANSI/BHMA A156.16 Auxiliary Hardware (2008)
10. ANSI/BHMA A156.18 Materials & Finishes (2006)
11. ANSI/BHMA A156.21 Thresholds (2009)
12. ANSI/BHMA A156.22 Door Gasketing Systems (2005)
13. ANSI/BHMA A156.26 Continuous Hinges (2006)
14. ANSI/BHMA A156.28 Keying Systems (2007)
15. ANSI/BHMA A156.32 Integrated Door Assemblies (2008)

16. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames (2006)

B. International Code Council/American National Standards Institute (ICC/ANSI)/ADA:
   1. ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities (2009).
   2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

C. Underwriters Laboratories, Inc. (UL):
   1. UL 10C Positive Pressure Fire Test of Door Assemblies
   2. UL 1784 Air Leakage Test of Door Assemblies
   3. UL/ULC Listed

D. Door and Hardware Institute (DHI):
   1. DHI Publication – Keying Systems and Nomenclature (1989)
   2. DHI Publication – Abbreviations and Symbols
   3. DHI Publication – Installation Guide for Doors and Hardware
   4. DHI Publication – Sequence and Format of Hardware Schedule (1996)

E. National Fire Protection Agency (NFPA)
   1. NFPA 70 National Electrical Code (2011)
   2. NFPA 80 Standard for Fire Doors and Other Opening Protective's (2010)
   3. NFPA 101 Life Safety Code (2009)
   4. NFPA 105 Standard for the Installation of Smoke Door Assemblies (2010)

F. Building Codes
   1. IBC 2015 International Building Code
   2. Local Building Code

1.03 SUBMITTALS

A. Submit in accordance with Conditions of the Contract and Division 1 Administrative Requirements.

B. Shop Drawings:
   1. Hardware schedule shall be organized in vertical format illustrated in DHI Publications Sequence and Formatting for the Hardware Schedule. Include abbreviations and symbols page according to DHI Publications Abbreviations and Symbols. Complete nomenclature of items required for each door opening as indicated.
   2. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.
   3. Architectural Hardware Consultant (AHC), as certified by DHI, who shall affix seal attesting to completeness and correctness, shall review hardware schedule prior to submittal.

C. Submit manufacturer's catalog sheet on design, grade and function of items listed in hardware schedule. Identify specific hardware item per sheet, provide index, and cover sheet.

D. Coordination:

1. Distribute door hardware templates to related divisions within fourteen calendar days of approved hardware schedule.

E. Closeout Submittals: Submit to Owner in a three ring binder or CD if requested.

1. Warranties.
2. Maintenance and operating manual.
3. Maintenance service agreement.
4. Record documents.
5. Copy of approved hardware schedule.
6. Copy of approved keying schedule with bitting list.
7. Hardware supplier name, phone number and fax number.

1.04 QUALITY ASSURANCE

A. Hardware supplier shall employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who shall be available at reasonable times during course of work for Project hardware consultation.

B. Door hardware shall conform to ICC/ANSI A117.1, Americans with Disabilities Act (ADA), and "Accessibility Guidelines for Buildings and Facilities (ADAAG).

1. Handles, Pulls, Latches, Locks and operating devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

C. Fire Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C, unless otherwise indicated.

D. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

E. Door hardware shall be certified to ANSI/BHMA standards as noted, participate and be listed in BHMA Certified Products Directory.

F. Pre-installation Meeting: Comply with requirements in Division 1 Section "Project Meetings."

1. Convene meeting seven calendar days before installation. Participants required to attend:
2. Contractor, installer, material supplier, manufacturer representatives, electrical contractor, security consultant and fire alarm consultant.
3. Include in conference decisions regarding proper installation methods and procedures for receiving and handling hardware.

4. Review sequence of operation for each type of electrified door hardware, inspect, and discuss electrical roughing-in and other preparatory work performed by other trades.
5. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

G. Installer Qualifications: Specialized in performing installation of this Section and shall have 5 years minimum documented experience.

H. Hardware listed in 3.07- Hardware Schedule is intended to establish a type and grade.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide a clean, dry and secure room for hardware delivered to Project but not yet installed.

B. Furnish hardware with each unit marked and numbered in accordance with approved finish hardware schedule. Include door and item number for each type of hardware.

C. Pack each item complete with necessary parts and fasteners in manufacturer's original packaging.

D. Deliver permanent key, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to Owner shall be established at "Keying Conference."

E. Waste Management and Disposal

1. Separate waste materials for reuse or recycling in accordance with Division 1.

1.06 WARRANTY

A. General Warranty: Owner may have under provisions of the Contract Documents and shall be an addition and run concurrent with other warranties made by Contractor under requirements of the Contract documents.

B. Special Warranty: Warranties specified in this article shall not deprive Owner of other rights. Contractor, hardware supplier, and hardware installer shall be responsible for servicing hardware and keying related problems.

1. Ten years for manual door closers.
2. Five years for mortise, auxiliary and bored locks.
3. Five years for exit devices.
4. Two years for electromechanical door hardware.

C. Products judged defective during warranty period shall be replaced or repaired in accordance with manufacturer's warranty at no cost to Owner. There is no warranty against defects due to improper installation, abuse and failure to exercise normal maintenance.

2.00 PRODUCTS

2.01 HINGES

A. Hinges and continuous hinges shall be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by the following:

1. Butts and Hinges: ANSI/BHMA A156.1
2. Template Hinge Dimensions: ANSI/BHMA A156.7
3. Continuous Hinges: ANSI/BHMA A156.26

C. Butt Hinges:

1. Hinge weight and size unless otherwise indicated in hardware sets:
    a. Doors up to 36” wide and up to 1-3/4” thick provide hinges with a minimum thickness of .134” and a minimum of 4-1/2” in height.
    b. Width of hinge is to be minimum required to clear surrounding trim.
2. Base material unless otherwise indicated in hardware sets:
    a. Exterior Doors: 304 Stainless Steel, Brass or Bronze material.
    b. Fire Rated Doors: Steel or 304 Stainless Steel materials.
    c. Stainless Steel ball bearing hinges shall have stainless steel ball bearings. Steel ball bearings are unacceptable.
3. Quantity of hinges per door unless otherwise stated in hardware sets:
    a. Doors up to 60”in height provide 2 hinges.
    b. Doors 60” up to 90” in height provide 3 hinges.
    c. Doors 90” up to 120” in height provide 4 hinges.
4. Hinge design and options unless otherwise indicated in hardware sets:
    a. Hinges are to be of a square corner five-knuckle design, flat button tips and have ball bearings unless otherwise indicated in hardware sets.
    b. Out-swinging exterior and out-swinging access controlled doors shall have non-removable pins (NRP) to prevent removal of pin while door is in closed position.
    c. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
    d. Provide mortar boxes for frames that require any electrically modified hinges if not an integral part of frame.
    e. When shims are necessary to correct frame or door irregularities, provide metal shims only.
5. Acceptable Manufactures:
    a. Hager

b. Stanley

c. Ives

d. McKinney

2.02 CONTINUOUS HINGES

A. Continuous hinges shall be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by the following:

1. Continuous Hinges: ANSI/BHMA A156.26 Grade 1

C. Continuous Geared Hinges:

1. Determine model number by door and frame application, door thickness, frequency of use, and fire rating requirements according to manufacturer's recommendations.

a. Length of hinge shall be 1" less door height unless otherwise stated in hardware sets.

D. Material and Design:

1. Base material: Anodized aluminum manufactured from 6063-T6 material, unexposed working metal surfaces shall be coated with TFE dry lubricant.

2. Bearings:

a. Vertical loads shall be carried on Lubriloy RL bearings for non Fire Rated doors.

b. Standard weight hinges shall have a minimum spacing between bearings of 5-1/8". Typical door from 80" to 84" in height to have a minimum of 16 bearings.

c. Heavy Weight hinges shall have a minimum spacing between bearings of 2-9/16". Typical door from 80" to 84" in height to have a minimum of 32 bearings.

3. Options:

a. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.

b. Fire rated hinges shall carry UL certification, up to and including 90-minute applications for wood doors and up to 3-hour applications for metal doors.

E. Acceptable Manufactures:

1. Stanley

2. Select

3. Ives

4. Markar

2.03 FLUSH BOLTS AND COORDINATORS

A. Flushbolts shall be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be listed by the following:

1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Labeled openings: Provide automatic or constant latching flush bolts per hardware schedule for inactive leaf of pairs of doors. Provide dust proof strikes for bottom bolt.

D. Non-Labeled openings: Provide two flush bolts for inactive leaf of pairs of doors per hardware schedule. Top bolt shall not be more than 78” centerline from floor. Provide dust proof strike for bottom bolt.

E. Acceptable Manufactures:

1. ABH
2. Ives
3. Trimco
4. Rockwood

2.04 LOCKS AND LATCHES

A. Locks and latches shall be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Product to be certified and listed by following:

1. ANSI/BHMA A156.1 Grade 1 for Operational and Security.
2. UL/cUL Labeled and listed for functions up to 3 hours for single doors up to 48” in width and up to 96” in height.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. ICC/ANSI A117.1.

C. Lock and latch function numbers and descriptions of manufactures series as listed in hardware sets.

D. Material and Design:

1. Lock cases from fully wrapped, 12 gauge steel, Zinc dichromate for corrosion resistance.
2. Non-handed, field reversible without opening lock case.
3. Break away spindles to prevent unlocking during forced entry or vandalism.
4. Levers are to be Stainless Steel and plated to match finish designation in hardware sets.
5. Sectional Roses are to be of Stainless Steel material and have a minimum diameter of 2-7/16”.
6. Escutcheons are to be of Stainless Steel material.
7. Armor fronts are to be self-adjusting to accommodate a square edge door or a standard 1/8” beveled edge door.

E. Latch and Strike:

1. Stainless Steel latch bolt with minimum of ¾” throw and deadlocking for keyed and exterior functions.

2. Strike is to fit a standard ANSI A115 prep measuring 1-1/4" x 4-7/8" with proper lip length to protect surrounding trim.

3. Deadbolts to be 1-3/4" total length with a minimum of a 1" throw and ¾" internal engagement when fully extended and made of Stainless Steel material.

F. Acceptable Manufactures: (No Substitution)

1. Best

2.05 EXIT DEVICES

A. Shall be touch pad type, finish to match balance of door hardware. Exit Devices shall be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be certified and or listed by the following:

1. BHMA Certified ANSI A156.3 Grade 1

2. UL/cUL Listed for up to 3 hours for "A" labeled doors

3. UL10C/UBC 7-2 Positive Pressure Rated

4. UL10B Neutral Pressure Rated

5. UL 305Listed for Panic Hardware

C. Material and Design:

1. Touch pad shall extend a minimum of one half-door width. Freewheeling lever design shall match design of locks levers. Exit device to mount flush with door.

2. Latchbolts:

a. Rim device – ¾" throw, Pullman type with automatic dead-latching, stainless steel

b. Surface vertical rod device – Top ½" throw, Pullman type with automatic dead-latching, stainless steel. Bottom ½" throw, Pullman type, held retracted during door swing, stainless steel.

c. Fasteners: Wood screws, machine screws and thru-bolts.

D. Lock and Latch Functions: Function numbers and descriptions of manufacturer's series and lever styles indicated in door hardware sets.

E. Acceptable Manufactures:

1. Precision

2. Sargent

2.06 CYLINDERS AND KEYING

A. Cylinders shall be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer shall meet the following:

1. Auxiliary Locks: ANSI/BHMA A156.5

2. DHI Handbook "Keying systems and nomenclature" (1989)

C. Cylinders:

1. Manufacturer's standard tumbler type, seven-pin IC core.
2. Shall be furnished with cams/tailpieces as required for locking device that is being furnished for project.

D. Keying:

1. Contact Owner with representative from hardware supplier to establish a keying conference. Verify keyway, visual key identification, number of master keys and keys per lock. Provide keying system per Owners instructions.
2. Copy of Owners approved keying schedule shall be submitted to Owner and Architect with documentation of which keying conference was held and Owners sign-off.
3. Provide a bitting list to Owner of combinations as established, and expand to twenty five percent for future use or as directed by Owner.
4. Key into Owner's existing keying system if applicable.
5. Keys to be shipped to Owner's representative, individually tag per keying conference.
6. Provide visual key control identification on keys.
7. Provide interchangeable cores with construction cores as required per hardware schedule.

E. Acceptable manufactures: (No Substitution)

1. Best

2.07 CLOSERS

A. Shall be product of one manufacturer. Unless otherwise indicated on hardware schedule, comply with manufacturer's recommendation for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirements, and fire rating.

B. Standards: Manufacturer to be certified and or listed by the following:

1. BHMA Certified ANSI A156.4 Grade 1
2. ADA Compliant ANSI A117.1
3. UL/cUL Listed up to 3 hours.
4. UL10C Positive Pressure Rated
5. UL10B Neutral Pressure Rated

C. Material and Design:

1. Provide cast iron non-handed bodies with full plastic covers.
2. Closers shall have separate staked adjustable valve screws for latch speed, sweep speed, and backcheck.
3. Provide Tri-Pack arms and brackets for regular arm, top jamb, and parallel arm mounting.
4. One-piece seamless steel spring tube sealed in hydraulic fluid.

5. Double heat-treated steel tempered springs.
6. Precision-machined heat-treated steel piston.
7. Triple heat-treated steel spindle.
8. Full rack and pinion operation.

D. Mounting:

1. Out swing doors shall have surface parallel arm mount closers except where noted on hardware schedule.
2. In swing doors shall have surface regular arm mount closers except where noted on hardware schedule.
3. Provide brackets and shoe supports for aluminum doors and frames to mount fifth screw.
4. Furnish drop plates where top rail conditions on door do not allow for mounting of closer and where backside of closer is exposed through glass.

E. Size closers in compliance with requirements for accessibility (ADDAG). Comply with following maximum opening force requirements.

1. Interior hinged openings: 5.0 lbs.
2. Fire rated and exterior openings shall have minimum opening force allowable by authority having jurisdiction.

F. Fasteners: Provide self-reaming and self-tapping wood and machine screws and sex nuts and bolts for each closer.

G. Acceptable manufactures:

1. Stanley
2. Sargent

2.08 PROTECTIVE TRIM

A. Size of protection plate: Single doors, size two inches less door width (LDW) on push side of door, and one inch less on pull side of door. For pairs of doors, size one inch less door width (LDW) on push side of door, and ½ inch on pull side of door.

1. Kickplates 10” high or sized to door bottom rail height

B. Standards: Manufacturer shall meet requirements for:

1. Architectural Door Trim: ANSI/BHMA A156.6
2. UL

C. Material and Design:

1. 0.050” gage stainless steel
2. Corners shall be square. Polishing lines or dominant direction of surface pattern shall run across the door width of plate.
3. Bevel top, bottom and sides uniformly leaving no sharp edges. Edges shall be de-burred.

4. Countersink holes for screws. Screws holes shall be spaced equidistant eight inches CTC, along a centerline not over ½ inch in from edge around plate. End screws shall be a maximum of 0.53 inch from corners.

D. UL label stamp required on protection plates when top of plate is more than 16 inches above bottom of door on fire rated openings. Verify door manufactures UL listing for maximum height and width of protection plate to be used.

E. Acceptable Manufactures:

1. Trimco
2. Ives
3. Rockwood
4. ABH

2.09 STOPS AND HOLDERS

A. Wall Stops: Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Provide wall stops when possible. Door stops and holders mounted in concrete floor or masonry walls shall have stainless steel machine screws and lead expansion shields.

B. Standards: Manufacturer shall meet requirements for:

1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Acceptable Manufactures:

1. Trimco
2. Ives
3. Rockwood
4. ABH

D. Overhead Stops and Holders: Provide overhead stop and holders for doors that open against equipment, casework sidelights and other objects that would make wall stops/holders and floor stops/holders inappropriate. Provide sex bolt attachments for mineral core wood door applications.

E. Standards: Manufacturer shall be certified by the following:

1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1

F. Acceptable Manufactures:

1. ABH
2. Glynn Johnson
3. Rockwood

2.10 DOOR GASKETING AND WEATHERSTRIP

A. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing where indicated on hardware schedule. Provide non-corrosive fasteners for exterior applications.

1. Perimeter gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting stile gasketing: Fasten to meeting stiles, forming seal when doors are in closed position.
3. Door bottoms: Apply to bottom of door, forming seal with threshold or floor when door is in closed position.
4. Sound Gasketing: Cutting or notching for stop mounted hardware not permitted.
5. Drip Guard: Apply to exterior face of frame header. Lip length to extend 4” beyond width of door.

B. Acceptable Manufactures:

1. Perimeter Gasketing:
   a. NGP
   b. Zero
   c. Pemko
2. Overhead Drip Guard
   a. NGP
   b. Zero
   c. Pemko

2.11 THRESHOLDS

A. Secured in a bed of sealant with lead expansion shields and stainless steel machine screws. Notched in field to fit frame by hardware installer. Refer to Drawings for special details.

B. Standards: Manufacturer to be certified by the following:

1. Thresholds: ANSI/BHMA A156.21
2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

C. Acceptable Manufactures:

1. NGP
2. Zero
3. Pemko

2.12 SILENCERS

A. Where smoke, light, or weather seal are not required, provide three silencers per single door frame, two per double door frame and four per Dutch door frame.

B. Standards: Manufacturer shall meet requirements for:

1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Acceptable Manufactures:

1. Trimco
2. Ives
3. Rockwood
4. ABH

2.13 KEY CABINET

A. Provide key cabinet, surface mounted to wall.

B. Key control system:

1. Include two sets of key tags, hooks, labels, and envelopes.
2. Contain system in metal cabinet with baked enamel finish.
3. Capacity shall be able to hold actual quantities of keys, plus 25 percent.
4. Provide tools, instruction sheets and accessories required to complete installation.

C. Acceptable Manufactures:

1. Lund Equipment
2. Telkey Incorporated

2.14 FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if within range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples.

B. Comply with base material and finish requirements indicated by ANSI/BHMA A156.18 designations in hardware schedule.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install hardware per manufacturer's instructions and in compliance with:

1. NFPA 80.
2. NFPA 105.
3. ICC/ANSI A117.1.
4. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames
5. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames
6. DHI Publication – Installation Guide for Doors and Hardware
7. UL10C/UBC7-2
8. Local building code.
9. Approved shop drawings.
10. Approved finish hardware schedule.

B. Do not install surface mounted items until finishes have been completed on substrates involved. Set unit level, plumb and true to line location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

3.03 FIELD QUALITY CONTROL

A. Material supplier to schedule final walk through to inspect hardware installation ten business days before final acceptance of Owner. Material supplier shall provide a written report detailing discrepancies of each opening to General Contractor within seven calendar days of walk through.

3.04 ADJUSTMENT, CLEANING AND DEMONSTRATING

A. Adjustment: Adjust and check each opening to ensure proper operation of each item of finish hardware. Replace items that cannot be adjusted to operate freely and smoothly or as intended for application at no cost to Owner.

B. Cleaning: Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no cost to Owner.

C. Demonstration: Conduct a training class for building maintenance personnel demonstrating the adjustment, operation of mechanical and electrical hardware. Special tools for finished hardware to be turned over and explained usage at this meeting.

3.05 PROTECTION

A. Leave manufacturer's protective film intact and provide proper protection for all other finish hardware items that do not have protective material from the manufacture until Owner accepts Project as complete.

3.06 HARDWARE SETS

A. The following schedule of hardware sets shall be considered a guide only. Furnish door hardware to meet required codes.

HARDWARE GROUP NO. 001

FOR USE ON MARK/DOOR #(S):
D105 D106 D114 D116

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

VAULT DOOR - ALL EXISTING HARDWARE TO REMAIN

HARDWARE GROUP NO. 101

FOR USE ON MARK/DOOR #(S):
A103B A106 A111 A117 A122 C116

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	ENTRY	9K37AB 15D	626	BES
1	EA	PERMANENT CORE	SFIC CORE - MATCH EXISTING CORMAX MX8	626	BES
1	EA	SURFACE CLOSER	D4551 REG/PA X SNB - MOUNT TO SUIT CONDITIONS	689	STA
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV - VERIFY BLOCKING IN WALL OR USE FLOOR STOP FS436	630	IVE
1	EA	GASKETING	188S-BK (AT RATED OR USE SILENCERS)	S-BK	ZER

HARDWARE GROUP NO. 103

FOR USE ON MARK/DOOR #(S):
D125A D125B

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

6	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	ENTRY	9K37AB 15D	626	BES
1	EA	PERMANENT CORE	SFIC CORE - MATCH EXISTING CORMAX MX8	626	BES
1	EA	WALL STOP	WS407CCV - VERIFY BLOCKING IN WALL OR USE FLOOR STOP FS436	630	IVE
1	EA	ASTRIGAL	DOOR MFG STANDARD		

HARDWARE GROUP NO. 301

FOR USE ON MARK/DOOR #(S):
D126

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY	9K3L 15D	626	BES
1	EA	SURFACE CLOSER	D4551 REG/PA X SNB - MOUNT TO SUIT CONDITIONS	689	STA
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV - VERIFY BLOCKING IN WALL OR USE FLOOR STOP FS436	630	IVE
1	EA	GASKETING	188S-BK (AT RATED OR USE SILENCERS)	S-BK	ZER

HARDWARE GROUP NO. 701

FOR USE ON MARK/DOOR #(S):
A143A A143B B105B B106A B109A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HW HINGE	3CB1HW 4.5 X 4.5	652	IVE
1	EA	EXIT DEVICE	2108 X 4908D X SNB	630	PRE
1	EA	SFIC CYLINDER	SFIC CYL - TYPE AS REQ X KEYED CONST CORE	626	BES
1	EA	PERMANENT CORE	SFIC CORE - MATCH EXISTING CORMAX MX8	626	BES
1	EA	SURFACE CLOSER	D4551 EDA REG/PA X SNB - MOUNT TO SUIT CONDITIONS	689	STA
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV - VERIFY BLOCKING IN WALL OR USE FLOOR STOP FS436	630	IVE
1	EA	GASKETING	188S-BK (AT RATED OR USE SILENCERS)	S-BK	ZER

HARDWARE GROUP NO. 801

FOR USE ON MARK/DOOR #(S):
D128A D128B D128C D128D D131b

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HW HINGE	3CB1HW 4.5 X 4.5	652	IVE
1	EA	90 DEG OFFSET PULL	8190 10" O	630	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	D4551 EDA REG/PA X SNB - MOUNT TO SUIT CONDITIONS	689	STA
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV - VERIFY BLOCKING IN WALL OR USE FLOOR STOP FS436	630	IVE
1	EA	GASKETING	188S-BK (AT RATED OR USE SILENCERS)	S-BK	ZER

END OF SECTION

08 80 00 GLAZING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors.
2. Window inserts

B. Related Sections

1. Section 08 11 13 “Hollow Metal Frames”.
2. Section 08 14 16 “Flush Wood Doors”.

1.03 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

1.04 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 F (67 C), ambient; 180 F (100 C), material surfaces.

1.05 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass ; 12 inches (300 mm) square.

1. Fire-resistive glazing products.

C. Glazing Accessory Samples: For gaskets and sealants , in 12-inch (300-mm) lengths.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional Architect responsible for their preparation.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers manufacturers of insulating-glass units with sputter-coated, low-e coatings glass testing agency and sealant testing agency.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass coated glass insulating glass glazing sealants and glazing gaskets.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Warranties: Sample of special warranties.

1.07 QUALITY ASSURANCE

A. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

B. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

D. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer’s name, type of glass, thickness, and safety glazing standard with which glass complies.

E. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer’s name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 F (250 C), and the fire-resistance rating in minutes.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer’s written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 F (4.4 C).

2.00 PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

B. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.

2.02 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies.

B. Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch (5-mm) nominal thickness; faced on one surface with a clear glazing film; complying with testing requirements in 16 CFR 1201 for Category II materials. Also tested to ASTM E 119 or UL 263

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite NT.

b. Safti First; SuperLite C/SP.

c. Schott North America, Inc;

d. Vetrotech Saint-Gobain; SGG Keralite FR-F.

2.03 WINDOW INSERTS

A. Manufacturer: Basis of design "Indow Windows" or comparable retrofit storm window insert system.

B. Shade grade: White framed tinted acrylic with a transmission coefficient of 47 and visible transmission of 63%. UV reduction of 90%.

C. Privacy grade: White framed translucent white acrylic window insert.

D. Size to fit existing window opening snug and secure.

2.04 FIRE-PROTECTION-RATED GLAZING TYPES

A. Glass Type: 90-minute fire-rated glazing; film-faced ceramic glazing.

1. Provide safety glazing labeling.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Minimum required face and edge clearances.

3. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.04 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.05 WINDOW INSERTS

A. Install window inserts on the interior side of existing windows per the manufacturers written instructions.

3.06 CLEANING AND PROTECTION

A. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

C. Wash glass on both exposed surfaces in each area of Project not more than 4 days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

08 90 00 LOUVERS AND VENTS

1.00 GENERAL

1.01 SUMMARY

A. This Section includes fixed, extruded-aluminum louvers.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and wind loads based on a uniform pressure of 20 lbf/sq. ft. (957 Pa), acting inward or outward, without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.

B. Thermal Movements: Provide louvers that allow for thermal movements resulting from a temperature change (range) of 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces, by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1.03 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

1. Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.
2. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Product test reports.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Louvers:
    a. Airline Products Co.
    b. Airolite Company (The).
    c. Construction Specialties, Inc.
    d. Greenheck.
    e. Ruskin Company; Tomkins PLC.

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005.

C. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.03 FABRICATION, GENERAL

A. Fabricate frames to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view.

2.04 COMBINATION, EXTRUDED-ALUMINUM LOUVERS

A. Dual-Blade, Drainable-Blade, Combination Louver: Fixed drainable blades and adjustable plain blades combined in single frame.

1. Basis-of-Design Product: Ruskin; extruded aluminum combination louver; ELC6375D or a comparable product.

2. Louver Depth: 6 inches (150 mm)

3. Performance Requirements:

a. Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) for 48-inch- (1.2-m-) wide by 48-inch- (1.2-m-) high louver.

b. Point of Beginning Water Penetration: Not less than 1000 fpm (5.1 m/s).

c. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 900-fpm (4.6-m/s) free-area velocity.

d. Air Leakage: Not more than 0.45 cfm per sq. ft. of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with adjustable louver blades closed.

4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

B. Electrical Operators:

1. Electrical operators shall have two (2) positions: power open, spring close, operating on a 120 volt control circuit.

2. Electrical operators shall be surface mounted near the louver with connecting rods and linkage exposed to the inside space.

2.05 LOUVER SCREENS

A. General: Provide screen at interior face of each exterior louver.

B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.

C. Louver Screening: Provide insect screen at louver openings.

1. Insect Screening: Stainless steel, 1/8-inch- (12.7-mm-) square mesh, 0.047-inch (1.19-mm) wire.

2.06 FINISHES

A. Aluminum, High-Performance Organic Finish: Two-coat thermocured system with fluoropolymer coats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

1. Color and Gloss: As selected by architect from manufacturer's full range.

3.00 EXECUTION

3.01 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

E. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

END OF SECTION

DIVISION 9
FINISHES

09 22 16 NON-STRUCTURAL METAL FRAMING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

1.04 INFORMATION SUBMITTALS

A. Evaluation Reports: For dimpled steel studs and runners**,** firestop tracks, from ICC-ES.

2.00 PRODUCTS

2.01 DESCRIPTION

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **25** percent.

D. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **25** percent.

E. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.

2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.
3. Studs and Runners: ASTM C645. Steel Studs and Runners:
    a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
    b. Depth: As indicated on Drawings.

F. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C645 top runner with 2-inch (51-mm) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    a. Products: Subject to compliance with requirements, provide one of the following:
        1). Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
        2). Steel Network Inc. (The); VertiTrack VTD Series.
        3). Superior Metal Trim; Superior Flex Track System (SFT).

G. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
    b. Grace Construction Products; FlameSafe FlowTrak System.
    c. Metal-Lite, Inc.; The System.

H. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).

I. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch (13-mm) wide flanges.
1. Depth: 1-1/2 inches (38 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch (1.72-mm) thick, galvanized steel.

J. Hat-Shaped, Rigid Furring Channels: ASTM C645.
1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
2. Depth: As indicated on Drawings.

K. Resilient Furring Channels: 1/2-inch (13-mm) deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

L. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch (13-mm) wide flanges.

1. Depth: 3/4 inch (19 mm).

2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).

3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch (1.59-mm) diameter wire, or double strand of 0.048-inch (1.21-mm) diameter wire.

2.02 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch (1.59-mm) diameter wire, or double strand of 0.048-inch (1.21-mm) diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to **5** times that imposed by construction as determined by testing according to ASTM E488 by an independent testing agency.

a. Post installed, chemical anchor or Post installed, expansion anchor.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch (13-mm) wide flanges.

1. Depth: 2-1/2 inches (64 mm).

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch (13-mm) wide flanges, 3/4 inch (19 mm) deep.

2. Steel Studs and Runners: ASTM C645.

a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).

b. Depth: As indicated on Drawings **or** 3-5/8 inches (92 mm).

3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch (22 mm) deep.

a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).

4. Resilient Furring Channels: 1/2-inch (13-mm) deep members designed to reduce sound transmission.

F. Configuration: Asymmetrical or hat shaped. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    b. Chicago Metallic Corporation; Drywall Grid System.
    c. USG Corporation; Drywall Suspension System.

2.03 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
    1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
    1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
B. Coordination with Sprayed Fire-Resistive Materials:

3.03 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.
    1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
C. Install bracing at terminations in assemblies.
D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.

b. Multilayer Application: 16 inches (406 mm)o.c. unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.

b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.

c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

D. Direct Furring:

1. Screw to wood framing.

2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

E. Z-Furring Members:

1. Erect insulation (specified in Section 07 21 00 “Thermal Insulation”) vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.

2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.05 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5. Do not attach hangers to steel roof deck.

6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

09 29 00 GYPSUM BOARD

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Interior gypsum board.

2. Texture finishes.

B. Related Requirements:

1. Section 09 22 16 “Non-Structural Metal Framing” for non-structural framing and suspension systems that support gypsum board panels.

2. Section 09 30 00 “Tiling” for cementitious backer units installed as substrates for ceramic tile.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

3. Product Data for Credit IEQ 4.1: For adhesives used to laminate gypsum board panels to substrates, documentation including printed statement of VOC content.

C. Samples: For the following products:

1. Trim Accessories: Full-size sample in 12-inch (300-mm) long length for each trim accessory indicated.

2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.04 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.

b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.

3. Simulate finished lighting conditions for review of mockups.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.02 GYPSUM BOARD, GENERAL

A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.
8. USG Corporation.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch (15.9 mm).

2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 5/8 inch (12.7 mm).

2. Long Edges: Tapered.

D. Abuse-Resistant Gypsum Board: ASTM C1629/C1629M, Level 2.

1. Core: 5/8 inch (15.9 mm), Type X.

2. Long Edges: Tapered.

3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

E. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or 1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:

a. C-Cure; C-Cure Board 990.

b. CertainTeed Corp.; FiberCement BackerBoard.

c. Custom Building Products; Wonderboard.

d. James Hardie Building Products, Inc.; Hardiebacker.

e. National Gypsum Company, Permabase Cement Board.

f. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch.

3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.04 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.

2. Shapes:

a. Cornerbead.

b. Bullnose bead.

c. LC-Bead: J-shaped; exposed long flange receives joint compound.

d. L-Bead: L-shaped; exposed long flange receives joint compound.

e. U-Bead: J-shaped; exposed short flange does not receive joint compound.

f. Expansion (control) joint.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.

2. Shapes:

a. Cornerbead.

b. LC-Bead: J-shaped; exposed long flange receives joint compound.

c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fry Reglet Corp.

b. Gordon, Inc.

c. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221 (ASTM B221M), Alloy 6063-T5.

3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.05 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.

4. Finish Coat: For third coat, use setting-type, sandable topping compound.

2.06 TEXTURE FINISHES

A. Primer: as recommended by texture manufacturer.

B. Non-Aggregate Finish: Pre-mixed, water-based texture finish for spray application.

1. Certain Teed Corporation

2. National gypsum Co.

3. United States Gypsum Co.

2.07 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer’s written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C1002, unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

E. Acoustical Joint Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.

b. Grabber Construction Products; Acoustical Sealant GSC.

c. Pecora Corporation.

d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.

e. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

G. Vapor Retarder: As specified in Section 07 21 00 "Thermal Insulation."

2.08 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Finish: Smooth.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.

2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch (6.4- to 9.5-mm) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch (6.4- to 12.7-mm) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.

2. Type X: Vertical surfaces unless otherwise indicated.

3. Ceiling Type: Ceiling surfaces.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to

framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.04 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.

2. LC-Bead: Use at exposed panel edges.

3. L-Bead: Use where indicated.

4. U-Bead: Use at exposed panel edges where indicated.

5. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.05 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in other Section 09 91 23 "Interior Painting."

3.06 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

4.00 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

09 30 00 TILING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Stone thresholds.
3. Waterproof membrane.
4. Crack isolation membrane.
5. Tile backing panels.
6. Metal edge strips.
7. Cove Base

B. Related Sections:

1. Section 07 92 00 “Joint Sealants” for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 09 29 00 “Gypsum Board” for cementitious backer units.

1.03 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in “American National Standard Specifications for Installation of Ceramic Tile.”

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.04 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the values as determined by testing identical products per ASTM C1028:

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

2. Product Data for Credit IEQ 4.3: For adhesives and grouts, documentation including printed statement of VOC content.

3. Product Data for Credit IEQ 4.3: For tile floors, documentation from an independent testing agency indicating compliance with the FloorScore Standard.

C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Samples for Initial Selection: For each type of tile and grout indicated. Include samples of accessories involving color selection.

E. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.

2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.

3. Full-size units of each type of trim and accessory for each color and finish required.

4. Stone thresholds in 6-inch (150-mm) lengths.

5. Metal edge strips in 6-inch (150-mm) lengths.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product, signed by product manufacturer.

D. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.08 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Stone thresholds.

2. Waterproof membrane.

3. Crack isolation membrane.

4. Joint sealants.

5. Cementitious backer units.

6. Metal edge strips.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.

2. Build mockup of each type of wall tile installation.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

2.00 PRODUCTS

2.01 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.

D. Low-Emitting Materials: Tile flooring systems shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved samples.

F. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

G. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.02 TILE PRODUCTS

A. Tile.

1. Basis-of-Design Product: Dal-Tile; Division of Dal-Tile International Inc. subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Olean; Division of Dal-Tile International Inc.

b. Crossville, Inc.

c. Dal-Tile; Division of Dal-Tile International Inc.

d. Interceramic.

e. Lone Star Ceramics Company.

2. Composition: refer to drawings

3. Module Size: refer to drawings.

4. Grout Color: As selected by Architect from manufacturer's full range.

5. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as required, selected from manufacturer's standard shapes.

2.03 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

B. Marble Thresholds: ASTM C503, with a minimum abrasion resistance of **12** per ASTM C1353 or ASTM C241 and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2. Description: Match Architect's sample.

2.04 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, in maximum lengths available to minimize end-to-end butt joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. C-Cure; C-Cure Board 990.

b. Custom Building Products; Wonderboard.

c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.

d. USG Corporation; DUROCK Cement Board.

2. Thickness: 1/2 inch (12.7 mm).

2.05 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Membrane: Basis of design.

1. Schluter® - KERDI

a. Description: 0.008” (8 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides, which meets or exceeds the requirements of the “American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10,” and is listed by cUPC®, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG 1204).

b. Waterproofing seaming membrane:

1). Provide Schluter® - KERDI-BAND Seams and Corners material 0.004” (4 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.

c. Waterproofing Accessories:

1). Provide Schluter® - KERDI-SEAL Mixing Valve seals.

2). Provide Schluter® - KERDI-SEAL pipe seals.

d. Sealing and Bonding Compound:

1). Provide Schluter® - KERDI-FIX.

2. Schluter® - KERDI-DS

a. Description: 0.20” (20 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides, which meets or exceeds the requirements of the “American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10,” and is listed by cUPC®, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG 1204).

b. Waterproofing seaming membrane:

1). Provide Schluter® - KERDI-BAND Seams and Corners material 0.004” (4 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.

c. Waterproofing Accessories:

1). Provide Schluter® - KERDI-SEAL Mixing Valve seals.

2). Provide Schluter® - KERDI-SEAL pipe seals.

2.06 CRACK ISOLATION MEMBRANE

A. General: Manufacturer’s standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc.; Durabond D-222 Duraguard Membrane.

b. C-Cure; Pro-Red Waterproofing Membrane 963.

c. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane.

d. Jamo Inc.; Waterproof.

e. Mer-Kote Products, Inc.; Fracture-Guard 5000.

f. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.

g. TEC; a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.

2.07 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D226, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils (0.1 mm) thick.

2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A185 and ASTM A82 except for minimum wire size.

3. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C847.

a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.

b. Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.

c. Configuration over Studs and Furring: Flat.

d. Configuration over Solid Surfaces: Self furring.

e. Weight: 2.5 lb./sq. yd. (1.4 kg/sq. m).

4. Latex Additive: Manufacturer’s standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed Portland cement and aggregate mortar bed.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Boiardi Products; a QEP company.

b. Bonsal American; an Oldcastle company.

c. Bostik, Inc.

d. C-Cure.

e. Custom Building Products.

f. Jamo Inc.

g. Laticrete International, Inc.

h. MAPEI Corporation.

i. Mer-Kote Products, Inc.

j. Southern Grouts & Mortars, Inc.

k. Summitville Tiles, Inc.

l. TEC; a subsidiary of H. B. Fuller Company.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

3. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to the other requirements in ANSI A118.4.

2.08 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

a. Boiardi Products; a QEP company.

b. Bonsal American; an Oldcastle company.

c. Bostik, Inc.

d. C-Cure.

e. Custom Building Products.

f. Jamo Inc.

g. Laticrete International, Inc.

h. MAPEI Corporation.

i. Southern Grouts & Mortars, Inc.

j. Summitville Tiles, Inc.

k. TEC; a subsidiary of H. B. Fuller Company.

2.09 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 07 92 00 “Joint Sealants.”

1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; Dow Corning 786.

b. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.

c. Laticrete International, Inc.; Latasil Tile & Stone Sealant.

d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.

e. Tremco Incorporated; Tremsil 600 White.

2.10 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, Portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A666, 300 Series exposed-edge material.

C. Cove Base

1. Basis of Design: Schluter Systems, Dilex HK, Cove Shape

D. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 F (49 to 60 C) per ASTM D87.

2. Grout release in form of manufacturer’s standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

F. Grout Sealer: Manufacturer’s standard product for sealing grout joints and that does not change color or appearance of grout.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bonsal American; an Oldcastle company; Grout Sealer.

b. Bostik, Inc.; CeramaSeal.

c. C-Cure; Penetrating Sealer 978.

d. Custom Building Products.

e. Jamo Inc.

f. MAPEI Corporation; KER.

g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.

h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

i. TEC; a subsidiary of H. B. Fuller Company.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.12 FLOOR DRAIN WITH INTEGRATED BONDING FLANGE

A. Schluter® - KERDI-DRAIN [Stainless Steel]

1. Description: stainless steel floor drain 9-27/32" (250 mm) diameter integrated bodning flange with no-hub outlet, and grate assembly. Grate assembly includes stainless steel grate, height adjustment, collar, and lateral adjustment ring with trapezoid perforations. Drain listed by UPC® to meet requirements of "International Association of Plumbing and Mechanical Officials Interim Guide Criteria for Floor Drain with Integrated Bonding Flange" (IGC 195), listed by CSA to meet requirements of the Canadian Standards Association standard, "Floor, Area, and Shower Drains, and Cleanouts for Residential Construction" (CSA B79), Drain type as referenced in methods B422, B422C and B422 STONE of the Tile Council of North America Handbook for Ceramic Tile Installation.

2. Drain Housing Material:

a. Stainless Steel

3. Grate Material and Finish:

a. E – Stainless Steel Type 304 = V2A

b. EOB – Oil-rubbed Bronze Stainless Steel Type 304 = V2A

c. ECS – Tileable covering support stainless steel Type 304 = V2A

d. ATGB – Brushed Nickel Anodized Aluminum

e. AKGB – Brushed Copper/Bronze Anodized Aluminum

f. AMGB – Brushed Brass Anodized Aluminum

4. Nominal Grate Size:

a. 4" (100 mm) x 4" (100 mm) square

b. 6” (150 mm) x 6” (150 mm) square

c. 6” (150 mm) round

5. Drain Outlet:

a. 2” (50 mm) outlet

b. 2” (50 mm) Threaded stainless steel outlet

2.13 LINEAR FLOOR DRAIN WITH OFFSET OUTLET (AT SHOWERS INDICATED ON PLAN)

A. Schluter® - KERDI-LINE DRAIN [Brushed Stainless Steel]

1. Description: Linear floor drain consisting of a formed stainless steel channel body and grate assembly that can be seamlessly adjusted to tile or stone covering thickness from 1/8 inch (3 mm) to 1 inch (25 mm). The channel body features a 2-1/4 inch (57 mm) wide trough, a 2 inch (50 mm) no-hub outlet and a 7/8 inch (22 mm) wide bonding flange laminated with a collar made of the Schluter-KERDI waterproofing membrane. Drain type as referenced in methods B422, B422C and B422 STONE in the Tile Council of North America Handbook for Ceramic, Glass, and Stone Tile Installation.

2. Channel Body and Grate Nominal Length:

a. 2-1/8" (54 mm) by 24" (60 cm) rectangle

3. Grate Frame Height:

a. 3/4" (19 mm)

4. Grate Material and Finish:

a. EB –Square Perforated Brushed Stainless Steel Type 304 =

5. Drain Outlet:

a. Offset (Refer plan layout for offset location)

6. Drain Grate Connector Plate:

a. EB – Brushed Stainless Steel Type 304 = V2A

2.14 PREFABRICATED SHOWER COMPONENTS

A. Schluter® - KERDI-SHOWER-ST

1. Description: trapezoid-imprinted, prefabricated, sloped tiled shower tray base, made of 2.75 lb/ft^3 (44 kg/m^3) density, self-extinguishing (HF-1 rating per UL-94) expanded polystyrene, with 12-5/16” (313 mm).

B. Schluter® - KERDI-SHOWER-LS (SHOWER TRAY WITH WALL DRAIN PLACEMENT)

1. Description: trapezoid-imprinted, prefabricated, sloped tiled shower tray base, made of 2.75 lb/ft3 (44 kg/m3) density, self-extinguishing (HF-1 rating per UL-94) expanded polystyrene, with removable recessed section and bonded Schluter-KERDI Membrane 0.008" (8 mil) thick, Project 09 30 00 - 37 Tiling which meets or exceeds the requirements of the American national standard specifications for load bearing, bonded,

waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10, and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG-1204). Drain type as referenced in methods B422, B422C and B422 STONE of the Tile Council of North America Handbook for Ceramic Tile Installation.

C. Schluter® -SHOWERPROFILE-WS

1. Description: two-part splashguard profile with a ¾" (19 mm) wide anodized aluminum support section and PVC insert that together form the visible surface between the tiled floors and walls.
2. Splashguard Insert:
    a. Semi-circular Lip

D. Schluter® - KERDI-BOARD-SN

1. Description: Prefabricated waterproof niche, constructed of rigid extruded polystyrene foam building element panel, with reinforcement material and polypropylene fleece webbing laminated on both sides for thin-set ceramic tile installations.
2. Nominal Niche Size:

    KB 12 SN 305 305 A – 12" by 12" by 3" (30 cm by 30 cm by 7.5 cm)

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, pre-coat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.03 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

a. Tile floors in wet areas.

b. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).

2. Paver Tile: 3/8 inch (9.5 mm).

3. Glazed Wall Tile: 1/16 inch (1.6 mm).

4. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-Portland cement mortar (thin set).

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

K. Grout Sealer: Apply grout sealer to grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.04 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-Portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.05 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.06 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.07 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-Portland cement grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.08 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Tile Installation F144: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA F144.

a. Thin-Set Mortar: Dry-set Portland cement mortar.

b. Grout: Standard sanded cement grout.

B. Interior Wall Installations, Metal Studs or Furring:

a. Thin-Set Mortar for Cured-Bed Method: Dry-set Portland cement mortar.

b. Grout: Standard sanded cement grout.

END OF SECTION

09 51 13 ACOUSTICAL PANEL CEILINGS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes

1. Acoustical panels.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.03 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pat-tern, and texture.

2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

D. Maintenance Data: For finishes to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.

2. Suspension System: Obtain each type through one source from a single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are en-closed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels in-dicated for Project when occupied for its intended use.

1.08 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

2.00 PRODUCTS

2.01 ACOUSTICAL PANELS, GENERAL

A. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 10 percent by weight.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

E. Antimicrobial Fungicide Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.02 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.

2. BPB USA

3. Chicago Metallic Corporation

4. Ecophon CertainTeed, Inc

5. Tectum Inc.

6. USG Interiors, Inc.

B. Basis-of-Design Product: ArmstrongF ine Fissured 1728 2x4. Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.

2. Pattern: C D.

C. Color: White

D. LR: Not less than 0.82

E. NRC: Not less than 0.55

F. CAC: Not less than 35.

G. Edge/Joint Detail:

1. Tile AC-1 Square

H. Thickness: 5/8 inch

2.03 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion anchors.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.

3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.

4. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.

E. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

2.04 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.

2. Chicago Metallic Corporation.

3. USG Interiors, Inc.

C. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude or a comparable product by one of the following:

D. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.

2. End Condition of Cross Runners: Butt-edge type.

3. Face Design: Flat, flush.

4. Cap Material: Steel cold-rolled sheet.

5. Cap Finish: Painted white

2.05 METAL EDGE MOLDINGS AND TRIM

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.

2. Chicago Metallic Corporation; USG Interiors, Inc.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude ML or a comparable product by one of the following:

C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.

2. For lay-in panels with reveal edge details, provide [stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

    1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

9. Do not attach hangers to steel deck tabs.

10. Do not attach hangers to steel roof deck. Attach hangers to structural members.

11. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.

b. Install panels with pattern running in one direction parallel to long axis of space.

c. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.

5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.04 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

09 51 13.1 FRP PANEL CEILINGS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes Fiberglass reinforced polyester panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

2. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.

C. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

D. Samples for Initial Selection: For components with factory-applied color finishes.

E. Samples for Verification: For each component indicated and for each exposed finish required, prepared on samples of size indicated below.

1. FRP Panel: Set of 6-inch (150-mm) square samples of each type, color, pattern, and texture.

2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch (150-mm) long samples of each type, finish, and color.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.

2. Structural members to which suspension systems will be attached.

3. Size and location of initial access modules for FRP panels.

4. Items penetrating finished ceiling including the following:

a. Lighting fixtures.

b. Air outlets and inlets.

c. Speakers.

d. Sprinklers.

e. Access panels.

5. Perimeter moldings.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each FRP panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. FRP Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.

2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical ceiling area as shown on Drawings.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver FRP panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing FRP panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle FRP panels carefully to avoid chipping edges or damaging units in any way.

1.09 FIELD CONDITIONS

A. Environmental Limitations: Do not install FRP panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning FRP panel ceiling installation.

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E1264 for or Class C materials.

2.02 CEILING PANELS, GENERAL

A. Source Limitations: Obtain each type of FRP ceiling panel and supporting suspension system from single source from single manufacturer.

B. Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns and lightcolor unless otherwise indicated.

C. Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, edge detail, and size.

2.03 FIBERGLASS REINFORCED POLYESTER (FRP) PANELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide FiberLite – FiberCorr by NUDO or comparable product by one of the following:

1. Crane Composites

2. FiberLite – FiberCorr by NUDO

3. Kal-lite

B. Classification: Provide fire-resistance-rated panels complying with ASTM D-5319 for FRP wall and ceiling panels as follows:

1. Type and Form: Smooth faced corrugated/fluted polyethylene core with FRP face double sided

2. E (lightly textured).

C. Color: White.

D. Edge/Joint Detail: Square.

E. Thickness: .400 inches.

F. Modular Size: 24 by 24 inches (610 by 610 mm.

2.04 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C6635M.

1. High-Humidity Finish: Comply with ASTM C6635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C6635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488 or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Post-installed expansion anchors.

b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

c. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.

d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B164 for UNS No. N04400 alloy.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A6641M, Class 1 zinc coating, soft temper.

2. Stainless-Steel Wire: ASTM A5580M, Type 304, nonmagnetic.

3. Nickel-Copper-Alloy Wire: ASTM B164, nickel-copper-alloy UNS No. N04400.

4. Size: Select wire diameter so its stress at three times hanger design load (ASTM C6635M, Table 1, “Direct Hung”) will be less than yield stress of wire, but provide not less than 0.135-inch (3.5-mm) diameter wire.

E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch (1-mm) thick, galvanized-steel sheet complying with ASTM A6653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch (8-mm) diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer’s standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer’s standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer’s standard seismic clips designed and spaced to secure panels in place.

I. Hold-Down Clips: Where indicated, provide manufacturer’s standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

2.05 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude Plus XL, 15/16” Exposed Tee System or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Chicago Metallic Corporation.
4. USG Interiors, Inc.; Subsidiary of USG Corporation.

C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A6653M, not less than G30 (Z90) coating designation; with prefinished 15/16-inch (24-mm) wide aluminum face, caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Aluminum.
5. Cap Finish: Painted white.

2.06 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Axiom – Class Trim, 6” high or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Chicago Metallic Corporation.
4. Fry Reglet Corporation.
5. Gordon, Inc.
6. USG Interiors, Inc.; Subsidiary of USG Corporation.

C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:

1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B221 (ASTM B221M) for Alloy and Temper 6063-T5.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
3. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C6635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of FRP panel ceilings.

B. Examine panels before installation. Reject FRP panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of FRP panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

A. General: Install FRP panel ceilings to comply with ASTM C6636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of ceiling area and where necessary to conceal edges of FRP panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned FRP panels as follows:
   a. As indicated on reflected ceiling plans.
   b. Install panels with pattern running in one direction parallel to long axis of space.
   c. Install panels in a basket-weave pattern.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by FRP panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.04 CLEANING

A. Clean exposed surfaces of FRP panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

09 65 13 RESILIENT BASE AND ACCESSORIES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

E. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Mockups: Provide resilient products with mockups specified in other Sections.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 F (10 C) or more than 90 F (32 C).

1.07 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 F (21 C) or more than 95 F (35 C), in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.

2. During installation.

3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 F (13 C) or more than 95 F (35 C).

C. Install resilient products after other finishing operations, including painting, have been completed.

2.00 PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base:

1. Basis-of-Design Product: Roppe subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Armstrong World Industries, Inc.

b. Burke Mercer Flooring Products; Division of Burke Industries, Inc.

c. Johnsonite.

d. Roppe Corporation, USA.

B. Resilient Base Standard: ASTM F1861.

1. Material Requirement: Type TS (rubber, vulcanized thermoset).

2. Manufacturing Method: Group I (solid, homogeneous).

3. Style: Straight (flat or toeless).

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Finish: As selected by Architect from manufacturer's full range.

I. Colors and Patterns: As selected by Architect from full range of industry colors.

2.02 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

B. Basis-of-Design Product:

1. Roppe subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.

b. Flexco, Inc.

c. Johnsonite.

d. R.C.A. Rubber Company (The).

e. Roppe Corporation, USA.

f. VPI, LLC; Floor Products Division.

C. Description: Transition strips.

D. Material: Vinyl.

E. Profile and Dimensions: As indicated.

F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.03 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
    a. Perform anhydrous calcium chloride test, ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Perform relative humidity test using in situ probes, ASTM F2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 RESILIENT BASE INSTALLATION

A. Comply with manufacturer’s written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer’s recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

3.04 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and other floor covering**s** that would otherwise be exposed.

3.05 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.

3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION

09 65 19 RESILIENT TILE FLOORING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Vinyl composition floor tile (VCT-1)
2. Vinyl composition anti-static tile (SDT) (VCT-2).

B. Related Sections:

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives, sealants, and chemical-bonding compounds, documentation including printed statement of VOC content.
2. Product Data for Credit IEQ 4.3: For adhesives and chemical-bonding compounds, documentation including printed statement of VOC content.
3. Product Data for Credit IEQ 4.3: For resilient tile flooring, documentation from an independent testing agency indicating compliance with the FloorScore Standard.

C. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.06 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for floor tile including resilient base and accessories.

a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations directed by Architect.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 F (10 C) or more than 90 F (32 C). Store floor tiles on flat surfaces.

1.09 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 F (21 C) or more than 95 F (35 C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.

2. During installation.

3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 F (13 C) or more than 95 F (35 C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.10 Warranty: limited 5-year Commercial Flooring Product Warranty

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Floor Score Compliance: Resilient tile flooring shall comply with requirements of FloorScore Standard.

B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.02 VINYL COMPOSITION FLOOR TILE: VCT -1

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. AB ColorPlus, American Biltrite (Canada) Ltd;
2. Armstrong World Industries, Inc;
3. Congoleum Corporation.

B. Tile Standard: ASTM F1066, Class 2, through-pattern tile.

C. Wearing Surface: Meets ADA slip requirements.

D. Thickness: 0.125 inch (3.2 mm).

E. Size: 12 by 12 inches (305 by 305 mm).

F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.03 VINYL COMPOSITION FLOOR TILE, (SDT) VCT-2

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Static Dissipative (SDT) Excelon Vinyl Composition tile or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. Congoleum Corporation; Mannington Mills, Inc.
3. Tarkett, Inc.; Tile Standard: ASTM F1066, Class 1, solid-color tile

B. Wearing Surface: Smooth.

C. Thickness: 0.125 inch (3.2 mm).

D. Size: 12 by 12 inches (305 by 305 mm).

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.04 INSTALLATION MATERIALS: VCT-1

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

1. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match floor tile.

D. Sealers and Finish Coats for Resilient Terrazzo Floor Tile: Premium-type products as recommended by manufacturer for resilient terrazzo floor tile.

2.05 INSTALLATION MATERIALS (SDT) VCT-2

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Coper ground strips as recommended by tile manufacturer.

C. Adhesives: SDT adhesive type recommended by manufacturer to suit floor tile and substrate conditions indicated and maintain conductivity.

1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

D. Polish: Armstrong S-392 Static Dissipative Tile Polish on SDT.

E. Electrical Properties:

1. Installed as a system using the required adhesive, grounding strips and polish, SDT yields the following electrical properties:

a. Resistance: ANSI / ESD-S7.1 and ASTM F-150

b. Point to point and point to ground: 10^6 to 10^9 ohms

c. Static Generation: ANSI / ESD STM 97.2 (flooring in combination with footwear and a person)

1). at 40% R.H. with ESD shoes: <10 volts

2). at 12% R.H. with ESD shoes: <10 volts

d. Static Dissipation at 12% R.H.: Flooring in combination with a person wearing dissipative foot ware:

1). 1000 to 100 volts: 0.2 seconds avg.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion and grounding of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

a. Perform anhydrous calcium chloride test, ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

b. Perform relative humidity test using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Ground with copper strips per manufacturers written instructions. Ground to steel columns as required.

C. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

D. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated.

E. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

F. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.

3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

E. Polish floors with SDT polish as recommended by manufacturer for VCT-2 tiles and polish as recommended for VCT-1 tiles.

END OF SECTION

09 91 00 ARCHITECTURAL PAINTING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color or finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Finished mechanical and electrical equipment.

b. Light fixtures.

c. Overhead coiling door

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Furred areas.

b. Ceiling plenums.

c. Utility tunnels.

d. Duct shafts.

3. Finished metal surfaces include the following:

a. Anodized aluminum.

b. Stainless steel.

c. Galvanized metal.

4. Operating parts include moving parts of operating equipment and the following:
    a. Valve and damper operators.
    b. Linkages.
    c. Sensing devices.
    d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
2. Division 9 Section "Protective Coatings" for industrial paints and maintenance and for special coatings.

1.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.04 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.
1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
3. Manufactures standard color selection chart or packet of color chips.
4. A pretreatment and coating plan for galvanized items required to be painted shall be submitted for approval. The plan shall include a description of the pretreatment method, the time after galvanizing that pretreatment will occur and the location of the item during pretreatment

B. Samples for Initial Selection: For each type of finish-coat material indicated.
1. After color selection, Architect will return selected color chips for surfaces to be coated.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Notice of galvanized surface pretreatment operations shall be given to the Architect at least 48 hours in advance. Reasonable access to facilities where pretreatment occurs shall be provided to the Architect.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.07 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Benjamin Moore & Co. (Benjamin Moore).
2. Coronado Paint Company (Coronado).
3. ICI Dulux Paint Centers (ICI Dulux Paints).
4. Kelly-Moore Paint Co. (Kelly-Moore).
5. PPG Industries, Inc. (Pittsburgh Paints).
6. Sherwin-Williams Co. (Sherwin-Williams).

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: As selected by Architect from manufacturer's full range.

2.03 CONCRETE UNIT MASONRY BLOCK FILLERS

A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.

1. Benjamin Moore; Moorcraft Super Craft Latex Block Filler No. 285: Applied at a dry film thickness of not less than 8.1 mils (0.206 mm).
2. Benjamin Moore; Moore's IMC Latex Block Filler No. M88: Applied at a dry film thickness of not less than 8.1 mils (0.206 mm).
3. Coronado; 946-11 Super Kote 5000 Commercial Latex Block Filler: Applied at a dry film thickness of not less than 8.4 mils (0.214 mm).
4. ICI Dulux Paints; Bloxfil 4000-1000 Interior/Exterior Heavy Duty Acrylic Block Filler: Applied at a dry film thickness of not less than 7.0 to 14.5 mils (0.178 to 0.368 mm).

5. Kelly-Moore; 521 Fill and Prime Acrylic Block Filler: Applied at a dry film thickness of not less than 10.0 mils (0.254 mm).
6. M. A. B. Paint; Block Kote No. 1000 Acrylic Latex Block Filler 064-145: Applied at a dry film thickness of not less than 12.0 mils (0.305 mm).
7. Pittsburgh Paints; 6-7 SpeedHide Interior/Exterior Masonry Latex Block Filler: Applied at a dry film thickness of not less than 6.0 to 12.5 mils (0.152 to 0.318 mm).
8. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils (0.203 mm).

2.04 EXTERIOR PRIMERS

A. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.
   1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
   2. Coronado; 36-11 Rust Scat Latex Metal Primer: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
   3. ICI Dulux Paints; 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
   4. ICI Dulux Paints; 4160-XXXX Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
   5. Kelly-Moore; 1722 Kel-Guard Acrylic Galvanized Iron Primer: Applied at a dry film thickness of not less than 1.8 mils (0.046 mm).
   6. Kelly-Moore; 5725 DTM-Acrylic Metal Primer: Applied at a dry film thickness of not less than 1.8 mils (0.046 mm).
   7. M. A. B. Paint; Rust-O-Lastic Hydro-Prime II Acrylic (DTM) Maintenance Primer 073-189: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
   8. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
   9. Sherwin-Williams; primer not required over this substrate.
   10. Sherwin-Williams; Galvite HS Paint B50WZ3: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

B. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
   1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
   2. Coronado; 35-147 Rust Scat Alkyd Metal Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
   3. ICI Dulux Paints; 4160-XXXX Devguard Multi-Purpose Tank & Structural Primer. Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

4. Kelly-Moore; 1711 Kel-Guard Alkyd White Rust Inhibitive Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
5. Kelly-Moore; 5725 DTM-Acrylic Metal Primer: Applied at a dry film thickness of not less than 1.8 mils (0.048 mm).
6. M. A. B. Paint; Rust-O-Lastic Anti-Corrosive Primer 073-132: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
7. Pittsburgh Paints; 90-712 Pitt-Tech One Pack Interior/Exterior Primer Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
8. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

2.05 INTERIOR PRIMERS

A. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.
   1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
   2. Coronado; 40-11 Super Kote 5000 Latex Primer-Sealer: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
   3. ICI Dulux Paints; 3030-1200 Bond-Prep Interior/Exterior Waterborne Pigmented Bonding Primer: Applied at a dry film thickness of not less than 1.8 mils (0.046 mm).
   4. Kelly-Moore; 971 Acry-Prime Interior Latex Primer/Sealer: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
   5. M. A. B. Paint; Fresh Kote Vinyl Primer 037-100: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
   6. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
   7. Sherwin-Williams; PrepRite Masonry Primer B28W300: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

B. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
   1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
   2. Coronado; 35-147 Rust Scat Alkyd Metal Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
   3. ICI Dulux Paints; 4130-6130 Devshield Rust Penetrating Metal Primer: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
   4. ICI Dulux Paints; 4160-6130 Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
   5. Kelly-Moore; 1711 Kel-Guard Alkyd White Rust Inhibitive Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

6. M. A. B. Paint; Rust-O-Lastic Anti-Corrosive Primer 073-132: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
7. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
8. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

2.06 EXTERIOR FINISH COATS

A. Exterior Full-Gloss Alkyd Enamel: Factory-formulated full-gloss alkyd enamel for exterior application.

1. Benjamin Moore; Moore's IMC Urethane Alkyd Enamel M22: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. Coronado; 1223 Line Super Kote 5000 High Gloss Alkyd Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
3. ICI Dulux Paints; 4308-XXXX Devguard Alkyd Industrial Gloss Enamel: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
4. Kelly-Moore; 1700 Kel-Guard Gloss Alkyd Rust Inhibitive Enamel: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
5. M. A. B. Paint; Rust-O-Lastic Finish Coating 074 Line: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
6. Pittsburgh Paints; 7-814 Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
7. Sherwin-Williams; Industrial Enamel B-54 Series: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

2.07 INTERIOR FINISH COATS

A. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.

1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
2. Coronado; 30-Line Super Kote 5000 Latex Eggshell Enamel: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
3. ICI Dulux Paints; 1402-XXXX Dulux Professional Acrylic Eggshell Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
4. Kelly-Moore; 1610 Sat-N-Sheen Interior Latex Low Sheen Wall and Trim Finish: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
5. Kelly-Moore; 1686 Dura-Poxy Eggshell Acrylic Enamel: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
6. M. A. B. Paint; Fresh Kote Latex Satin Eggshell Enamel 405 Line: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).

7. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils (0.032 mm).
8. Sherwin-Williams; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

B. Interior Semigloss Alkyd Enamel: Factory-formulated semigloss alkyd enamel for interior application.

1. Benjamin Moore; Moorcraft Super Spec Alkyd Semi-Gloss Enamel No. 271: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
2. Coronado; 27-Line Super Kote 5000 Alkyd Semi-Gloss Enamel: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
3. ICI Dulux Paints; 1516-XXXX Ultra-Hide Alkyd Semi-Gloss Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.7 mils (0.043 mm).
4. Kelly-Moore; 1630--Kel-Cote Interior Alkyd Semi-Gloss Enamel: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
5. M. A. B. Paint; Fresh Kote Semi-Gloss 403 Line: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
6. Pittsburgh Paints; 6-1110 Series SpeedHide Interior Enamel Wall & Trim Semi-Gloss Oil: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
7. Sherwin-Williams; ProMar 200 Interior Alkyd Semi-Gloss Enamel B34W200 Series: Applied at a dry film thickness of not less than 1.7 mils (0.043 mm).

C. Interior Ferrous-Metal Zinc Rich: For Hollow Metal doors.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.

b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

4. Galvanized Surfaces:

a. Pretreat galvanized surfaces by one of the following methods:

1). Phosphating: Apply a phosphate-containing solution to form a non-reactive zinc phosphate layer on the surface.

2). Sweep Blasting: Provide a light blast cleaning intended to remove zinc oxides on the surface and roughen it without significant removal of the galvanizing. Sweep blasting should be performed with soft abrasives. Use an abrasive with a Moh’s scale hardness of 5 or less. The particle size should be in the range of 8 to 20 mils.

b. Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Repair factory finish of doors on tops, bottoms, and side edges the same as faces.
9. Sand lightly between each succeeding coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items indicated on drawings and as listed below.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
2. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
3. Mechanical equipment that is indicated for field painting.

G. Electrical items to be painted include, but are not limited to, the following:

1. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.05 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.06 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Semi-Gloss Alkyd-Enamel Finish: Two finish coats over a rust-inhibitive primer.

a. Primer: Exterior ferrous-metal primer.

b. Finish Coats: Exterior full-gloss alkyd enamel.

3.07 INTERIOR PAINT SCHEDULE

A. Concrete and concrete masonry units overhead: Provide the following system:

1. Primer: acrylic-latex interior primer.

2. Finish coats: 2 finish coats of egg shell acrylic-latex interior paint

B. Concrete Unit Masonry (Other than intergral color Concrete Masonry Units): Provide the following finish systems over interior concrete masonry:

1. Low Luster Acrylic Finish: Two finish coats over a block filler.

a. Block Filler: Concrete unit masonry block filler.

b. Finish Coats: Interior egg shell low luster acrylic paint.

C. Gypsum Board:

1. Low-Luster Acrylic Enamel Acrylic Finish: Two finish coats finish coats over a primer.
    a. Primer: A. Interior Gypsum Board Primer
    b. Finish Coats: Interior egg shell acrylic paint.

D. Ferrous Metal: Provide the following finish systems over ferrous metal:
    1. Semigloss Alkyd-Enamel Finish: Two finish coats over a primer.
        a. Primer: Interior ferrous-metal primer.
        b. Finish Coats: Interior semigloss alkyd enamel.

E. All-Service Jacket over Insulation: Provide the following finish system on cotton or canvas insulation covering:
    1. Flat Acrylic Finish: Two finish coats. Add fungicidal agent to render fabric mildew proof.
        a. Finish Coats: Interior flat latex-emulsion.

END OF SECTION

DIVISION 10
SPECIALTIES

10 21 13 TOILET COMPARTMENTS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Solid polymer units toilet compartments configured as toilet enclosures, entrance screens and urinal screens.

B. Related Sections:

1. Section 05 50 00 “Metal Fabrications” for supports that attach floor-anchored compartments to overhead structural system.
2. Section 06 10 00 “Rough Carpentry” for overhead support of floor-anchored compartments.
3. Section 10 28 00 “Toilet, Bath, and Laundry Accessories” for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of cutouts for compartment-mounted toilet accessories.
2. Show locations of reinforcements for compartment-mounted grab bars.
3. Show locations of centerlines of toilet fixtures.
4. Show overhead support or bracing locations.

C. Samples for Initial Selection: For each type of unit indicated. Include samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer’s standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for units, prepared on 6-inch (152-mm) square samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 200 or less.

2. Smoke-Developed Index: 450 or less.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities", 2012 TAS and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

2.00 PRODUCTS

2.01 MATERIALS

A. Aluminum Castings: ASTM B26M.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M).

C. Stainless-Steel Sheet: ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless-Steel Castings: ASTM A7743M.

E. Adhesives: Manufacturer's standard product that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.02 SOLID-POLYMER UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Metpar solid HDPE systems or comparable product by one of the following:

1. Accurate Partitions Corporation.

2. American Sanitary Partition Corporation.

3. Ampco, Inc.

4. Bobrick Washroom Equipment, Inc.

5. Bradley Corporation; Mills Partitions.
6. Flush Metal Partition Corp.
7. General Partitions Mfg. Corp.
8. Global Steel Products Corp.
9. Knickerbocker Partition Corporation.
10. Metpar Corp.
11. Partition Systems Incorporated of South Carolina.
12. Rockville Partitions Incorporated.
13. Sanymetal; a Crane Plumbing company.
14. Shanahan's Limited.
15. Tex-Lam Manufacturing, Inc.
16. Weis-Robart Partitions, Inc.
17. Young Group Ltd. (The); Fabricated Products Division; DesignRite Partitions.

B. Toilet-Enclosure Style: Overhead braced and Floor anchored.

C. Entrance-Screen Style: Overhead braced and Floor anchored.

D. Urinal-Screen Style: Wall hung floor braced.

E. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: Metpar SP510 Pale Green.

F. Pilaster Shoes: Fabricated from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

G. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.03 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Clear-anodized aluminum and Stainless steel .
2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors and entrance-screen doors.
5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.04 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch (610-mm) wide, in-swinging doors for standard toilet compartments and 36-inch (914-mm) wide, out-swinging doors with a minimum 32-inch (813-mm) wide, clear opening for compartments designated as accessible.

3.00 EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:
   a. Pilasters and Panels: 1/2 inch (13 mm).
   b. Panels and Walls: 1 inch (25 mm).
2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than **t**hree brackets attached at midpoint and near top and bottom of panel.
   a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
   b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.02 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION

10 22 13 WIRE MESH PARTITIONS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Heavy-duty wire mesh partitions.

1.03 DEFINITIONS

A. As defined in ASTM E2016:

1. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.

2. Lock Crimp: Deep crimps at points of the intersection that lock wires securely in place.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design wire mesh units, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Wire mesh units shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7:

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 F (67 C), ambient; 180 F (100 C), material surfaces.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wire mesh items.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include clearances required for operation of doors.

C. Setting Drawings: For anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: 12-by-12-inch (300-by-300-mm) panel constructed of specified frame members and wire mesh. Show method of finishing members at intersections.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Welding certificates.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wire mesh unit hardware to include in maintenance manuals.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Locks: Equal to 5 percent of amount installed for each type indicated.

1.09 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1. Installer's responsibilities include fabricating and installing wire mesh items and providing professional engineering services needed to assume engineering responsibility.

2. Engineering Responsibility: Preparation of data for wire mesh items, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain wire mesh items from single source from single manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Preinstallation Conference: Conduct conference at Project site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire mesh items crated to provide protection during transit and Project-site storage. Use vented plastic.

B. Inventory wire mesh partition door hardware on receipt and provide secure lockup for wire mesh partition door hardware delivered to Project site.

1. Tag each item or package separately with identification and include basic installation instructions with each item or package.

C. Deliver keys to Owner by registered mail or overnight package service**.**

1.11 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with wire mesh units by field measurements before fabrication.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acorn Wire & Iron Works, Inc.
2. American Woven Wire Corporation.
3. California Wire Products Corporation.
4. Central Wire and Iron.
5. Donaldson, R. J., Inc.
6. Folding Guard Corporation.
7. G-S Company (The).
8. Indiana Wire Products, Inc.
9. Jesco Industries, Inc.
10. Kenco Wire and Iron Products Inc.
11. Kentucky Metal Products Co.
12. King Wire Partitions, Inc.
13. Lakeside Wire and Iron Company.
14. Miller Wire Works, Inc.
15. Newark Wire Works Inc.
16. Standard Wire & Steel Works.
17. Wire Crafters, LLC.

2.02 MATERIALS

A. Steel Wire: ASTM A510 (ASTM A510M).

B. Steel Plates, Channels, Angles, and Bars: ASTM A36M.

C. Cold-Rolled Steel Sheet: ASTM A101008M, Commercial Steel (CS), Type B.

D. Steel Pipe: ASTM A53M, Schedule 40 unless another weight is indicated or required by structural loads.

E. Square Steel Tubing: ASTM A500, cold-formed structural-steel tubing.

F. Metallic-Coated Steel Sheet: ASTM A6653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.

G. Panel-to-Panel Fasteners: Manufacturer's standard tamper-proof steel bolts, nuts, and washers.

H. Post installed Expansion Anchors: Tamper-proof with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.

1. Stainless Steel: ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Alloy Group 1 or 4), for bolts and nuts; ASTM A276 or ASTM A666, Type 304 or 316, for anchors.

2. For Post installed Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.

3. For Post installed Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

I. Power-Actuated Fasteners in Concrete: Tamper-proof fastener system of type suitable for application indicated and fabricated from corrosion-resistant materials; with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by wire mesh construction, as determined by testing per ASTM E1190, conducted by a qualified testing and inspecting agency.

J. Seismic Bracing: Angles with legs not less than 1-1/4 inch (32 mm) wide, formed from 0.04-inch (1-mm) thick, metallic-coated steel sheet; with bolted connections and 1/4-inch (6-mm) diameter bolts.

K. Zinc-Rich Primer: Compatible with topcoat, complying with SSPC-Paint 20 or SSPC-Paint 29.

2.03 HEAVY-DUTY WIRE MESH PARTITIONS

A. Mesh: 0.192-inch (4.8-mm) diameter, intermediate-crimp steel wire woven into 2-inch (50-mm) diamond mesh.

B. Vertical and Horizontal Panel Framing: 1-1/2-by-3/4-by-1/4-inch (38-by-19-by-6-mm) cold-rolled steel channels; with 3/8-inch (9.5-mm) diameter bolt holes spaced not more than 18 inches (450 mm) o.c. along center of framing. Provide vertical panel stiffeners in shapes and sizes as recommended by manufacturers.

C. Horizontal Panel Stiffeners: Two cold-rolled steel channels, not less than 1 by 1/2 by 1/8 inch (25 by 13 by 3 mm), bolted or riveted toe to toe through mesh or1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3-mm) cold-rolled steel channels with wire woven through.

D. Top Capping Bars: 3-inch-by-4.1-lb. (76-mm-by-1.9-kg) hot-rolled steel channels.

E. Posts for 90-Degree Corners: 2-by-2-by-1/8-inch (50-by-50-by-3-mm) steel angles with 3/8-inch (9.5-mm) diameter bolt holes aligning with bolt holes in vertical framing; with floor anchor clips.

F. Posts for Other-Than-90-Degree Corners: Manufacturer's standard steel 2-inch (50-mm) OD pipe or tubing with 3/8-inch (9.5-mm) diameter bolt holes aligning with bolt holes in vertical framing.

G. Adjustable Corner Posts: 2, manufacturer's standard steel pipe or tubing posts connected by steel hinges at 36 inches (900 mm) o.c. attached to posts; with 1/4-inch (6-mm) diameter bolt holes aligning with bolt holes in vertical framing.

H. Line Posts: 3-inch-by-4.1-lb. (76-mm-by-1.9 kg) or 3-1/2-by-1-1/4-by-0.1265-inch (89-by-32-by-3.2-mm) steel channels; with 5-by-18-by-1/4-inch (125-by-450-by-6-mm) steel base plates punched for attachment to floor.

I. Three-and Four-Way Intersection Posts: 2-by-2-inch (50-by-50-mm) tubular steel, with 3/8-inch (9.5-mm) diameter bolt holes aligned for bolting to adjacent panels.

J. Floor Shoes: Steel, cast iron, or cast aluminum, not less than 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.

K. Sliding Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3.2-mm) steel channels, banded with 1-1/2-by-1/8-inch (38-by-3.2-mm) flat steel bar cover plates on four sides.

   1. Hardware: Two, four-wheel roller-bearing carriers, box track, and bottom guide channel for each door.

   2. Padlock Lug: Mortised into door framing and enclosed with steel cover.

L. Finish: Hot-dipped galvanized.

2.04 FABRICATION

A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-sized components as recommended by wire mesh item manufacturer. As required for complete installation, provide bolts, hardware, and accessories with manufacturer's standard finishes.

1. Fabricate wire mesh items to be readily disassembled.

2. Welding: Weld corner joints of framing and grind smooth, leaving no evidence of joint.

B. Heavy-Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.

1. Mesh: Securely clinch mesh to framing.

2. Framing: Fabricate framing with mortise and tenon corner construction.

a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.

b. Fabricate three-and four- way intersections using intersection posts.

c. Fabricate partition and door framing with slotted holes for connecting adjacent panels.

3. Fabricate wire mesh partitions with bottom horizontal framing flush with finished floor.

4. Doors: Align bottom of door with bottom of adjacent panels.

a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.

5. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

2.05 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.06 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A1123M, for galvanizing steel and iron components.

2. ASTM A1153M, for galvanizing steel and iron hardware.

3. Preparation for Shop Priming: After galvanizing, thoroughly clean wire mesh components of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Interiors (SSPC Zone 1A): SSPC-SP 3, “Power Tool Cleaning.”

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, “Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel,” for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

D. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer’s standard two-coat, baked-on finish, suitable for use indicated, consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat.

1. Color and Gloss: As selected by Architect from manufacturer’s full range.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine floors for suitable conditions where wire mesh items will be installed.

C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 WIRE MESH PARTITIONS ERECTION

A. Wire mesh partitions are to extend from floor to bottom of deck above with framing around structure.

B. Anchor wire mesh partitions to floor with 3/8-inch (9.5-mm) diameter, post installed expansion anchors at 12 inches (305 mm) o.c. through anchor clips located at each post and corner. Shim anchor clips as required to achieve level and plumb installation.

   1. Anchors may be set with power-actuated fasteners instead of post installed expansion anchors if indicated on Shop Drawings.

C. Anchor wire mesh partitions to floor with 3/8-inch (9.5-mm) diameter, post installed expansion anchors at 12 inches (305 mm) o.c. through floor shoes located at each post and corner. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.

   1. Anchors may be set with power-actuated fasteners instead of post installed expansion anchors if indicated on Shop Drawings.

D. Anchor wire mesh partitions to walls at 12 inches (305 mm) o.c. through back corner panel framing and as follows:

   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

   2. For hollow masonry anchorage, use toggle bolts.

   3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

   4. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

   5. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

E. Secure top capping bars to top framing channels with 1/4-inch (6-mm) diameter “U” bolts spaced not more than 28 inches (700 mm) o.c.

F. Provide line posts at locations indicated or, if not indicated, as follows:

   1. On each side of sliding door openings.

   2. For partitions that are 7 to 9 feet (2.1 to 2.7 m) high, spaced at 15 to 20 feet (4.6 to 6.1 m) o.c.

   3. For partitions that are 10 to 12 feet (3.0 to 3.7 m) high, located between every other panel.

   4. For partitions that are more than 12 feet (3.7 m) high, located between each panel.

G. Provide seismic supports and bracing as indicated or, if not indicated, as recommended by manufacturer and as required for stability, extending and fastening members to supporting structure.

H. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.

I. Install doors complete with door hardware.

J. Install service windows complete with window hardware.

K. Weld or bolt sheet metal bases to wire mesh partitions and doors where indicated.

L. Bolt accessories to wire mesh partition framing.

3.03 ADJUSTING AND CLEANING

A. Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Remove and replace defective work including doors and framing that are warped, bowed, or otherwise unacceptable.

C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

10 26 00 WALL AND DOOR PROTECTION

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Corner guards.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.

2. Keep plastic materials out of direct sunlight.

3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

a. Store corner-guards in a vertical position.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain wall- protection products from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 450 or less.

2.03 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards: Basis of design Koffler Sales Company Stainless Steel Corner guards - #A674, 2 1/2” x 2 1/2” x 4 foot. Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Babcock-Davis
2. Balco, Inc
3. Koffler Sales Company
4. Wall Guard.com
5. Material: Stainless-steel sheet, Type 304.
    a. Thickness: Minimum 16 gauge .
    b. Finish: Directional satin, No. 4
6. Wing Size: 2-1/2 by 2-1/2 inches.
7. Corner Radius: 1/8 inch (3 mm).
8. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

2.04 MATERIALS

A. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

B. Adhesive: As recommended by protection product manufacturer.

2.05 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.06 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Complete finishing operations, including painting, before installing wall protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.03 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

3.04 CLEANING

A. Immediately after completion of installation, clean using a standard cleaning agent as recommended by the manufacturer.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

10 28 00 TOILET AND BATH ACCESSORIES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.

2. Warm-air dryers.

3. Custodial accessories.

B. Related Sections:

1. Section 09 30 00 “Tiling” for ceramic toilet and bath accessories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.

2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

3. Material and finish descriptions.

4. Features that will be included for Project.

5. Manufacturer’s warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

1. Approved full-size samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.

2. Identify products using designations indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.07 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.08 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

2.00 PRODUCTS

2.01 MATERIALS

A. Stainless Steel: ASTM A666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A101008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A6653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A1153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.02 PUBLIC-USE WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
6. Tubular Specialties Manufacturing, Inc.
7. Georgia-Pacific Professional.

B. Toilet Tissue (Roll) Dispenser- TTD:

1. Basis-of-Design Product: Model B-2840, by Bobrick.
2. Description: Double-roll dispenser.
3. Mounting: Surface mounted.
4. Operation: Non-control delivery.
5. Capacity: Designed for 5-inch (127-mm) diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Grab Bar- GB:

1. Basis-of-Design Product: 6806 Series by Bobrick.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
    a. Finish: Smooth, No. 4 finish (satin).
4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings.

D. Robe Hook- RH:

1. Basis-of-Design Product: Heavy-Duty Clothes Hook.
2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Towel Pin- TP

1. Basis-of-Design Product: Towel Pin No. B-677 by Bobrick
2. Description: Single prong
3. Material and finish: Stainless steel No. 4 finish

F. Mirror Unit- FMR:

1. Basis-of-Design Product: Mirror with Stainless Steel Channel Frame, Model B-165 Series.
2. Frame: Stainless-steel channel.
    a. Corners: Mitered and mechanically interlocked.
    b. Wall bracket of galvanized steel, equipped with concealed locking devices.
    c. Size: As indicated on Drawings.

G. Mirror Unit- FMR:

1. Basis-of-Design Product: Mirror with Stainless Steel Channel Frame, Model B-165 2460 Series.
2. Frame: Stainless-steel channel.
    a. Corners: Mitered and mechanically interlocked.
    b. Wall bracket of galvanized steel, equipped with concealed locking devices.
    c. Size: As indicated on Drawings.

H. ADA Compliant Folding Shower Seat:

1. Basis-of-Design Product: Bradly Folding Reversible Shower Seat, Model 9594
2. Frame: Stainless-steel; 18 gauge, 1-inch diameter tubing.
    a. Seat: 1-inch thick high-density polyethylene.
    b. Mounting flanges: 7 gauge stainless-steel.

c. Lower support bracket: 16 gauge stainless-steel

d. Size: 34.5-inch (876-mm) by 22-inch (559-mm).

2.03 WARM-AIR DRYERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following

B. Basis-of-Design Product: Product: Dyson Airblade V. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

C. American Dryer, Inc.

D. American Specialties, Inc.

E. Bobrick Washroom Equipment, Inc.

F. Bradley Corporation.

G. Excel Dryer Corporation.

H. World Dryer Corporation.

I. Warm-Air Dryer Insert drawing designation: HD

J. Dyson Airblade V.

K. Mounting: Surface mounted.

L. Operation: Electronic-sensor activated with timed power cut-off switch.

M. Operation Time: 30 seconds.

N. Cover Material and Finish: Molded plastic, white.

O. Electrical Requirements: 115 V, 13 A, 1500 W.

2.04 CUSTODIAL ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. A & J Washroom Accessories, Inc.

2. American Specialties, Inc.

3. Bobrick Washroom Equipment, Inc.

4. Bradley Corporation.

5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

6. Tubular Specialties Manufacturing, Inc.

7. Stern-Williams Co., Inc.

C. Mop and Broom Holder **-** MH:

1. Basis-of-Design Product: Model T-40 by Stern-Williams.

2. Description: Unit with holders.

3. Length: 24 inches.

4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.

5. Material and Finish: Stainless steel, No. 4 finish (satin).

2.05 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

3.00 EXECUTION

3.01 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F446.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

10 43 10 SIGNS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Panel signs.

2. Dimensional characters.
3. Signage accessories.

B. Related Sections include the following:

1. Division 15 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.

2. Division 16 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.

3. Division 16 Section "Interior Lighting" for illuminated exit signs.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

C. Samples for Verification: For each type of sign, include the following Samples to verify color selected:

1. Panel Signs: Full-size Samples of each type of sign required.

2. Approved samples will be returned for installation into Project.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each sign type through one source from a single manufacturer.

B. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions of the Texas Department of Licensing and Regulation (Texas Accessibility Standards).

1.05 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.02 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

C. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

2.03 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

B. Available Manufacturers:

1. Takeform Architecural Graphics

2. American Graphics Inc.

3. Andco Industries Corp.
4. APCO Graphics, Inc.
5. ASI Sign Systems, Inc.
6. Best Manufacturing Co.
7. Multi-graphics, Incorporated, Pelham, Ga.
8. Mohawk Sign Systems.
9. Seton Identification Products.
10. Signature Signs, Inc.

2.04 PANEL SIGN TYPES

A. Room Signs: Room ID w/ Small Insert F01B-D1

1. Manufacturer: Takeform Architectural Graphics
2. Series: Quad Fusion 01
3. Material: Laminate Sheet.
4. Metal Accent Bar/ Hardware: 01 Natural
5. Perimeter: Unframed.
6. Copy: Tactile and Braille.
7. Character Style: Meta Bold MB101
8. Character Color: Owner to select from full range of colors
9. Text: As indicated in the Sign Schedule.
10. Message: Changeable
11. Sizes:
    a. Sign: 8.50” x 5.63”;
    b. Character: Minimum 1-inch high characters.
12. Colors: Owner to select from full range of colors and textures.
13. Font: Arial Regular

B. Toilet Room Signs: F01-B-G2-BC Men's; F01-B-G2-BC Women's

1. Manufacturer: Takeform Architectural Graphics
2. Series: Fusion 01
3. Material: Laminate Sheet.
4. Perimeter: Unframed.
5. Copy: Raised and Braille.
6. Character Style: Meta Bold MB101
7. Text: According to requirements in the ADA or of authorities having jurisdiction, whichever are more stringent.
8. Message: Fixed.
9. Sizes:
    a. Sign: 8.5" x 8.94"
    b. Character: Minimum 1-inch high characters.
10. Colors: To be selected by owner

2.05 DIMENSIONAL CHARACTERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Takeform Architectural Graphics or a comparable product by one of the following:

1. ACE Sign Systems, Inc.
2. Advance Corporation; Braille-Tac Division.
3. A. R. K. Ramos.
4. ASI-Modulex, Inc.
5. Bunting Graphics, Inc.
6. Charleston Industries, Inc.
7. Gemini Incorporated.
8. Grimco, Inc.
9. Innerface Sign Systems, Inc.
10. Metal Arts; Div. of L&H Mfg. Co.

11. Mills Manufacturing Company.
12. Mohawk Sign Systems.
13. Nelson-Harkins Industries.
14. Signature Signs, Incorporated.
15. Southwell Company (The).

C. Cast Characters: Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.

1. Character Material: Aluminum.
2. Thickness: As indicated.
3. Color(s): Dark bronze anodized.
4. Mounting: Concealed studs, noncorroding for substrates encountered.
5. Font: Arial Regular

D. Dimensional Character Sign Schedule:

1. Sign Type: Aluminum Lettering:
   a. Sign Size: As indicated.
   b. Character Size: As indicated.
   c. Letter type: Helvetica
   d. Text/Message: As indicated.
   e. Location: As indicated.

2.06 ACCESSORIES

A. Vinyl Film: Provide opaque nonreflective vinyl film, 0.0035-inch (0.089-mm) minimum thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

B. Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.

C. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

D. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel

or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.07 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious mat-ter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.

2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

C. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Flush Mounting: Mount characters with backs in contact with wall surface.

3.03 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.04 SIGN SCHEDULE: NOTE: ROOM NUMBERS AND UPDATEABLE INSERT TEXT TO BE DECIDED BY OWNER

A. Interior Room Signs (Provide signs at all interior room types and exits)

1. Vaults - VAULT

2. Physical Training – TRAINING

3. Janitor –JANITOR

4. Lactation - LACTATION

5. Women’s Restroom - WOMEN

6. Men’s Restroom – MEN

7. Kitchen – KITCHEN

8. Library/Classroom – LIBRARY/CLASSROOM

9. Language Center – LANGUAGE CENTER

10. Training Simulator – TRAINING SIMULATOR

11. Conference Room – CONFERENCE ROOM
12. Storage - STORAGE
13. Data - DATA
14. Office - OFFICE
15. Class Room – CLASSROOM
16. Electrical – ELECTRICAL
17. Mechanical / Riser – MECH/RISER
18. Exits – EXIT

END OF SECTION

10 51 13 METAL LOCKERS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Standard metal lockers.
2. TA-50 metal lockers.
3. Locker benches.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.

1. Show locker trim and accessories.
2. Include locker identification system and numbering sequence.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For metal lockers, in manufacturer's standard sizes.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Full-size units of the following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:

a. Identification plates.

b. Hooks.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain metal lockers**,** locker benches and accessories from single source from single manufacturer.

C. Regulatory Requirements: Where metal lockers and benches are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities", TAS and ICC/ANSI A117.1.

D. Preinstallation Conference: Conduct conference at Project site.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.09 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.10 COORDINATION

A. Coordinate sizes and locations of bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.

b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.

3. Warranty Period for All-Welded Metal Lockers: Lifetime from date of Substantial Completion.

2.00 PRODUCTS

2.01 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A101008M, Commercial Steel (CS), Type B, suitable for exposed applications.

B. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

C. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.

2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.02 STANDARD METAL LOCKERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Art Metal Products.

2. ASI Storage Solutions Inc.; Traditional Collection.

3. DeBourgh Mfg. Co.; Worley Lockers.

4. General Storage Systems Ltd.; Decor Tri-Lok .

5. Hadrian Manufacturing Inc.; Emperor Lockers.

6. List Industries Inc.

7. Lyon Workspace Products, LLC; Standard Lockers.

8. Penco Products, Inc.

9. Republic Storage Systems Company.

10. Shanahan's Manufacturing Limited; Deluxe Series Lockers.

11. Tennsco Corp.; Tennsco Lockers.

B. Locker Arrangement: Double tier, 36" high x 12" wide x 15" deep. Single tier, 72" high x 12" wide X 15" deep.

C. Material: Cold-rolled steel sheet.

D. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet as follows:

1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch (0.61-mm) nominal thickness, with single bend at sides.

2. Backs and Sides: 0.024-inch (0.61-mm) nominal thickness, with full-height, double-flanged connections.

3. Shelves: 0.024-inch (0.61-mm) nominal thickness, with double bend at front and single bend at sides and back.

E. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
2. Frame Vents: Fabricate face frames with vents.

F. Doors: One piece; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Doors less than 12 inches (305 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
2. Doors for box lockers less than 15 inches (381 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet; welded to inner face of doors.
5. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
6. Door Style: Vented panel as follows:
    a. Louvered Vents: No fewer than three louver openings at top and bottom for double-tier lockers.
    b. Security Vents: Manufacturer's standard, stamped horizontal or vertical.

G. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Continuous Hinges: Manufacturer's standard, steel, full height.

H. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.

1. Latch Hooks: Equip doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
2. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

I. Door Handle and Latch for Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

J. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:

1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

K. Accessories:

1. Continuous Zee Base: Fabricated from manufacturer's standard thickness, but not less than 0.060-inch (1.52-mm) nominal-thickness steel sheet.

a. Height: 4 inches (102 mm).

2. Continuous Sloping Tops: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm) nominal-thickness steel sheet.

a. Closures: Vertical-end type.

b. Sloping-top corner fillers, mitered.

3. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

4. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm) nominal-thickness steel sheet.

5. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.

6. Center Dividers: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.

7. Handicap markings: Provide handicap symbol signage for those units.

L. Finish: powder coat.

1. Color(s): As selected by Architect from manufacturer's full range.

2.03 TA-50 METAL LOCKERS

A. Basis of Design: TA-50 Military Storage Locker

B. Manufacturers: Subject to compliance with requirements, provide one of the following:

1. WireCrafters

C. Locker Arrangement: Single tier, 78" high x 24" wide X 24" deep.

D. Material: 10 gauge - 2" X 2" square welded wire mesh welded to 1-1 /4" X 1-1/4" x 13 gauge rolled formed angle frame.

E. Body: Assembled by welding or bolting body components together. Fabricate as follows:

1. Mesh: 10 gauge - 2" X 2" square welded wire mesh

2. Sides: 1-1 /4" X 1-1/4" x 13 gauge roll form angle frame with 2" square mesh securely welded to frame.

3. Doors: 1-1/4" x 1-1/4" x 13 gauge roll form angle with 2" square mesh securely welded to frame. Doors have full length angle strike, three point cane bolt lock on double door units with padlockable handle.

4. Top: Formed 16 gauge sheet with 1-1/4" flanges and formed integral door stop.

5. Shelves: Formed 16 gauge sheet with one piece coat rod bolted to underside of shelf.

6. Bottom Panels: 14 gauge sheet metal, 4" high.

7. Back: 16 gauge sheet metal.

8. Clothing Rod: 3/4" schedule 40 pipe welded to 1/8" x 1-1/4" mounting brackets. Finish is hot dip galvanized.
9. Coat Hooks: Three per unit standard, mounted on back wall under shelf.
10. Hardware: All interconnecting and assembly hardware is supplied by manufacturer.
11. Finish: All non-plated parts shall be Powder Coated. Color(s): As selected by Owner from manufacturer's full range.

2.04 LOCKER BENCHES

A. Provide bench units with overall assembly height of 17-1/2 inches (445 mm).

B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick (241 mm wide by 32 mm thick) except provide minimum 20-inch (508-mm) wide tops where accessible benches are indicated.
2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

C. Freestanding Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top, complete with fasteners, and as follows:

1. Aluminum: 1/8-inch thick by 3-inch wide (3-mm thick by 76-mm wide) channel or 1/4-inch thick by 3-inch wide (6-mm thick by 76-mm wide) bar stock, shaped into inverted-T form; with nonskid pads at bottom.
    a. Finish: Clear anodic finish.

2.05 FABRICATION

A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for preassembly at plant prior to shipping.

D. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

F. Coat Rods: Fabricated from 1-inch (25-mm) diameter steel, chrome finished.

G. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.

H. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

I. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

J. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practical; finished to match lockers.

K. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

L. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

M. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.06 STEEL SHEET FINISHES

A. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Metal Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
    a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
4. Attach recess trim to recessed metal lockers with concealed clips.
5. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
6. Attach sloping-top units to metal lockers, with closures at exposed ends.
7. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.03 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

DIVISION 12
FURNISHINGS

12 36 61 SIMULATED STONE COUNTERTOPS (SOLID SURFACE)

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops and backsplashes.

B. Related Sections:

1.03 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

2. Certificates for Credit MR 7: Chain-of-custody certificates indicating that wood products comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.

3. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

D. Samples for Initial Selection: For each type of material exposed to view.

E. Samples for Verification: For the following products:

1. Countertop material, 6 inches (150 mm) square.

1.04 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.05 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

2.00 PRODUCTS

2.01 QUARTZ AGGLOMERATE COUNTERTOPS

A. Countertops: 1/2-inch (12.7-mm) thick, quartz agglomerate with front edge built up with same material.

B. Backsplashes and end splashes: 1/2-inch (12.7-mm) thick, quartz agglomerate.

C. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

2.02 COUNTERTOP MATERIALS

A. Certified Wood Materials: Fabricate countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Plywood: Treated plywood sub top, Grade CCX

C. Adhesives: Adhesives shall not contain urea formaldehyde.

D. Adhesives: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.

1. Manufacturers: Basis of design, Zodiac by Dupont. Subject to compliance with requirements, products by one of the following will be considered if it the same in appearance.
    a. Cambria.
    b. Caesarstone
    c. Cosentino USA.
    d. E. I. du Pont de Nemours and Company.
2. Colors and Patterns: As indicated by manufacturer's designations.

3.00 EXECUTION

3.01 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION

DIVISION 13
SPECIAL CONSTRUCTION

13 34 23 MODULAR RESTROOM AND SHOWER BUILDING

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide work as described hereinafter.

1. Provide the labor, materials, equipment, and incidentals required to make the modular building completely operable.

2. Test and place the completed modular building in operation.

3. Drawings and specifications do not indicate or describe all of the work required to complete the project. Additional details required for the correct installation of selected products are to be provided by the Manufacturer and coordinated with the Owner.

B. Furnish equipment, manpower, products, and other items necessary to complete the modular building with an acceptable industry standard of quality and within the contract time.

C. Provide modular buildings complete with structural frame, axles, tires, floors, ceilings, exterior walls, interior fixtures and finishes, lighting, plumbing, heating – ventilation and air conditioning, and all necessary appurtenances required for complete functionality of the building.

1. One Restroom Modular Building to include separate facilities for Men and Women. Modular building to include a total of at least 10 Water Closets; 7 located in Men's Room and 3 located in Women's Room. Also provide at least 4 lavatories in the Men's Room and 2 lavatories in the Women's Room.

2. One Shower Modular Building to include separate facilities for Men and Women. Modular building to include a total of at least 8 Showers; 6 located in Men's Shower Room and 2 located in Women's Shower Room. Provide at least 4 lavatories in the Men's Shower Room and 2 lavatories in the Women's Shower Room. Provide lockers and bench in both Men's and Women's Shower Room.

D. Deliver the building to the designated site in operational condition, requiring only the extension of utilities, electrical, plumbing and sanitary sewer to a single point of connection.

1.02 QUALITY ASSURANCE

A. Employ competent workmen, skilled in the occupation for which they are employed. Provide only first quality workmanship. Owner's Representative shall determine if the quality of work is acceptable.

B. A defective product is any product that has been found not to be up to manufacturer's standards or is damaged prior to final completion. Defective products shall be removed from the site immediately and replaced, or may remain at the site if arrangements have been made with the Owner's Representative to allow repair of the product at the site. Clearly mark the defective product as "defective" until removed or allowable repairs have been completed.

C. Assume responsibility for the design of the products to include structural stability and operational capability.

D. Design members to withstand all loads imposed by installation, erection, and operation of the product without deformation, failure, or adversely affecting the operational requirements of the product. Size and strength of materials for structural members are specified as minimums only.

E. Design, fabricate, assemble, deliver and install according to normally accepted engineering and shop practices, except where a higher standard of quality is required by the Contract Documents.

F. Manufacture like parts of duplicate units to standard sizes and gages. Like parts are to be interchangeable.

G. Provide design documents for structural, and MEP systems sealed by a registered Professional Engineer.

H. Two (2) or more items of the same kind are to be identical and made by the same manufacturer.

I. Provide products suitable for the intended service.

J. Do not use products for any purpose other than that for which it is designed.

K. Products shall not have been in service at any time prior to delivery, except as required by tests.

L. Materials shall be suitable for service conditions.

M. Arc-flash: Perform an arc-flash analysis on the electrical system, and provide arc-flash labeling per the National Electrical Code and NFPA 70E. The arc-flash labeling shall be placed on the outside of the cover of the panelboard, switchboard, distribution panel, etc. such that it can be read without opening the electrical equipment.

1.03 SUBMITTALS

A. Submittals shall include:

1. Fabricated structures, framing, and construction materials and methods, including design shop drawings.

2. Plumbing, electrical, lighting, heating ventilating and air conditioning fixtures equipment and accessories.

3. Dimensioned layout showing sizes and locations of all utility single point connections.

4. Finishes

5. Copies of Manufacturer's printed instructions to all parties involved in the installation of the product prior to beginning the work.

1.04 JOB CONDITIONS

A. Comply with all applicable state and local codes and regulations pertaining to the nature and character of the work being performed. The City of Weslaco currently requires compliance with the 2015 International Building Codes, including Plumbing, Mechanical, Energy, and Fire Codes.

B. The terms manufactured and fabricated are the same and all references thereto include the entity that constructs, fabricates and builds the structure and all components therein.

C. Comply with the provisions of, and submit drawings to the Texas Department of Licensing and Regulations, for Texas Accessibility Standards Compliance where required by State law.

1.05 MODULAR BUILDING UTILITIES

A. The Owner will extend utilities to the modular building under a separate contract.

B. The modular building manufacturer shall provide a single point of connection for each utility, including:

1. Power
2. Plumbing
3. Sanitary Sewer

1.06 OWNER FURNISHED PRODUCTS

A. Products furnished and paid for by Owner:

1. Lock cores and keys.

1.07 MANUFACTURERS USE OF PROJECT SITE

A. Security Provisions comply with the Homeland Security Act. Comply with Federal, State, County and Local Laws and Ordinances. Persons entering this site by virtue thereof give consent to a search of their vehicles, property and persons without recourse.

B. Limit the use of project site for work and storage to the areas at the site approved by the Owner's Representative.

C. Coordinate the use of the premises with the Owner's Representative.

D. Assume full responsibility for the protection and safekeeping of products stored at the site until accepted by the owner.

E. Store products to allow Owner access for maintenance and operations.

F. Any damage to existing facilities, including contamination, caused by the Manufacturers personnel, visitors, materials, or equipment, shall be repaired or corrected at the Manufacturers expense.

G. Alcoholic beverages or illegal substances are prohibited on the site at any time, nor will persons under the influence of same be permitted to remain on the premises. Persons on site under the influence of alcoholic beverages or illegal substances will be permanently removed from the site in addition to possible criminal and civil penalties.

H. Park equipment and employees' vehicles in designated areas only.

I. The use of loud radios, obnoxious vulgar or abusive language, or sexual harassment in any form will not be tolerated and will be cause for immediate removal of the offender from the premises permanently, in addition to possible criminal or civil penalties.

J. Workers attire shall be professional and commensurate to the trade. Sleeveless shirts, shorts, exceedingly torn, ripped or soiled clothing shall not be permitted.

K. Firearms, concealed or illegal weapons are not permitted on the site under any conditions, including persons with concealed handgun permits.

1.08 HAZARDOUS MATERIALS

A. Contractor shall furnish Material Safety Data sheets for any material provided under this contract in accordance with Federal Standard 313 including but not limited to Paint, Varnish, adhesives and Sealers.

B. Asbestos Certification:

1. Prior to final payment, submit the following notarized certification on contractor's company letterhead: "To the best of my information, knowledge and belief, asbestos or asbestos containing materials have not been incorporated in the work."

1.09 PERFORMANCE REQUIREMENTS

A. Provide modular buildings capable of withstanding the effects of gravity loads and stresses; Seismic performance and thermal movements in accordance with the International Building Codes.

B. The exterior walls shall be framed braced and secured in accordance with the requirements of the International Building Code, based on wind loads applicable to the installation site.

2.00 PRODUCTS

2.01 MODULAR BUILDING CONSTRUCTION

A. Frame: Outrigger type, with M12 x 11 8# 14 ga. Formed steel at a minimum of 48 inches on center for both outrigger and crossmember. Demountable hitch with 2-5/16" coupler and elevated jack. Four (minimum) underslung 5000 Lb. axles with electric brakes on 3 axles. 8.00 x 14.5 10 ply rated tires on all units. Paint entire assembly flat black, less axles.

B. Flooring: 0.040 Rolled, one piece bottom board, R – 19 Kraft faced fiberglass batts. 2 x 8 #2 yellow pine wood joists installed 16 inches on center traverse. Double 2 x 8 # 2 yellow pine perimeter rails on all sides of each module. Single layer 1 – 1/8 inch tongue and groove underlayment grade plywood installed perpendicular to floor joists.

C. Floor Covering:

1. Finished Areas: Sheet vinyl floor covering with backing per ASTM F 1303, Grade 1 wear-layer thickness, class A backing. Provide integral base. Minimum sheet width 12 feet. Wearing surface shall be smooth with embedded abrasives. Provide heat welded seams complying with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering.

D. Exterior Walls: IBC Framing, Studs - 2 x 4 #2 SYP at 16 inch on center, single 2 x 4 #2 SYP bottom plate, Double 2 x 4 #2 SYP top plate, Double 2 x 4 SYP on edge with ½ inch CDX plywood filler headers. Flat 2 x 4 # 2 SYP sills.

E. Insulation:

1. Walls: R – 19 Kraft faced fiberglass batts.

2. Roof and Flooring: R – 19 Kraft faced fiberglass batts.

F. Sheathing, Siding and trim: Exterior grade gypsum sheathing installed on the entire perimeter. 15# felt paper installed over sheathing. High rib commercial steel siding with "R panel" profile baked with enamel finish, 26 ga. "Z" bottom trim, 6 inch "J" trim around windows and doors. 6 inch 26 ga. Steel fascia/rake trim around entire building except above entrance doors. Skirting - 26 ga., high rib commercial steel insulated (R-11) siding with "R Panel" profile.

G. Tie downs shall be frame ties with auger and/or concrete anchors.

H. Interior Walls: 2 x 2 # 2 SYP at 16 inches on center, with single 2 x 4 #2 SYP bottom and double 2 x 4 # 2 SYP top plate. Double 2 x 4 # 2 SYP on edge headers with ½ inch CDX plywood filler. Height 8 ft – 1-1/2 inches.

I. Interior wall finish:

1. Unfinished walls (Fire Sprinkler room) painted 5/8 inch Type "X" moisture resistant gypsum wallboard.

2. Finished walls:

a. Fiberglass reinforced, Class "C" panels, laminated to 5/8 inch Type "X" gypsum wallboard, full height, color: white.

J. Ceiling: Suspended 5/8" sag-resistant gypsum wallboard, with manufacturer's standard framing. Color: white.

K. Roof: Manufacturer's standard commercial steel roof, 29 gauge min. Color to be selected by Owner. All structural components of roof system shall be designed and erected to span their respective areas and carry a minimum live load of 20 psf and a minimum dead load of 10 psf.

L. Doors, General: Provide construction cores on all doors, compatible with Best cores. Provide owner's standard hardware on all doors, unless noted otherwise. Confirm standard hardware with Owner's representative.

M. Exterior Doors: 18 gauge hollow metal commercial insulated steel doors in 16 gauge knockdown steel frame.

1. Hardware:

a. Hinges: 1½ pair, 4½"x4½" Non-removeable pin butt hinges.

b. Weatherstrip

c. Threshold

d. Door Sweep

e. Lockset: Best 93K7D15Dx626 with lever handles.

f. Closer: LCN 4041xAL

N. Interior Doors: 1-3/4 inches thick; solid core construction; wood veneer faces. Solid, Non-Rated Core: AWI Section 1300, PC-Particleboard. Doors shall be installed in prefinished 18 gauge commercial steel frames.

1. Hardware:

a. Hinges: 1½ pair, 4½"x4½" Non-removeable pin butt hinges.

b. Lockset: Doors into Shower Room to be Best 93K0N15D-STK with 626 Finish; Door into Equipment Room to be Best 93K7D15D-STK with 626 finish.

c. Final lock core to be furnished by Owner using Owner's master key system.

O. Millwork: All counters and urinal screens shall be constructed of ¾" exterior grade plywood with "Formica" or equal high pressure plastic laminate. Provide 4" backsplash on counters. Adhere with adhesive over entire surface. Make joints and corners hairline. Match patterns. Cap exposed edges with plastic laminate of same finish and pattern. Apply laminate backing sheet on reverse side of plastic laminate finished surfaces.

P. Stairs and landings: A complete landing and stair assembly shall be provided at exterior entry doors. All assemblies shall be fabricated from treated lumber, finished as determined by Owner. Landings will consist of 6'x6' platforms. All steps and landings shall be provided with handrails.

Q. Electrical:

1. General Electrical Requirements:

a. All electrical components shall be UL listed, and all electrical installation shall be in accordance to the National Electric Code (NEC) and amendments issued by the city of Fort Worth.

b. Lighting shall in compliance with the state of Texas Energy Code. Compliance documents must be signed by a professional engineer holding a valid license in the state of Texas.

2. Electrical Service and Equipment:

a. Electrical utility service to each portable building shall be 208/120 Volts, 3-phase, 4 wire plus ground, rated 150 amps minimum.

b. Provide a panelboard for single point connection to each portable building. Panelboard shall have a main circuit breaker or disconnect switch and a disconnecting means for service entrance disconnect.

c. Panelboard shall be rated for service entrance applications. Panelboard shall be sized for the applied loads plus 25% spare capacity. Provide a minimum of six spare 20-amp single-pole circuit breakers.

d. Each panelboard shall have a typewritten circuit breaker directory. Panelboards shall have a lockable door.

e. Provide labels on the panelboard to warn qualified persons of potential electric arc flash hazards as the required by the National Electric Code section 110.16; see also fine print notes No. 1 and No. 2 for planning and design of safety signs or labels.

3. Lighting:
    a. Provide recessed fluorescent light fixtures for interior general lighting. Lighting levels shall be 30 FC average minimum.
    b. Locate lighting fixtures so that the maximum output is concentrated on urinals and toilet stalls to encourage more effective hygiene. Provide supplemental fluorescent lighting in shower stalls.
    c. Provide emergency lighting in compliance with NFPA-101. Emergency lighting fixtures shall self-diagnostic type.
    d. Lighting shall meet or exceed efficiency required by the energy code.
    e. Lighting fixtures shall be suitable for damp locations in areas subject to moisture. Provide .125 acrylic lenses for fluorescent fixtures as required. Provide fluorescent fixtures with electronic high efficiency ballast, 20% THD.
    f. Lights shall be controlled by wall switches.
    g. At the entrance of each building, provide exterior fluorescent with lights suitable for exterior locations and with appropriate cold weather ballasts. Exterior lights shall be controlled by a photocell.
4. Power for HVAC Equipment
    a. Provide circuits and safety disconnects for all HVAC equipment in accordance with the NEC. Provide convenience 120-volt outlets at all HVAC equipment in accordance with the NEC.
5. Convenience outlets (120-Volts duplex receptacles):
    a. Provide convenience receptacles with dedicated circuits for hair dryers at each mirror.
    b. All receptacles shall have ground fault circuit interrupters (GFCI). Feed-through GFCI receptacles and GFCI circuit breakers are not acceptable.
    c. At each entrance, provide one exterior receptacle with a “rain tight-while-in-use” cover.
6. Wiring:
    a. All wiring shall be copper, sized according to the NEC. All wiring shall be in conduit. All wiring and conduit shall be concealed.

R. Air Conditioning System
1. Provide air conditioning system to heat and cool Men’s and Women’s locker / shower areas, equipment storage areas, fire riser areas and vestibules.
    a. Cooling: Design system to maintain an interior DB temperature of 75 Degrees F and 50% RH with an outside temperature of 100.3 degrees F DB and 79.3 degrees F WB (ASHRAE 0.4%).
    b. Heating: Design system to maintain an interior DB temperature of 75 Degrees F with an outside temperature of 10 degrees F DB.

c. Ventilation: Design system to provide ventilation air from outside building which shall provide ventilation air for occupants per code requirements and makeup air for exhaust system.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Bard Manufacturing Company or Marvair Division of Airxcel, Inc.

3. Description: Factory-assembled and tested, self-contained, wall-mounted A/C unit with wall-hung cabinet outside building with no protrusions beyond inside wall, with electric refrigeration cooling system, electric-resistance heating section**,** and temperature controls; fully charged with refrigerant and filled with oil.

   a. Power Supply: Hard-wired for 208V/three phase units

4. Cabinet: 0.052-inch- (1.32-mm-) thick, galvanized steel with removable front panel with concealed latches.

   a. Mounting: Wall with wall sleeve.

   b. Finish: Baked enamel.

   c. Access Door: Hinged door in top of cabinet for access to controls.

   d. Wall Sleeves: Galvanized steel with polyester finish.

   e. Louvers: Extruded aluminum with enamel finish; white.

5. Refrigeration System: Direct-expansion indoor coil with capillary restrictor, hermetically sealed scroll compressor with internal spring isolation, external isolation, permanent-split-capacitor motor, and overload protection, outdoor coil and fan.

6. Indoor Fan: Forward curved, centrifugal, with permanent-split-capacitor motor and positive-pressure ventilation damper with electric operator.

   a. Motor Sizes: Large enough so driven load will not require motor to operate in service factor range above 1.0.

   b. Noise Rating: Quiet.

7. Filters: Throw-away, 2 inch pleated 30-35% efficient.

8. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch.

9. Condensate Drain: Drain pan and piping to direct condensate to a code-approved place of disposal.

10. Outdoor Fan: Forward curved, centrifugal type driven by indoor fan motor.

    a. Motor Sizes: Large enough so driven load will not require motor to operate in service factor range above 1.0.

    b. Noise Rating: Quiet.

11. Ductwork:

    a. Concealed rigid foil-faced fiberglass duct board with 1-1/2” wall thickness with balancing damper and insulated round flex duct to each air device.

12. Diffusers, Registers and Grilles: Aluminum construction double-deflection supply air grilles and single-deflection return air grilles; white.
13. Controls
    a. Thermostatic Control: Wall-mounted, solid-state, 7-day, 24-hour programmable thermostat with over-ride that meets requirements of Section 803.2.3.1 of the 2003 International Energy Conservation Code.
    b. Low Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F, outdoor-air temperature.
    c. Compressor Override: Manual switch prevents compressor operation.
14. Quality Assurance
    a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
    b. Energy-Efficiency Ratio: Equal to or greater than prescribed by Fort Worth Energy Code.
    c. Coefficient of Performance: Equal to or greater than prescribed by Fort Worth Energy Code.

S. Exhaust System
1. Provide exhaust system to serve Men's and Women's locker, shower and toilet area. System shall include:
    a. Exhaust system sized to serve total exhaust load.
    b. Exhaust fan(s) with backdraft dampers.
    c. Aluminum exhaust ductwork with aluminum balancing dampers to allow proper system balancing.
    d. Exhaust grilles:
        1). Aluminum construction, single-deflection, white.
        2). One for each shower area sized for and balanced to 20 cfm each (sized based on continuous exhaust operation when building is occupied).
        3). One for each water closet and urinal area sized for and balanced to 75 cfm each.
    e. Exhaust system shall operate continuously during occupied hours.

T. Plumbing
1. Plumbing
    a. Sanitary Drainage, Waste and Vent piping systems:
        1). Cast Iron Pipe: (ASTM A74) service weight. Fittings: Cast iron. Joints: Hub-and-spigot, CISPI HSN compression type with (ASTM C564) neoprene gaskets. (exposed)

2). PVC DWV Pipe: Polyvinyl Chloride, Schedule 40 (ASTM D2665) pipe, and fittings (ASTM D2466) In heated spaces.

b. Water Piping Systems

1). (ASTM B88), Type L, hard drawn. Fittings: ANSI/ASME B16.18, cast brass, or ANSI/ASME B16.22, wrought copper. Joints: (ANSI/ASTM B32), solder, (Grade 95TA)

c. Pipe Insulation: Manufacturers Options (a – c) One Inch Thick. Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less

a). Heavy duty preformed fiberglass (ASTM C 547, type 1, 2 or 3). Schuller, Knauf or Certainteed.

b). Preformed flexible elastomeric insulation (ASTM C 534) Armstrong "Armaflex", or Schuller "Rubatex".

c). Preformed unicellular polyolefin foam (ASTM C534) tubular preslit with adhesive. IMCOA.

d). All purpose jacket, high density white kraft bonded to aluminum foil, reinforced with fiberglass yarn lap and butt, self sealing, pressure sensitive. Schuller "Micro-Lok", Certainteed "Snap-On".

e). PVC fitting covers, one piece pre molded high impact PVC white gloss insulating fitting covers and jackets. Schuller "Zeston 2000PVC".

d. Water Heater:

1). Domestic water heater; ASHRAE 90.1B-1992 energy efficient, electric vertical type, interior-lined tank, anode protection, drain valve, AMSE safety relief valve, high-temperature cut-off, individual operating thermostats, insulated tank, baked enamel exterior steel jacket, and UL listed. Provide with expansion tank and heat traps as recommended by the water heater manufacturer. Water Heater Manufacturer shall confirm selection and provide adequately sized unit. Provide adequate water heater to serve three showers, two lavatories for continuous use for one hour with an available recovery time of three hours minimum. Provide automatic time clock to shut down the power to the unit during off use periods. Water Heater shall be wired for 208V/1 phase power.

e. Plumbing Fixtures

1). Water Closet: Accessible floor-mounted, flush-valve type bottom outlet, white vitreous china, siphon-jet action, elongated bowl, 1-1/2" top inlet spud and designed to operate on 1.6 gallons per flush maximum (Mounting height + 17" from finished floor to rim

a). Flush-Valve For Water Closets: Exposed type, chrome-plated, 1" supply inlet, screw driver back-check angle stop, vacuum breaker, lever activating handle, solid ring pipe support 1-1/2" top outlet spud with wall and spud flanges. Inlet of flush-valve shall be 24" above rim of water closet, 44" above finished floor, maximum, for accessible.

b). Seat for Water Closets: White, elongated type, open front, extra heavy construction, concealed check stainless steel hinges, and rubber bumpers. Provide with antimicrobial agent option.

2). Urinal: Accessible wall-mounted, white vitreous china, 14" minimum elongate rim type, siphon-jet action, flushing rim, integral trap, 3/4" top inlet spud and designed to operate on 1.0 gallon per flush maximum (Mounting height + 17" from finished floor to rim).

a). Flush-Valve for Urinals (UR1 & UR2): Exposed type, chrome-plated, 3/4" supply inlet, screw driver back-check angle stop, vacuum breaker, lever activating handle, 3/4 " top outlet spud with wall and spud flanges and 1.0 gallon per flush maximum

3). Lavatory: Countertop mounted, White vitreous china, size 20" x 17", oval, stainless steel trim, template and sealant, front overflow, and 4" center holes.

a). Faucet for Lavatories; Chrome-plated brass, soft flow vandal proof spout, with infra-red sensor utilizing 4 AA alkaline batteries. Electrical components separate from spout assembly and sealed in a water-proof compartment. Provide with thermal mixing valve. Maximum flow is 2.20 GPM

4). Shower Enclosure and fittings: Accessible Shower; Vacuum formed one-piece sanitary grade, solid surface shower enclosure (ASTMD-2583), slip resistant bottom (ASTM FF 462-79), thermostatic or pressure balanced mixing valve, soap dish, flame spread rating of "C" (less than 200) (ASTM E-162), with approved accessible personal hand-held showerhead and mounting bar. Two (2) minimum 1 ½" dia. grab bars and a fold down seat, all complying with TAS. Provide a commercial grade vinyl shower curtain, 1" stainless steel rod and collapsible rubber water retainer (Best Bath, model MWR, or approved equal). Nominal size (I.D.): 36" wide minimum x 36" deep minimum x 73" to 84" tall.

5). Shower (standard): Vacuum formed one-piece sanitary grade, solid surface shower enclosure (ASTM D-2583), with slip resistant bottom (ASTM FF 462-79), thermostatic or pressure balanced mixing valve, soap dish, flame spread rating of "C" (less than 200) (ASTM E-162). Provide a commercial grade vinyl shower curtain and 1" stainless steel rod. Nominal size (I.D.): 36" wide minimum x 36" deep minimum x 78" tall.

U. Accessories:

1. Toilet rooms:

a. Grab bars: Stainless steel

b. Single roll toilet paper holder.

2. Shower stall

a. Robe Hook Stainless steel, satin finish.

b. Shelf: 12"x6" Stainless steel, satin finish.

c. Shower curtain: Opaque, matte white vinyl, minimum 0.008-inch- (0.2-mm-) thick, with integral antibacterial and flame retardant agent. Curtain shall have hemmed bottom and sides with corrosion resistant grommets. Provide two curtains at each

stall, one for the shower, and one for the adjacent drying area, including two separate heavy duty commercial grade curtain rods.

3. Shower room
    a. Paper Towel dispenser: Stainless steel, one at each counter.
    b. Soap dispenser: Stainless steel, one at each counter.
    c. Mirrors: 18”x36” metal edged mirror above each lavatory.

3.00 EXECUTION

3.01 SITE PREPARATION

A. The G.C. will prepare the sites to receive the modular buildings. Specific instructions will be provided to the Owner prior to delivery of each unit, a minimum of 10 days notice shall be provided to the Owner prior to delivery.

3.02 INSTALLATION

A. Set and level modular buildings on prepared sites.

B. Install exposed plumbing pipe, or pipe subject to freezing in such a manner and with adequate protection to prevent breakage caused by freezing temperatures. Provide freeze protection tape only on metallic pipe, provide copper or cast iron pipe on water and drain pipes subject to freezing to allow the installation of freeze protection tape.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative for the A/C units to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
    1. After electrical circuitry has been energized, test for compliance with requirements.
    2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
    3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove malfunctioning A/C units, replace with new units, and retest as specified above.

3.04 STARTUP SERVICE FOR A/C UNITS

A. Engage a factory-authorized service representative to perform startup service.

B. After installation, verify the following:
    1. Unit is level on base and is flashed in exterior wall.
    2. Unit casing has no visible damage.
    3. Compressor, air-cooled condenser coil, and fans have no visible damage.

4. Labels are clearly visible.
5. Controls are connected and operable.
6. Filters are installed and clean.
7. Drain pan and drain line are installed correctly.

C. Complete installation and startup checks according to manufacturer's written instructions, including the following:

1. Lubricate bearings on fan.
2. Check fan-wheel rotation for correct direction without vibration and binding.

D. After startup service and performance test, change filters.

3.05 ADJUSTING A/C SYSTEM

A. Adjust initial temperature set point.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

END OF SECTION

DIVISION 22
PLUMBING SYSTEMS

22 00 01 PLUMBING SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and incidentals for complete, operable plumbing systems. Provide appurtenances for every pipe, valve, and fixture or equipment item for a complete operable system.

1.02 QUALITY ASSURANCE

A. Verify location, size, depth and pressure of each utility prior to beginning Work. If conditions are found that will adversely affect the installation, notify the Owners Representative in writing before proceeding with Work.

B. Plumbing fixtures and trim of like kind shall be of the same manufacturer throughout the Project, in the following categories:

1. Water closets, lavatories, urinals.
2. Showers.
3. Countertop sinks.
4. Service sinks.
5. Electric water coolers.
6. Faucets, mixing valves (other than thermostatic mixing valves).
7. Tailpiece, fixture traps, escutcheons, arm extensions, strainers.
8. Fixture carriers.

1.03 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 “Submittal Procedures” and include manufacturer’s Product Data sheets for the following:

1. Plumbing fixtures and trim.
2. Piping materials and valves.
3. Equipment and accessories.

B. Operation and Maintenance Data: Submit operation and maintenance data in accordance with Division 01.

1.04 STANDARDS

A. Authority Having Jurisdiction: Perform all Work in accordance with the regulations and ordinances of federal, state, and local agencies, who have lawful jurisdiction over the Place of Record. Notify proper authorities for inspections as Work progresses.

B. Codes and Ordinances: The design and installation shall be in accordance with the applicable provisions of the latest edition of the following codes and ordinances. These codes and ordinances shall apply as if written here in their entirety:

1. International Building Codes 2015 with local amendments.
2. International Plumbing Code (IPC) 2015, with local amendments.
3. International Fuel Gas Code (IFGC) 2015, with local amendments.
4. International Energy Conservation Code (IECC) 2015, with local amendments.
5. Occupational Safety and Health Standards (OSHA).
6. Architectural Barriers Act (ABA) Standards 2015.
7. UFC-3-420-01 Plumbing Systems.
8. UFC 4-010-01 DOD Minimum Antiterrorism Standards for Buildings.
9. UFC 1-200-02 High Performance and Sustainable Building Requirements.
10. Army National Guard DG 415-5 General Facilities Information Design Guide.

C. Standards:

1. The design and installation shall be in accordance with the applicable provisions of the following standards. These standards shall apply as if written here in their entirety:
    a. American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
    b. American National Standards Institute (ANSI)/ American Society for Testing Materials (ASTM).
    c. American National Standards Institute (ANSI)/ American Welding Society (AWS).
    d. American National Standards Institute (ANSI)/ American Water Works Association (AWWA).
    e. American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA).
    f. American Society of Testing and Materials (ASTM) Publications.
    g. American Welding Society (AWS) Specifications.
    h. American Water Works Administration (AWWA) Publications.
    i. American Society of Sanitary Engineering (ASSE).
    j. Cast Iron Soil Pipe Institute (CIPE) Standards.
    k. Texas Commission on Environmental Quality (TCEQ).
2. Comply with the provisions of the Buy American Act 41 U.S.C. §§ 8301–8305.

1.05 DELIVERY AND STORAGE

A. Deliver and store equipment and materials in accordance with Division 01. Handle pipe in a manner which prevents damage. Store on raised platforms or wood runners in neat piles. Prevent debris or dirt from entering open ends of pipe.

1.06 JOB CONDITIONS

A. Drawings are schematic and intended to show the general arrangement and extent of the Work. Follow dimensions without regard to scale. Determine the exact location and arrangement of piping regarding the actual equipment furnished, the surrounding conditions and the work installed by other trades.

B. Review the Drawings and each Section of the Specifications. Install Work indicated, regardless of which Drawing or Section of the Specifications it occurs. No allowances shall be made for the Contractor's failure to review complete Contract Documents.

C. Locate by field measurement the exact rough-in and final connection location of all fixtures, drains and plumbing. Center pipe between walls and chases.

D. Conform to the manufacturer's rough-in and installation requirements for each fixture equipment and appliance.

E. This project is a renovation to an existing building. Work of this discipline consists of additions and alterations to existing systems. Existing conditions depicted on the drawings are from record drawings, 'as built' drawings provided by the Owner and cursory field observations of unconcealed conditions. The exact location, size and type of existing fixtures, equipment, pipe valves fittings and other appurtenances may vary from what is indicated. Before proceeding with construction verify the exact location, size, type, and condition of each item and modify the new construction to coordinate with existing.

F. Perform cutting and patching required to install the Work under the requirements of the individual trade. Patching shall restore the area to the original condition. No structural member shall be cut without the written approval of the Engineer.

G. Schedule Work to avoid conflicts with other trades.

H. Materials within plenums, rated spaces above ceilings and as required by Code shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E84. PVC Piping installed in plenums shall be wrapped in an approved fire blanket or protective enclosure.

I. Installation of Liquid Propane gas to equipment and appliances; comply with the requirements and recommendations of the equipment manufacturer including engineering manuals and O & M/installation guides. Where the design of gas regulators, pipe sizes, and any other appurtenance conflicts with the manufacturers requirements and recommendation's, provide for the greater of the two – design or manufacturers recommendations in the bid.

J. Pipe penetrations through concrete walls shall be core drilled smooth with a maximum of ½" annular space around the pipe, or a sleeve is required. Where an existing pipe penetration has more than a 2" annular space around the pipe, a sleeve will be required. Where a sleeve is used, provide a sleeve with a maximum of ½" annular space between the pipe and sleeve. Load bearing walls shall be sleeved with schedule 40 steel pipe. Seal existing and new annular space between the opening and pipe. Seal pipe with approved

rated materials for rated walls. Exposed pipe penetrations shall have escutcheons on the exposed side(s) of the wall.

1.07 GUARANTEES

A. In addition to the Contractor's standard 1 year guarantee, provide the manufacturer's warranty for all equipment installed. Include warranties in the O & M Manual, in accordance with Division 01.

2.00 PRODUCTS

2.01 PIPE AND FITTINGS

A. Water Piping Buried Within 5 Feet of Building:

1. Copper Tubing: For 2-inch diameter and less, (ASTM B88), Type L or K or annealed. Fittings: ANSI/ASME B16.18, cast copper or ANSI/ASME B16.22, wrought copper. Joints: AWS A5.8 BCuP silver braze.
2. Copper Tube for 2-1/2-inch Diameter and Greater: (ASTM B88) Type L or K hard drawn. Fittings ANSI/ASME B16.8 cast copper or ANSI/ASME B16.22 wrought copper. Joints: AWS A5.8 BCuP silver braze.
3. Ductile Iron Piping for 3-inch Diameter and Greater: Pipe: ANSI/AWWA C151, Class 50. Fittings: ANSI/AWWA C110, ductile iron, standard thickness. Joints: ANSI/AWWA C111, rubber gasket, mechanical joint. Pipe and fittings shall have tar coated outside and cement mortar lined inside in accordance with ANSI A21.4.
4. PVC, AWWA Pipe: AWWA C900, Class 150 with bell end with gasket, and with spigot end.
    a. Comply with UL 1285 for fire-service mains if indicated.
    b. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
    c. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
    d. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
        1). Gaskets: AWWA C111, rubber.
    e. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
        1). Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Water Piping Above Grade:

1. Copper Tubing: For 4-inch diameter and less, (ASTM B88), Type L or K, hard drawn. Fittings: ANSI/ASME B16.18, cast brass, or ANSI/ASME B16.22, wrought copper. Joints: (ANSI/ASTM B32), solder, (Grade 95TA) or Copper Pipe 2 through 6 inches may be

installed using mechanical type couplings on roll-grooved pipe; coupling housing, ductile iron (ASTM A536) grade 65-45-12, with factory coat copper alkyd enamel paint. Gaskets, flanges, shall be rated for the system by the manufacturer.

C. Sanitary Drain, Sanitary Waste and Vent Piping (DWV) Buried:

1. PVC DWV Pipe: Polyvinyl Chloride, Schedule 40 (ASTM D2665) pipe, and fittings (ASTM D2466).

2. PVC Sewer Pipe (beyond 5 feet of building): Polyvinyl Chloride Gravity Sewer Pipe (ASTM 3034) SDR 35, or (ASTM F789) PS 46 and Fittings, with elastomeric Joints. (Uni-Bell B-4-82, ASTM D3212).

3. Cast Iron Pipe: (ASTM A74) service weight. Fittings: Cast iron. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International. Joints: Hub-and-spigot, CISPI HSN compression type with (ASTM C564) neoprene gaskets.

D. Sanitary Drain, Sanitary Waste and Vent Piping (DWV) Above Grade:

1. Cast Iron Pipe: For pipe below the first floor concrete slab - (ASTM A74), service weight. Fittings: Cast iron. Joints: Hub-and-spigot, CISPI HSN compression type with (ASTM C564) neoprene gaskets. For pipe beyond the building foundation - PVC DWV Pipe: Polyvinyl Chloride, Schedule 40 (ASTM D2665) pipe, and fittings (ASTM D2466).

2. Cast Iron Pipe: (CISPI 301), hubless (no-hub), service weight. Fittings: Cast iron. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International. Joints: Cast-iron couplings (ASTM A48, Class 30-A) with neoprene gaskets (ASTM C1277, ASTM D412 18-8 and CISPI 310) stainless steel bolts and nuts; manufactured by MG Piping Products Co. or equal.

3. PVC Pipe: (ASTM F1760 and ASTM D2665), Schedule 40. Fittings: PVC DWV Type, Schedule 40, (ASTM D2665). Joints: (ASTM D2885) and (ASTM D2564), solvent cemented. PVC pipe installed in plenums and above ceilings shall be wrapped or coated with an approved fire retardant to comply with requirements.

E. Roof and Storm Drainage Piping Below Grade:

1. PVC Pipe (ASTM F1760 and ASTM D2665). Joints: (ASTM D2885) and (ASTM D2564), solvent cemented.

2. Cast Iron Pipe: (ASTM A74) service weight. Fittings: Cast iron. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

F. Roof and Storm Drainage Piping Above Grade:

1. PVC Pipe (ASTM F1760 and ASTM D2665). Joints: (ASTM D2885) and (ASTM D2564), solvent cemented. PVC pipe installed in plenums and above ceilings shall be wrapped or coated with an approved fire retardant to comply with requirements.

2. Cast Iron Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International. Joints: Cast-iron coupling (ASTM A48 Class 30-A) with neoprene gasket (ASTM D412) 18-8 stainless steel bolts and nuts.

G. Condensate Drain Piping, Above Grade:

1. Copper Tubing: For 4-inch diameter and less, (ASTM B88), Type L, hard drawn. Fittings: ANSI/ASME B16.18, cast brass, or ANSI/ASME B16.22, wrought copper. Joints: (ANSI/ASTM B32), solder, (Grade 95TA) or Copper Pipe 2 through 6 inches may be installed using mechanical type couplings on roll-grooved pipe; coupling housing, ductile iron (ASTM A536) grade 65-45-12, with factory coat copper alkyd enamel paint. Gaskets, flanges, shall be rated for the system by the manufacturer.

2. PVC, Schedule 40 Pipe: ASTM D 1785. or PVC, Schedule 40 Socket Fittings: ASTM D 2466. (Where installed above the ceiling in return air plenum space, PVC shall comply with 25/250 ASTM E84, and shall include insulation and pipe hangars at a maximum 5'–0").

H. Natural Gas Piping:

1. Natural Gas Piping, Buried:

a. Polyethylene Piping (for below ground use only): Pipe: ASTM D1248 and ASTM D2513, 75 psi rated working pressure. Fittings: PE fittings, ASTM D1248 and ASTM D2513, SDR 11, 50 psi rated working pressure. Joints: Butt fusion, in accordance with manufacturer's recommendations and the Department of Transportation Title 49 of Federal Specifications, as it applies to heat fusion.

2. Natural Gas Piping, Above Grade:

a. Steel Pipe: ASTM A53, Schedule 40 black. Fittings: ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type. Joints: Screwed for pipe 2 inches and under; ANSI/AWS D1.1, welded, for pipe over 2 inches.

b. Interior and Exterior Steel Piping Above Ground: Field apply two coats of exterior grade enamel paint. Color: Safety Yellow or as directed by Owner or authority having jurisdiction. The paint shall be the manufacturer's best quality product. Certification of paint grades shall be submitted. Paints which contain lead in excess of 0.06 percent by weight of the total non-volatile content shall not be used. Paints containing zinc chromate or strontium chromate pigments shall not be used. Exterior painting shall not be performed in rainy, damp or frosty weather, or until surface is thoroughly dry. Prepare surface by removing loose rust, loose mill scale and loose paint to firm surface by hand chipping, scraping, sanding or wire brushing. Follow with solvent wash to remove any remaining residue.

2.02 FLANGES, UNIONS, AND COUPLINGS

A. Pipe size 2 inches and under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, solder joints.

B. Pipe size over 2 inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

D. Gas Service Line Risers: PE pipe with coated, anodeless, steel pipe casing on riser section. Include inlet for heat-fusion connection to PE pipe and outlet for connection to shutoff valve.

2.03 NATURAL GAS REGULATORS

A. Service Regulators: AGA/IAS-listed for service regulators, single stage, steel jacketed, and corrosion resistant. Include atmospheric vent, elevation compensator, with threaded ends for NPS 2 and smaller, and flanged ends for NPS 2-1/2 and larger. Acceptable manufacturers: American Meter Co.; Equimeter, Inc.; Fisher Controls International, Inc.; National Meter; Schlumberger Industries, Gas Div.; or approved equal.

1. Regulator Vents: Factory-installed or field-installed, corrosion-resistant screen in opening.

2.04 VALVES (WITHIN 5 FEET OF BUILDING)

A. Ball Valves (For Water Shut-Off and Throttling):

1. Ball Valves 2 inches and Less: Full-port, rated 175-lb. minimum water, oil, air and gas pressure, brass or bronze construction, seat material as recommended by manufacturer for material conveying, lever handle, threaded or soldered connections. Throttling valves shall be provided with memory stops. Acceptable manufacturers and models: Crane, 9302, 9322; ITT Grinnell, 3500, 3500SJ; Milwaukee, BA-200, BA-250; Watts, B-6000, B-6001 and Nibco, T-580, S-580.

2. Ball Valves 2-1/2 inches and Greater: Full-port, rated 150-lb. minimum water, oil, air and gas pressure, bronze or carbon steel construction, seat material as recommended by manufacturer for material conveying, lever handle, flanged connections. Throttling valves shall be provided with memory stops. Acceptable manufacturers and models: Watts, G-4000M1; Crane, 941-TF; Apollo, 88-100 and Jamesbury, D150F.

B. Valves (For Gas Piping Only):

1. Non-lubricated, Tapered Plug Valves (for 2 inches and Smaller): Brass or cast-iron body, with brass tapered plug; lever operation; and complying with ASME B16.33, MSS SP-78, UL 842, or AGA/IAS listing. Include lever. Include locking device. Acceptable manufacturers: Essex Brass Corp.; Grinnell Corp.-Mueller Co.-Gas Products Div.; Lyall, R.W. & Co., Inc.; McDonald, A.Y. Mfg. Co.

C. Check Valves (Swing Check Valves):

1. Check valves 2 inches and Less: MSS SP-80 rated 175-lb. minimum water and air pressure, brass or bronze construction, bronze disc, threaded or soldered connections. Acceptable manufacturers and models: Watts, B-5000 & B-5001; Nibco, T-413-B & S-413-B; Milwaukee, 509-1509; Crane, 37/1707 & 1707S.

2.05 DOMESTIC WATER HEATERS

A. Natural Gas Water Heaters (Direct Fired).

1. Domestic Water Heater (GWH1-GWH5): ASHRAE 90.1-2013 energy efficient, natural gas-fired, tankless, condensing, wall mounted. Water heater air intake and exhaust gas vent shall be Schedule 40 PVC. Water heater shall be controlled by an internal circuit board that monitors the inlet and outlet temperatures with installed thermistors, sensing and controlling flow rate to set point temperature with air-fuel ratio controls in order to maintain thermal combustion efficiency. Units shall include safety features such

as flame sensor system, high limit sensors, overheat prevention device, freeze protection mode, and fan rotation detector. Manifolded units shall be installed by connecting the units using cable-only connections. Set outlet temperature to 127°F maximum. The Contractor shall extend vent piping to the outside of the building in accordance with manufacturer's instructions.

a. Acceptable Manufacturers and Models:

1). Navien NPE-240S-NG, or owner approved equal.

2.06 WATER HEATING SYSTEM ACCESSORIES

A. Circulation Pumps: Inline type, flanged connections, rated for 125 psi at 220 F, single stage, vertical split case, all bronze or stainless steel and provided with oil cups, 1/12 HP, 115V, 1 phase, 6 gpm at 10 ft hd. Acceptable manufacturer and Model: Bell & Gossett Ecocirc XL 20-35, or approved equal.

B. Thermostatic Control for Circulation Pumps: Heavy-duty snap-acting SPDT switch, copper constructed liquid filled capillary and bulb sensing element, 100 to 210°F setpoint adjustment range, 5 to 15°F adjustable differential, 120 VAC, UL listed. One 0-10V (Analog): Speed Control by external controller. One 4-20mA (Analog): Connection with an external pressure sensor for the pressure control mode (two different pressure sensor ranges: 0-15 PSI and 0-30 PSI) l One external temperature sensor input for Differential Temp operating mode. Sensor Type KTY38 PN:104502 l One built-in temperature sensor for Set Point Temp and Differential-Temp operating mode. REMOTE BUILDING MANAGEMENT SYSTEM, The pump monitored or controlled by a signal from BMS (Building Management System). With built in BACnet protocols.

C. Expansion Tank for Water Heaters: Bladder type, factory pre-charged, fabricated steel shell, heavy duty butyl FDA approved bladder, 150 psig working pressure, 200°F operating temperature. Tank head shall be galvanized or polypropylene lined. Pre-charge tank to static pressure of system. Acceptable manufacturers and models: Taco, CAX Series and Amtrol, ST Series, WHTS, DET. Series.

2.07 PLUMBING FIXTURES AND TRIM

A. Water Closets:

1. Water Closet (WC1): Accessible floor-mounted, flush-valve type bottom outlet, white vitreous china, siphon-jet action, elongated bowl, 1 1/2 inch top inlet spud and designed to operate on 1.28 gallons per flush maximum. Mounting height to be 17 inches from finished floor to rim. Acceptable manufacturers and models: American Standard, 3461.001; Kohler K-4405; Zurn, Z5665-BWL.

2. Water Closet (WC2): Floor-mounted, flush-valve type bottom outlet, white vitreous china, siphon-jet action, elongated bowl, 1-1/2-inch top inlet spud and designed to operate on 1.28 gallons per flush maximum. Acceptable manufacturers and models: American Standard, 3451.001; Kohler, K-4406; Zurn, Z5655-BWL-AM.

B. Flush-Valves for Water Closets:

1. Flush-Valve for Water Closets (WC1 & WC2): Exposed type, chrome-plated, 1-inch supply inlet, screw driver back-check angle stop, vacuum breaker, lever activating

handle, solid ring pipe support 1-1/2-inch top outlet spud with wall and spud flanges. Flush valve flow to be 1.8 gpf maximum. Inlet of flush-valve shall be 11-1/2 inches maximum, above rim of water closet, coordinate flush valve location with grab bars for accessible installations. Acceptable manufacturers and models: Sloan, Royal III-1.28; Delany, U402-1.28 and Zurn, Z-6000-AV-HET.WS-1.

C. Seats for Water Closets:

1. Seat for Water Closets (WC1 & WC2): White, posture molded, elongated type, open front, extra heavy construction, concealed check stainless steel hinges, and rubber bumpers. Provide with antimicrobial agent option. Acceptable manufacturers and models: Olsonite, 10CC; Church/Bemis, 1955C; Beneke, 527 or 533 and Kohler, K-4680-CA series.

D. Urinals:

1. Urinal (UR1): Accessible wall-mounted, white vitreous china, 14-inch minimum elongate rim type, siphon-jet action, flushing rim, integral trap, 3/4-inch top inlet spud and designed to operate on .125 gallon per flush maximum. Mounting height to be 17 inches from finished floor to rim. Acceptable manufacturers and models: American Standard, 6042.001EC; Kohler, K-4991-ET; Zurn, Z5738.207.00 Series.

2. Urinal (UR2): Wall-mounted, white vitreous china, 14-inch minimum elongate rim type, siphon-jet action, flushing rim, integral trap, 3/4-inch top inlet spud and designed to operate on .125 gallon per flush maximum. Standard mounting height. Acceptable manufacturers and models: American Standard, 6042.001EC; Kohler, K-4991-ET Zurn, Z5738.207.00 Series.

E. Flush Valves for Urinals:

1. Flush-Valve for Urinals (UR1 & UR2): Exposed type, chrome-plated, 3/4-inch supply inlet, screw driver back-check angle stop, vacuum breaker, lever activating handle, 3/4-inch top outlet spud with wall and spud flanges. Flush valve flow to be 0.125 gpf maximum. Acceptable manufacturers and models: Sloan Regal, 186-0125; Delany, 451-0125 and Zurn, Z-6003AV-ULF.

F. Urinal Carriers:

1. Carriers for Urinals: Mounted on concrete block walls or walls other than concrete block, wall and floor supported type, compatible with specified urinal, complete with chrome-plated finished exposed trim, adjustable through the wall frame including top and bottom hanger plates, steel uprights, block foot supports, and accessories. Acceptable manufacturers and models: Josam, 17810 Series; Jay R. Smith, 637 Series; Tyler/Wade, W-400-AM11 Watts Drainage CA-321 and Zurn, Z-1222 Series.

G. Lavatories:

1. Lavatory (L1): Under-countertop mounted, white vitreous china, nominal size including rim 21 by 17 by 5-1/2 inches deep (bowl size: 19” x 15-3/8” x 5-1/2” deep), oval, unglazed rim, template and sealant, rear overflow. Acceptable manufacturers and models: American Standard, 0497.221; Toto, LT587.

H. Faucets for Lavatories:

1. Faucet for Lavatories (L1): Chrome-plated brass, soft flow, vandal proof spout, proximity sensoring with vandal proof 24-VAC solenoid sensor unit. All metal construction, 0.5 gpm vandal resistant spray outlet, soft flow spout, serviceable filter screen upstream of the valve, 4-inch centers for hot and cold water supplies. Provide with thermal mixing valve. Equipped with infra-red sensor activated with vandal proof 24-VAC solenoid sensor unit. Acceptable manufacturers and models: American Standard, 6059.205; Delta, 591TP0250 and Zurn Z6950-XL-S-CP4-CWB.

I. Supplies and Stops for Lavatories:

1. Supply and Stop for Lavatories (L1): Supplied through the wall, chrome-plated cast brass stop, 1/2-inch female standard pipe thread inlet by 3/8-inch O.D. compression type outlet angle stop, wheel or four-armed handle, 3/8-inch O.D. chrome-plated copper flexible riser, and wall escutcheon. Acceptable manufacturers and models: McGuire, 2165LK; Eljer, American Standard, Cambridge/Delta, Zurn and Engineered Brass (Just), Specified trim.

J. Strainer and Tailpiece for Lavatories:

1. Offset Strainer for Lavatories (L1): Heavy Duty 17-gauge chrome plated wheelchair strainer and tailpiece, cast grid drain plug with strainer. Acceptable manufacturers and models: McGuire, 155WC; Eljer, American Standard, Crane, Cambridge/Delta, Specified Trim ST155WC, Zurn and Engineered Brass (Just).

K. P-Trap for Lavatories:

1. P-Trap for Lavatories (L1): 17-gauge chrome-plated brass size 1-1/4 inches, integral cleanout, and wall escutcheon. Acceptable manufacturers: McGuire, B8872**;** Eljer, American Standard, Crane, Cambridge/Delta, Zurn and Engineered Brass (Just).

L. Lavatory Insulation Kits: Fully molded closed cell vinyl insulation 3/16-inch thick with nylon fasteners. K factor of 1.17 (ASTM C177) self-extinguishing burn characteristics (ASTM D635). Insulation kit for p-trap, tailpiece, trap arm, hot and cold water supplies, white. Acceptable manufacturers and models**;** Truebro Inc., #102 with accessory #105**;** Brocar Products Inc., Plumberex, and TCI Products.

M. Sinks

1. Sink (S1): Countertop mounted, double compartment, 18-gauge stainless steel, self-rimming, faucet deck, with four 1-1/2-inch diameter holes, 4-inch centers, with undercoated underside. Size 21 by 33 by 5-1/2 inches deep. Acceptable manufacturers and models: Elkay, LRAD-3321 and Just, DL-ADA-3321-A-GR -L or R.

N. Faucets for sinks

1. Faucets for Sinks (S1): Chrome-plated brass, deck mount, 8” centers, swing gooseneck soft flow spout with 8”-9” reach (centerline of spout inlet to centerline of spout outlet), vinyl hose with deck mounted automatic spray diverter, and chrome-plated brass lever or wing handles. Faucet shall automatically divert water to spray when spray handle is used. Hose connection to faucet shall be provided with backflow preventer under counter. Maximum flow is 2.20 GPM. Acceptable manufacturer and models: Chicago Faucet, 1102, E3, 1000; T & S Brass, B-1172, B-970; Royal Brass, 5269.3-BH-136; Speakman, SC-5773; American Standard, 7231.000 with .342H lever or .352H Cross handles, Cambridge/Delta, 2276LHP and Zurn, Z-87163-HS.

O. Supplies and stops for sinks

1. Supply and Stop for Sinks: Supplied through the wall, chrome-plated cast brass stop, 1/2” female standard pipe thread inlet by 3/8” O.D. compression type outlet angle stop, wheel or four-armed handle, 3/8” O.D. chrome-plated copper flexible riser, and wall escutcheon. Acceptable manufacturers: McGuire, Eljer, American Standard, Cambridge/Delta, Zurn and Engineered Brass (Just).

P. Strainer and tailpiece for sinks

1. Offset Strainer for Sinks (S1): 17-gauge chrome plated wheelchair strainer and tailpiece, cast grid drain plug with strainer. Acceptable manufacturers: McGuire, Eljer, American Standard, Crane, Cambridge/Delta, Zurn and Engineered Brass (Just).

Q. P-traps for sinks

1. P-Trap for Sinks (S1): Chrome-plated, 17-gauge cast brass, size 1-1/2”, with integral cleanout, and wall escutcheon. Acceptable manufacturers: McGuire, Eljer, American Standard, Crane, Cambridge/Delta, Zurn and Engineered Brass (Just).

R. Insulation kit for accessible sinks

1. Sink Insulation Kits: Fully molded closed cell vinyl insulation 3/16” thick with nylon fasteners. K factor of 1.17 (ASTM C-177) self-extinguishing burn characteristics (ASTM D635). Insulation kit for p-trap, tailpiece, trap arm, hot and cold water supplies, white. Acceptable manufacturers: Truebro Inc., Brocar Products Inc., Plumberex, TCI Products. Insulation kit is not required if a trap/supplies enclosure is provided under another division.

S. Electric Water Coolers:

1. Electric Water Cooler (EWC1): Wall-mounted, dual unit, bi-level, wheelchair type, complete water station including laminar flow 1.1 gpm flow rate bottle filling station on high unit and dual water coolers, a hermetically sealed compressor with built-in overload protection, large capacity dryer-strainer, condenser and self-lubricated fan. Refrigeration system to use R-134A refrigerant. Unit shall meet NSF/ANSI 61/372, UL 399 and ASHRAE requirements. Minimum energy-efficiency performance per CSA 815-99. Front and sides push bars with raised lettering, stainless steel top, stainless steel cabinet with flexible hooded two-stream bubblers, inlet strainer and NSF/ANSI 42 certified carbon activated class 1 chlorine and particulate 3,000-gallon capacity filter with NSF/ANSI 53 certified lead reduction media. Bottle filling station to include electronic no-touch sensor activated laminar flow spout with 20 second shut off timer and green, yellow and red LED light visual filter maintenance monitor. Provide optional stainless steel apron on high unit as required by TAS/ADA for each installation. Wheelchair unit shall be mounted in accordance with TAS/ADA requirements. Water cooler shall deliver a 7.5 gph minimum of 50 F water, based upon 80 F inlet water temperature and 90 F ambient air temperature. Acceptable manufacturers and models: Halsey Taylor HTHB-HACG8BLSS-WF, or approved equal.

T. Supplies and Stops for Electric Water Coolers:

1. Supply and Stop for Electric Water Coolers: Supplied through the wall, chrome-plated brass, 1/2-inch female standard pipe thread inlet by 3/8-inch O.D. compression type outlet angle stop, wheel or four-armed handle, with flexible riser and wall escutcheon.

Acceptable manufacturers and models: McGuire, 2166LK; Eljer, American Standard, Cambridge/Delta, Specified Trim, Zurn and Engineered Brass (Just).

U. P-Trap for Electric Water Coolers:

1. P-Trap for Electrical Water Coolers: 17-gauge chrome-plated brass, size 1-1/4 inches, integral cleanout, and wall escutcheons. Acceptable manufacturers and models: McGuire, B8912; Eljer, American Standard, Cambridge/Delta, Zurn and Engineered Brass (Just).

V. Electric Water Cooler Carriers:

1. Carriers for Electric Water Coolers Mounted on Concrete Block Walls or Walls other than Concrete Block: Wall and floor supported type, compatible with specified electric water cooler, complete with adjustable through the wall frame including top and bottom hanger plates, steel uprights, and block foot supports, and accessories. Acceptable manufacturers and models: Josam, 17900; Jay R. Smith, 830; Tyler/Wade, W400-AM11; HAWS, 6800; MC-33 (Bi-Level type); Watts Drainage CA-321 and Zurn, Z-1225.

W. Service Sinks:

1. Service Sink (SSK1): Floor-mounted, corner type, terrazzo material, five-sided, nominal size 28 by 28 by 12 inches, 6-inch drop front corner, 3-inch drain, with mop hanger, hose and hose bracket, stainless steel curb caps, removable stainless steel strainer, cast integral stainless steel drain body, provide for a caulked lead connection of not less than 1 inch deep to a 3-inch drain pipe. One piece basin constructed of black and white marble chips cast in gray Portland cement, to produce a compressive strength of 3000 psi, 7 days after casting, ground smooth, grouted and sealed to resist stains and moisture. Acceptable manufacturers and models: Florestone, (Basin) 96; Florestone, (Hose & Bracket), MR-370; Florestone (Mop Hanger), MR-372; Florestone (Wall Guard), MR-377 (24-inch).

X. Faucets for Service Sinks:

1. Faucets for Service Sinks: Chrome-plated, 3/4-inch hose thread outlet, wall-mounted for concealed supply pipe, wall brace, integral stops, pail hook, and vacuum breaker. Maximum flow is 2.20 gpm. Acceptable manufacturers and models: Chicago Faucet, 897; T & S Brass, B-665-BSTR; Royal Brass, 552-49; Speakman, SC-5811-RCP; American Standard, 8344.111; Fiat, 830AA; Moen 8124, Cambridge/Delta 28T2263, Stern Williams, T-15-VB and Zurn, Z-841MI.

Y. Traps for Service Sinks:

1. Trap for Floor-Mounted Service Sinks: 3-inch cast iron, under floor.

Z. Showers:

1. Accessible Shower (SH1): 36” x 36” (nominal) Accessible Shower enclosure is a built-up type. Refer to the architecture drawings and specifications.

2. Accessible Wide Shower (SH2): 36” x 60” (nominal) Accessible Wide Shower enclosure is a built-up type. Refer to the architecture drawings and specifications.

AA. Mixing Valve Assembly for Showers:

1. Mixing Valve Assembly for Shower (SH1): Pressure balancing type mixing valve with integral volume control, adjustable temperature limit stop, single lever handle, and integral service and check stops. Maximum flow for shower head is 2.75 gpm. Acceptable manufacturers and models: Leonard, 5500 w/accessories; Powers, 902 w/accessories; Speakman, SM-1422 w/accessories; Symmons, S-86 w/accessories; Bradley, IC-EF w/accessories; American Standard, 1312 SS.014, Cambridge/Delta 11T5113 and Zurn, TEMPGARD 7120 with accessories.
2. Mixing valve assembly for showers (SH2): Pressure balancing mixing valve with integral volume control, adjustable temperature limit stop, integral service and check stops, lever handles, separate lever handle diverter and volume control with shower arm, hand held sprayer, escutcheon, flexible 5-foot hose, wall connection, flange, in-line vacuum breaker, 30-inch polished chrome finish slide bar. Acceptable manufacturers: Symmons, Powers, Leonard, Bradley, American Standard, Cambridge/Delta, Speakman, Acorn, and Zurn –Tempgard.

BB. Shower Heads for Showers:

1. Shower SH1 Shower Heads: Provided with shower enclosure. Chrome plated brass, 1.5 gpm, ball joint fitting, two mode. Acceptable manufacturer and model: Symmons model 4-231-1.5, or approved equal.
2. Shower SH2 Accessible Hand Held Sprayer: Polished chrome, 1.5 gpm, integral service stops, integral check stops. Acceptable manufacturer and model: Symmons Temptrol C-96-500B30-V–1.5, or approved equal.

CC. Shower Pans and Drain Flashings:

1. Shower pans shall be copper or nonplasticized chlorinated polyethylene sheet.
    a. Sheet copper shall be 16 ounce weight.
    b. Sheet nonplasticized chlorinated polyethylene shall be 40 mils thickness. Acceptable manufacturer and model: The Noble Co., “Chloraloy”.

2.08 PLUMBING SPECIALTIES

A. Floor Drains:

1. Floor Drain (FD1) (for use in finished floor areas and showers): ANSI A112.21.1; cast iron body, double drainage flange, weepholes, bottom outlet, vandal proof secured 6-inch diameter nickel bronze adjustable flat strainer, and non-puncturing flashing collar.
    a. Acceptable Manufacturers and Models:
        1). Josam: Series 30000-6A.
        2). Jay R. Smith: Series 2005 or 2010.
        3). Wade: Series W-1100.
        4). Zurn: Series Z-415.
        5). Mifab: Series F-1100.

A. Floor Sink Drains:

1. Floor Sink Drain (FS1): ANSI A112.21.1; square cast iron body, double drainage flange, weepholes, bottom outlet aluminum dome strainer, non-puncturing flashing collar, porcelain enamel or epoxy coated interior and 1/2 grate. Size 8 by 8 by 6 inches. Provide with trap primer connection adapter.
    a. Acceptable Manufacturers and Models:
        1). Josam: Series 4900.
        2). Jay R. Smith: Series 3100.
        3). Wade: Series W-9110-24.
        4). Zurn: Series ZN-1815.
        5). Mifab: Series FS-1520.

B. Cleanouts:

1. Floor Cleanout (FCO) (for Use in Finished Floors): Cast iron body, adjustable type, inside caulk connection, vandal proof secured, standard round nickel bronze top, threaded brass plug.
    a. Acceptable Manufacturers and Models:
        1). Josam: Series 56000.
        2). Jay R. Smith: Series 4128-NB.
        3). Wade: Series W-6000.
        4). Zurn: Series Z-1405-2.
        5). Mifab: Series C-1100.
        6). Watts Drainage: Series CO-200.
2. Wall Cleanout (WCO): Recessed wall type, cast iron body with threaded brass plug, flush mounted stainless steel access cover with countersunk center screw and vandal proof secured.
    a. Acceptable Manufacturers and Models:
        1). Josam: Series 58710.
        2). Jay R. Smith: Series 4402.
        3). Wade: Series W-8450-R.
        4). Zurn: Series ZN-1440-1.
        5). Mifab: Series C-1400.
        6). Watts Drainage: Series CO-380.
3. Plug Cleanout (PCO): Cast iron body with threaded brass plug, specify with no access cover.
    a. Acceptable Manufacturers and Models:
        1). Josam: Series 58710, Less cover.
        2). Jay R. Smith: Series 4402, Less cover.

3). Wade: Series W-8450-R, Less cover.

4). Zurn: Series ZN-1440, Less cover.

5). Watts Drainage: Series CO-380, less cover.

4. Grade Cleanout (GCO & DGCO): Cast iron body, with straight body for caulking into soil pipe hub with countersunk tapered threaded bronze plug. Provide "T" handle wrench. Double Grade Cleanouts (DGCO) will require two GCO's as described above, along with the proper two-way cleanout pipe fitting.

a. Acceptable Manufacturers and Models:

1). Josam: Series 58850-22.

2). Jay R. Smith: Series 4338.

3). Wade: Series W-8530.

4). Zurn: Series Z-1450.

5). Mifab: Series C-1300.

6). Watts Drainage: Series CO-260.

C. Roof Drainage Downspouts:

1. Downspout Nozzle (DSN): Bronze, wall flange and threaded inlet. Coordinate height and location with Architecture and also with all other discipline's equipment or devices on exterior wall.

a. Acceptable Manufacturers and Models:

1). Josam: Series 25010.

2). Jay R. Smith: Series 1770.

3). Wade: Series W-3940.

4). Zurn: Series Z-199.

5). Mifab: Series R-1940.

6). Watts Drainage: Series RD-940.

D. Backflow Preventers:

a. All fixtures and hose bibbs or hydrants shall be provided with approved individual backflow devices in accordance with the Authority Having Jurisdiction. Provide RPZ or DCV building backflow preventers where required by the AHJ.

E. Water Hammer Arrestors:

1. Water Hammer Arrestors (WHA): ANSI A112.26.1, ASSE 1010, and PDI WH-201; permanently sealed bellows or expanding chamber. Sizing designations indicated on the Drawings are standard classifications established by Plumbing and Drainage Institute "Standard PDI-WH201." Verify that system pressure meets minimum required for water hammer arrestor provided.

a. Acceptable Manufacturers and Models:

1). Josam: 75000.

2). Jay R. Smith: 5000.

3). Wade: "SHOKSTOP" Series.

4). Zurn: Z-1700.

5). Sioux Chief: "Hydra-Rester" Series.

6). Watts: No. 15M2 Series.

7). PPP: SC & SWA Series.

8). Mifab: WHB Series.

F. Trap Seals:

1. Trap Seals (TS): Flexible elastomeric or neoprene trap seal device utilizes a normally closed seal to prevent evaporation of the liquid trap seal and also protects against sewer gases from backing up into the building or surrounding areas. The device opens when liquid enters to allow drainage to flow through into the building drainage piping, and closes when there is no drainage flow entering the drain. Provide in all floor drains, floor sinks, area drains and hub drains connected to the sanitary sewer system or to other systems that may have sewer gases present in the drainage system.

   a. Acceptable Manufacturers and Models:

      1). ProVent Systems, Inc.: ProSet Trap Guard Series.

      2). Mifab: Mi-Gard Series.

      3). SureSeal.

      4). Jay R. Smith Mfg. Co.: Quad Close Series.

2. Thermostatic Tempering Valves:

   a. Thermostatic Tempering Valve (TTV): The valve shall be constructed of solid brass/bronze. The valve shall feature union connection, integral checks, locking temperature adjustment. All internal components shall be lead-free, stainless steel, Teflon, or other corrosion resistant materials. The valve shall be CSA B125 certified and meet ASSE 1017 requirements. Temperature adjustment shall be vandal resistant. In the event of interruption of the cold water supply, the control mechanism shall close off the hot water port, stopping all flow. In the event of interruption of the hot water supply, the control mechanism shall allow cold flow only. In the event that the thermostatic tempering mechanism fails, the control mechanism shall close off the hot water port and allow cold water flow only. Valve assembly shall be equipped with spring loaded in-line check valves and ball valve shut-offs.

   b. Capacity of the valve at a 45 psi differential shall be as follows and must be able to control down to 0.5 gpm: 1/2 inch = 17 gpm, 3/4 inch = 20 gpm, 1 inch = 23 gpm.

      1). Acceptable Manufacturers and Models:

         a). Powers: LFLM490 Series.

         b). Watts: USG-B or MMV-M1.

         c). Leonard: Eco-Mix LF Series.

d). Symmons.

e). Lawler.

f). Armstrong.

G. Hose Bibbs:

1. Hose Bibb (HB): Chrome plated brass, provided with wall flange, 1/2-inch female NPT inlet by 3/4-inch male N.H.T. outlet, with chrome plated vacuum breaker in conformance with ANSI/ASSE 1011.

a. Acceptable Manufacturers and Models:

1). Chicago Faucet: 15-E27 or 7-E27.

2). T&S Brass: B-702-B-972.

3). Royal Brass: 5115-136-G.

4). Woodford: 24P.

5). Watts: SC8-1.

H. Wall Hydrants:

1. Non-Freeze Wall Hydrant (NFWH1): ANSI/ASSE 1019; exposed flush mount, wall hydrant type, with chrome plated brass or nickel bronze finish on brass castings, freezeless, 3/4-inch hose thread nozzle, integral vacuum breaker, and loose key handle.

a. Acceptable Manufacturers and Models:

1). Woodford: 65.

2). Josam: 71050.

3). Jay R. Smith: 5609.

4). Wade: W-8620.

5). Zurn: Z-1310.

6). Watts: HY-420.

I. Ice Maker Outlet Boxes:

1. Ice Maker Outlet Box (IMOB): Recessed 16-gauge steel cabinet with white powder coated finish, 1/2-inch domestic water ball valve meeting lead-free requirements.

a. Acceptable Manufacturers and Models:

1). Guy Gray: MIB1DAB, or approved equal.

J. Pipe Hangers and Supports:

1. Hangers for pipe sizes 1/2 to 1-1/2 inches: Malleable iron, adjustable swivel, split ring.

2. Hangers for pipe sizes 2 to 4 inches and cold pipe sizes 6 inches and over: Carbon steel, adjustable, clevis.

3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for hot pipe sizes 6 inches and over.

4. Vertical Support: Steel riser clamp.
5. Floor Support for pipe sizes to 4 inches and all cold pipe sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
7. Shields for insulated piping 2 inches and smaller: 18 gage galvanized steel shield over insulation in 180 degree segments, minimum 12-foot long at pipe support.
8. Shields for insulated piping 2-1/2 inches and larger (Except Cold Water Piping): Pipe covering protective saddles.
9. Shields for insulated cold water piping 2-1/2 inches and larger: Hard block non-conducting saddles in 90 degree segments, 12-inch minimum length, block thickness same as insulation thickness.
10. Shields for Vertical Copper Pipe Risers: Sheet lead.
11. Adjustable rooftop pipe supports:
    a. Adjustable rooftop supports for piping shall be provided for installation without requiring roof penetrations, flashing, or damage to the roofing material. Support Bases shall be made of a UV-stabilized, EPDM rubber sized to fit the diameter of the pipe or conduit being supported. The support shall contain appropriate additives for UV protection.
    b. The support shall allow for tool-free pipe installation and integrally-connected height adjustability of up to 4", 6" or 7" in ½" increments.
    c. The support shall have a continuous bottom surface to minimize point loading of the roof membrane. The support shall not have discontinuities, cutouts, or pockets on the surface contacting the roof. The placement of slip sheets or mats between the support and the roof surface shall not satisfy the continuous bottom surface requirement.
    d. Acceptable Manufacturers and Models: Erico, Caddy Pyramid or approved equal.
12. Support horizontal piping as follows:

Pipe Size	Max. Hanger Spacing	Hanger Diameter
1/2" to 1-1/4"	6'-6"	3/8"
1-1/2" to 2"	10'-0"	3/8"
2-1/2" to 3"	10'-0"	1/2"
4" to 6"	10'-0"	5/8"
PVC (All Sizes)	5'-0"	3/8"
C.I. Bell and Spigot (or No-Hub)	5'-0" and at Joints	

13. Hanger Notes:
    a. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent Work.
    b. Place a hanger within 12 inches of each horizontal elbow.

c. Use hangers with 1-1/2-inch maximum vertical adjustment.

d. Support horizontal cast iron pipe adjacent to each hub, with 5-inch maximum spacing between hangers.

e. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

f. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers. Consult with project structural engineer for approval.

g. Support riser piping independently of connected horizontal piping.

h. For below floor hanger installations, place one hanger at each pipe penetration thru a concrete grade beam, at either side, a minimum of 12 inches from the face of the grade beam.

K. Hanger Rods:

1. Steel Hanger Rods: Threaded both ends.

L. Inserts:

1. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

M. Insulation:

1. Pipe insulation for domestic hot and cold water pipe.

a. Heavy duty preformed fiberglass (ASTM C547, type 1, 2 or 3). Schuller, Knauf or Certainteed.

b. Preformed flexible elastomeric insulation (ASTM C534) Armstrong “Armaflex”, or Schuller “Rubatex.”

c. Preformed unicellular polyolefin foam (ASTM C534) tubular preslit with adhesive. IMCOA.

Insulation Schedule	
Cold Water	1” thick up to 2” pipe size 1-1/2” thick over 2” pipe size
Hot Water	1” thick up to 2” pipe size 1-1/2” thick over 2” pipe size
Condensate Drainage	1” thick
Roof Drainage	2” thick up to and including 4” pipe size and body, 1” thick for pipe sizes over 4”

d. Provide all purpose jacket, high density white kraft bonded to aluminum foil, reinforced with fiberglass yarn lap and butt, self-sealing, pressure sensitive. Schuller “Micro-Lok”, Certainteed “Snap-On.”

e. PVC fitting covers, one piece pre molded high impact PVC white gloss insulating fitting covers and jackets. Schuller “Zeston 2000PVC.”

2. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

    a. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

    b. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

N. Piping Identification:

1. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

    a. Pipes with OD, Including Insulation, Less than 6 inches: Pre-tensioned pipe markers. Use size to match pipe and ensure a tight fit.

    b. Pipes with OD, Including Insulation, 6 inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

    c. Locate pipe markers and color bands on piping as follows: Near each valve and control device; Near each branch connection, excluding short takeoffs; Where flow pattern is not obvious, mark each pipe at branch; At other points of origination and termination; Spaced at maximum intervals of 50 feet along each run; Reduce intervals to 25 feet in areas of congested piping and equipment.

3.00 EXECUTION

3.01 PREPARATION

A. Establish invert elevations for drainage piping within 5 feet of building. Minimum slopes for drainage pipe is 1/4 inch per foot for 2 1/2-inch diameter and less and 1/8 inch per foot for 3-inch diameter pipe and greater.

B. Close equipment shutoff valves before turning off gas to premises or piping section.

C. Inspect liquid propane gas piping according to NFPA 54 to determine that liquid propane gas utilization devices are turned off in piping section affected.

D. Comply with NFPA 54, Part 1, “Prevention of Accidental Ignition” Paragraph.

3.02 INSTALLATION

A. Pipe, Valves and Fittings:

1. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

2. Provide clearance for installation of insulation, and access to valves and fittings.

3. Provide access doors where valves and equipment are not accessible. Coordinate size and location of access doors with applicable Section.
4. Install sanitary piping and storm drainage piping true to line with proper grading. Connect horizontal branches to one another with 45 degrees “Y” fittings, combination “Y” and 1/8 bend fittings. Connect horizontal lines to vertical stacks using 45 degrees “Y” branches, 60 degree “Y” branches, or combination “Y” and 1/8 bend fittings. Horizontal branches turning down to vertical stacks may use a short sweep or 1/2 bend. Branches connecting to mains or to other branches shall enter the branch line at a 45 degree angle, tilted 45 degrees upward, so that the entry is from the side and top.
5. Materials exposed within ducts or plenums (ceiling spaces used as supply or return air plenums) shall have a flame-spread index of not more than 25 and a smoke-developed rating of not more than 50 when tested in accordance with the test for Surface Burning Characteristics of Materials, UBC Standard (ASTM E84). Wrap or enclose with rated materials, any CPVC, PVC or PEX piping installed in rated spaces, including return air plenums.
6. Piping hangers shall be sized large enough to allow insulation to pass through. Hangers for piping 2-1/2 inches and greater shall be provided with pipe covering protection saddle, or high compressive strength insulation saddle. Hangers for piping 2 inches and less shall be provided with pipe covering shields. On cold water piping provide vapor barrier through hanger.
7. Anchor piping with regard to the transmission of vibration and noise. Securely anchor copper piping to studs or wood blocking with “C” clamp of proper size for piping. At each fixture location where the piping penetrates the partition, back the elbow inside the partition, or chase, with wood blocking. Anchor with “C” clamps or cast brass drop ear elbows to prevent movement. Do not use wire as an anchoring device.
8. Piping shall not come into direct contact with metal studs, beams, or other construction elements. Provide a non-metallic separation between dissimilar metals when copper piping is installed in direct contact with steel.
9. Install unions in piping 2 inches and smaller and flanges in piping 2-1/2 inches and larger, adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.
10. Install piping adjacent to equipment and specialties to allow service and maintenance.
11. Install piping free of sags and bends.
12. Install strainers on inlet side of service regulators.
13. Install metal shutoff valves on aboveground, gas distribution piping.
14. Install aboveground, shutoff valves in accessible locations, protected from physical damage. Include metal tag, attached to valve with metal chain, indicating piping systems supplied.
15. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on or near each service regulator and meter.

a. Text: Distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.

16. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tape during backfilling of trenches for piping.

B. Plumbing Specialties and Equipment:

1. Pipe relief valves and drains to nearest floor drain. Minimum slope 1/16 inch per foot. Provide 2-inch air gap.
2. Install equipment plumb and square to wall on a 4-inch thick (minimum) reinforced concrete housekeeping pad.
3. Provide all interconnecting electrical power and control wiring from control panels to equipment and accessories for a complete operable systems. All exposed wiring shall be in conduit. Comply with Division 26.
4. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
5. Encase grade cleanouts in concrete flush with grade when not located in concrete, pavement, sidewalk, etc.
6. Grade cleanouts located in pavement or sidewalks shall have a brass or cast iron cover that extends to grade and a brass cap shall be installed.
7. Trap all drains connected to the sanitary sewer.
8. Install floor and area drains with top depressed 1/2 inch below finished floor elevation.
9. In addition to cleanouts, as shown on the Drawings, Contractor shall provide any additional cleanouts required by local codes and ordinances at no additional cost to the Owner.
10. Outlet of plumbing vents and flues shall be located a minimum of 25 feet from fresh air intakes. Provide offset as required.
11. Relief valve discharge drain from reduced pressure backflow preventers shall be piped full outlet size down to nearest floor sink. Drain line shall terminate above floor drain with air gap unless otherwise indicated on the drawings.
12. Prior to ordering and installing water hammer arrestors, verify that the pressure at the point of installation does not drop to below 30 psig at any time. If the pressure drops below 30 psig, do not install piston type water hammer arrestors. Install bellows type arrestors under low pressure circumstances. Provide access panel directly in front of each water hammer arrestor.

C. Plumbing Fixtures and Connections:

1. Furnish and install plumbing fixtures, as noted on the Drawings. Each fixture shall be complete with trim and fittings, including traps and supply fittings. Set fixture with close tolerance to wall and floor surfaces.

2. Provide all wall mounted fixtures with floor carriers. Install and secure fixtures in place with wall supports carriers and bolts. Exposed bolts, nuts, etc. shall be stainless steel or chrome-plated brass.
3. Seal fixtures to wall and floor surfaces with white mildew resistant sealant.
4. Mount fixtures to Architectural Drawings interior wall elevations, manufacturers recommended elevations or the requirements of the ADA or TAS, whichever is applicable.
5. Provide removable insulation covering on stops and supplies and drains and P-traps on all handicapped lavatories. All lavatories in rooms with handicapped water closets are considered handicapped lavatories.
6. Provide accessible stops on all water supplies to fixtures and equipment.
7. Provide accessible water hammer arresters on hot and cold water supplies to plumbing fixtures and/or fixture groups in accordance with Standard PDI-WH-201. Water hammer arresters shall be as shown on diagrams and if not shown, provide for plumbing fixtures and/or fixture groups in accordance with Standard PDI-WH-201.
8. Provide drainage and vent piping run-outs to plumbing fixtures and drains, with approved trap, of sizes indicated, but in no case smaller than required by the governing Plumbing Code.
9. Provide drainage piping run-outs to urinals of cast iron material. Copper or brass material is prohibited.

D. Trenching, Excavation and Backfill:

1. Perform excavating and backfilling necessary for the installation of Work. Shore, bail, pump and maintain all trenches dry until the Work is completed. Keep trenches open until piping has been inspected, tested and approved. Take necessary precautions to protect the public from open trenches. Erect and maintain barricades and warning devices in accordance with OSHA requirements.
2. Backfill trenches after piping has been tested and approved. Material for backfilling shall be a clean, sandy loam up to 4 inches above the top of pipe. Above that point, use overburden removed in the excavation process. Overburden shall be free of trash, debris, rocks or boulders. Deposit backfill material in 12-inch layers and compact to the density of the adjacent, undisturbed soil. Remove all excess material from the Site.

3.03 TESTING

A. Piping Systems:

1. General: Furnish pumps, compressors,-gauges, equipment and personnel required, and test as necessary to demonstrate the integrity of the finished installation.
2. Sanitary Waste and Vent, Storm Drainage: Unless otherwise directed by the authority having jurisdiction, plug all openings except for the highest opening and fill with water to the point of overflow. Perform a water test consisting of no less than 10 feet of head shall be applied to the system. Allow to stand 1 hour or longer as required. The system should be water tight and leak free. If leaks exist, repair and retest.

3. Water: Unless otherwise directed by the authority having jurisdiction, hydrostatically test and make tight the entire system at 120 psi. Retain for 4 hours. The system should be water tight and leak free. If leaks exist, repair and retest.

4. Liquid Propane Gas: Unless otherwise directed by the authority having jurisdiction, and after flushing of gas piping, pneumatically test and make tight all new and existing gas piping systems from the meter and throughout the building. Test at 1-1/2 times the normal operating pressure and not less than 50 psi. Where the test pressure exceeds 125 psi, the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe. Reduce test pressure if required. Retain for 4 hours minimum or not less than 1/2 hour for each 500 cubic feet of pipe volume or fraction thereof. When testing a system having a volume of less than 10 cubic feet, the test duration shall be permitted to be reduced to 10 minutes. For piping systems having a volume of more than 24,000 cubic feet, the duration of the test shall not be required to be more than 2 hours. Test every pipe, fitting, regulator, valve and appurtenance on the gas system including appliances and equipment. The system shall be air tight and leak free. If leaks exist, repair and retest the entire system. Verify capacities and pressure ratings of service regulators and meters. Verify correct pressure settings for service regulators. PROVIDE A CERTIFICATE OF FLUSHING AND TESTING TO THE OWNER UPON COMPLETION, INDICATING THAT THE SYSTEM HAS BEEN TESTED IN ACCORDANCE WITH THIS SPECIFICATION AND NFPA 54, THE NATIONAL FUEL GAS CODE. CERTIFICATE SHALL INDICATE TESTING COMPANY NAME AND PERSONNEL COMPLETING TESTS AND TWO WITNESSES COMPLETE WITH NAMES AND ADDRESSES.

3.04 DEMONSTRATION OF EQUIPMENT

A. Prior to final acceptance, Contractor and Manufacturer's Representative of Domestic Water Heaters and associated accessories and controls, each shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of the equipment.

B. Prior to final acceptance, Contractor shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of all the plumbing equipment and associated accessories and controls.

3.05 FLUSHING

A. General: After piping systems have been tested and approved, systems shall be flushed. Furnished compressors, pumps, equipment, personnel, etc. required to flush piping systems.

B. Soil, Sanitary Waste and Vent, Storm Drainage: Unless otherwise directed by the authority having jurisdiction, thoroughly flush piping systems with water until free of debris, or detrimental materials that may cause partial or full blockage. As a minimum comply with the International Plumbing Code, Section 302, of the latest edition.

C. Water Piping: Unless otherwise directed by the authority having jurisdiction, flush piping with water until water flows clear for a minimum of 60 seconds per 100 linear feet of piping being flushed at a velocity of 9 feet per second.

D. Liquid Propane Gas Piping: Unless otherwise directed by the authority having jurisdiction, and prior to pipe integrity testing, flush all new and existing piping with clean, dry

compressed air until air flows clear for a minimum of 60 seconds per 100 linear feet of piping being flushed at 25 cfm per 1-inch diameter of pipe from every outlet.

E. All strainers and filters shall be cleaned and replaced prior to start-up.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting Work, verify system is complete, flushed and clean.

B. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum five remote outlets.

D. Maintain disinfectant in system for 24 hours.

E. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

F. Take Samples no sooner than 24 hours after flushing, from five remote outlets and from water entry, and analyze in accordance with AWWA C601.

G. Disinfection and disinfection procedures shall be witnessed and approved by the Owners Representative.

H. After disinfection is completed, submit “Disinfection Certificate of Approval” for domestic water piping systems to the Owners Representative stating that all test results are satisfactory. Certificate of Approval must be signed by Contractor, Testing Laboratory. Certificate shall show the date, time and residual of each of the following tests:

1. Initial disinfection residual (50 ppm minimum) - five Samples.
2. Final disinfection residual (25 ppm minimum) - five Samples.
3. After flushing residual (5 ppm maximum) - five Samples.
4. Analyze in accordance AWWA C601 - five Samples.

3.07 CLOSING IN UNINSPECTED WORK

A. Do not cover up or enclose Work until it has been properly and completely inspected and approved. Should any of the Work be covered up or enclosed prior to all required inspections and approvals, uncover the Work as required. After it has been completely inspected and approved, make all repairs and replacements as necessary to the satisfaction of the Owner’s representative. Repairs and replacements shall be at no additional cost to the Owner.

END OF SECTION

DIVISION 23
HVAC

23 00 00 HEATING, VENTILATING, AND AIR CONDITIONING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Mechanical demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.
13. HVAC coil protective coatings.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

A. Welding Certificates.

1.05 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Standards of Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing; connecting electrical services, circuit breakers, and conduit sizes are appropriately modified; and all is provided at no additional cost. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 HVAC COIL PROTECTIVE COATINGS

A. Coating Type: Aluminum impregnated polyurethane coating.

B. Application: Provide coating on HVAC copper tube coils.

C. The coating manufacturer shall be able to document the successful completion of accelerated product testing of a minimum 3000 hours in both salt spray (ASTM B117) and acidic salt spray tests (ASTM G85); and shall provide a 3-year warranty for the coating applied on aluminum-finned, copper tube coils.

D. The product application process shall include the application of a chromate-free conversion layer applied to the coil that achieves total coverage and penetration.

E. An aluminum-impregnated polyurethane topcoat shall be applied that ensures total penetration and coverage without bridging or significantly affecting the heat transfer ability of the coil.

F. The total dry film thickness of the topcoat shall be 20 to 25 microns. (0.020 to 0.025 mm) The coating shall provide protection against ultraviolet radiation and be temperature resistant up to 194 F (90 C).

G. Product: “PoluAl” by Blygold America, “Bronz-Glow” or approved equal.

3.00 EXECUTION

3.01 MECHANICAL DEMOLITION

A. Refer to Divisions 1 and 2 for general demolition requirements and procedures.

B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping, pipe hangers and supports to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Wrap or enclose with rated materials PVC piping installed in rated spaces, including return air plenums.

M. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

c. Insulated Piping: One-piece, stamped-steel type with spring clips and chrome plated finish.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.

f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with chrome-plated finish.

h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:

a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.

b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips with chrome-plated finish.

c. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

e. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.

f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.

g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).

b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 for flashing.

1). Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 for materials and installation.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.

2. Install cast-iron “wall pipes” for sleeves 6 inches (150 mm) and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron “wall pipes” for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 for materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.03 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 Appendixes.

3. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.

5. PVC Non-pressure Piping: Join according to ASTM D2855.

6. PVC to ABS Non-pressure Transition Fittings: Join according to ASTM D3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.

K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1. Plain-End Pipe and Fittings: Use butt fusion.

2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.04 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping Materials of dissimilar metals.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.06 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 09.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.07 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit and not less than top level at 4 inches (100 mm) above grade or finished floor.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03.

3.08 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Sections for miscellaneous metal fabrications and structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.09 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.10 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes basic requirements for factory-installed motors.

1.03 DEFINITIONS

A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.05 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:

1. Compatible with the following:

a. Magnetic controllers.

b. Multispeed controllers.

c. Reduced-voltage controllers.

2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.

3. Matched to torque and horsepower requirements of the load.

4. Matched to ratings and characteristics of supply circuit and required control sequence.

2.00 PRODUCTS

2.01 MOTOR REQUIREMENTS

A. Motor requirements apply to factory-installed motors except as follows:

1. Different ratings, performance, or characteristics for a motor are specified in another Section.

2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

2.02 MOTOR CHARACTERISTICS

A. Motors 3/4 HP and Larger: Three phase.

B. Motors Smaller Than 3/4 HP: Single phase.

C. Frequency Rating: 60 Hz.

D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

E. Minimum Service Factor: 1.15 for open dripproof motors; 1.10 for totally enclosed motors.

F. Duty: Continuous duty at ambient temperature of 105 F (40 C) and at altitude of 3300 feet (1005 m) above sea level.

G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

H. Enclosure: Unless indicated otherwise, provide the following enclosure type:

1. Open dripproof (ODP): In indoor, moderately clean and dry environments.

2. Totally enclosed, non-ventilated (TENV): In damp, dirty, corrosive or contaminated environments.

3. Totally enclosed, fan cooled (TEFC): Outdoors.

4. Hazardous location motors:

a. In Class I environments which involve potentially explosive liquids, vapors and gases; with motor approved for specific hazard category as defined by Article 500 of the National Electric Code.

b. Dust ignition resistant: In Class II environments that contain combustible dusts such as coal, grain, flour, etc.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium as defined in NEMA MG 1.

C. Stator: Copper windings, unless otherwise indicated.

1. Multispeed motors shall have separate winding for each speed.

D. Rotor: Squirrel cage, unless otherwise indicated.

E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating, unless otherwise indicated.

G. Insulation: Class F, unless otherwise indicated.

H. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

I. Enclosure: Cast iron for motors 7.5 HP and larger; rolled steel for motors smaller than 7.5 HP.

1. Finish: Gray enamel.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Inverter – duty rated. Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Designed with critical vibration frequencies outside operating range of controller output.

2. Temperature Rise: Matched to rating for Class B insulation.

3. Insulation: Class H.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with non-hygroscopic material.

1. Finish: Chemical-resistant paint over corrosion-resistant primer.

2.05 SINGLE-PHASE MOTORS

A. Type: One of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split-phase start, capacitor run.

3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: For motors 1/20 HP and smaller only.

C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

3.00 EXECUTION (NOT USED)

END OF SECTION

23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, “Guidelines on Terminology for Pipe Hangers and Supports.”

1.04 SUBMITTALS

A. Shop Drawings: Signed and sealed by a qualified professional engineer for each multiple piping support, trapeze and seismic restraint. Include design calculations and indicate size and characteristics of components and fabrication details.

B. Welding Certificates: Copies of certificates for welding procedures and operators.

1.05 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, “Welding and Brazing Qualifications.”

B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.

1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:

1. Pipe Hangers:
    a. AAA Technology and Specialties Co., Inc.
    b. B-Line Systems, Inc.
    c. Carpenter & Patterson, Inc.
    d. Empire Tool & Manufacturing Co., Inc.
    e. Globe Pipe Hanger Products, Inc.
    f. Grinnell Corp.
    g. GS Metals Corp.
    h. Michigan Hanger Co., Inc.
    i. National Pipe Hanger Corp.
    j. PHD Manufacturing, Inc.
    k. PHS Industries, Inc.
    l. Piping Technology & Products, Inc.
2. Channel Support Systems:
    a. B-Line Systems, Inc.
    b. Grinnell Corp.; Power-Strut Unit.
    c. GS Metals Corp.
    d. Michigan Hanger Co., Inc.; O-Strut Div.
    e. National Pipe Hanger Corp.
    f. Thomas & Betts Corp.
    g. Unistrut Corp.
    h. Wesanco, Inc.
3. Thermal-Hanger Shield Inserts:
    a. Carpenter & Patterson, Inc.
    b. Michigan Hanger Co., Inc.
    c. PHS Industries, Inc.

d. Pipe Shields, Inc.

e. Rilco Manufacturing Co., Inc.

f. Value Engineered Products, Inc.

4. Powder-Actuated Fastener Systems:

a. Gunnebo Fastening Corp.

b. Hilti, Inc.

c. ITW Ramset/Red Head.

d. Masterset Fastening Systems, Inc.

2.02 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.

2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly. Calculation and detail of each support is required.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

1. Material for Cold Piping: ASTM C552, Type I cellular glass or water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier.

2. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.

2.03 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Do not use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Do not use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.

C. Structural Steel: ASTM A36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

3.00 EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 F (49 to 232 C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).
7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN10 to DN200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN10 to DN80).
12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN50 to DN1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN50 to DN600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 F (49 to 232 C) piping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 F (49 to 232 C) piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb. (340 kg).
    b. Medium (MSS Type 32): 1500 lb. (675 kg).
    c. Heavy (MSS Type 33): 3000 lb. (1350 kg).
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

3.02 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Field assemble and install according to manufacturer’s written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

K. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.9.
2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
    a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
    c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
    d. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
    e. NPS 16 to NPS 24 (DN400 to DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.04 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
    1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    2. Obtain fusion without undercut or overlap.
    3. Remove welding flux immediately.
    4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.06 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Access panel and door markers.
5. Pipe markers.
6. Duct markers.
7. Stencils.
8. Valve tags.
9. Valve schedules.
10. Warning tags.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Valve Numbering Scheme.

D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, “Scheme for the Identification of Piping Systems,” for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.05 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

2.00 PRODUCTS

2.01 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:

a. Manufacturer, product name, model number, and serial number.

b. Capacity, operating and power characteristics, and essential data.

c. Labels of tested compliances.

2. Location: Accessible and visible.

3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.

2. Data:

a. Name and plan number.

b. Equipment service.

c. Design capacity.

d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

3. Size: 2-1/2 by 4 inches (64 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

C. Equipment Signs: ASTM D709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.

2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.

3. Thickness: 1/16 inch (1.6 mm) for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3.2 mm) for larger units.

4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch (1.6-mm) thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch (3.2-mm) center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.02 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.

2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

3. Pipes with OD, Including Insulation, Less than 6 inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.

4. Pipes with OD, Including Insulation, 6 inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.

5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

2.03 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.04 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

1. Stencil Paint: Exterior, gloss, alkyd enamel or acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.

2. Identification Paint: Exterior, alkyd enamel or acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.

2.05 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers, with numbering scheme approved by Owner's Representative. Provide 5/32-inch (4-mm) hole for fastener.

1. Material: 0.032-inch (0.8-mm) thick brass.

2. Valve-Tag Fasteners: Brass wire-link chain.

2.06 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.

2. Frame: Extruded aluminum.

3. Glazing: ASTM C1036, Type I, Class 1, Glazing Quality B, 2.5 mm, single-thickness glass.

2.07 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches (100 by 178 mm).

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

4. Color: Yellow background with black lettering.

3.00 EXECUTION

3.01 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.02 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering 2/3 to 3/4 the size of principal lettering.

2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
    a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    b. Fire department hose valves and hose stations.
    c. Meters, gages, thermometers, and similar units.
    d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    g. Fans, blowers, primary balancing dampers, and mixing boxes.
    h. Packaged HVAC central-station and zone-type units.
    i. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
1. Identify mechanical equipment with equipment markers in the following color codes:
    a. Green: For cooling equipment and components.
    b. Yellow: For heating equipment and components.
    c. Green and Yellow: For combination cooling and heating equipment and components.
    d. Brown: For energy-reclamation equipment and components.
2. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering 2/3 to 3/4 the size of principal lettering.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

D. Install access panel markers with screws on equipment access panels.

3.03 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Pretensioned pipe markers. Use size to ensure a tight fit.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.04 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:
   1. Green: For cold-air supply ducts.
   2. Yellow: For hot-air supply ducts.
   3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
   4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
   5. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering 2/3 to 3/4 the size of principal lettering.

B. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow, may be provided instead of laminated-plastic duct markers, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

C. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.05 VALVE-TAG INSTALLATION

A. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
   1. Valve-Tag Size and Shape:
      a. Fire Protection: 1-1/2 inches (38 mm), round.
      b. Gas: 1-1/2 inches (38 mm), round.
   2. Valve-Tag Color:
      a. Fire Protection: Natural.
      b. Gas: Natural.

3. Letter Color:
    a. Fire Protection: Black.
    b. Gas: Black.

3.06 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.07 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.08 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.09 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.00 GENERAL

1.01 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:

a. Constant-volume air systems.

b. Variable-air-volume systems.

c. Multizone systems.

2. Hydronic Piping Systems:

a. Constant-flow systems.

b. Variable-flow systems.

3. HVAC equipment quantitative-performance settings.

4. Kitchen hood airflow balancing.

5. Existing systems TAB.

6. Verifying that automatic control devices are functioning properly.

7. Reporting results of activities and procedures specified in this Section.

1.02 SUBMITTALS

A. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit four copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

B. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

C. Warranties specified in this Section.

1.03 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," as applicable.

1.04 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.05 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.06 WARRANTY

A. National Project Performance Guarantee: If AABC, provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.

2. Systems are balanced to optimum performance capabilities within design and installation limits.

B. Special Guarantee: If NEBB, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.

2. Systems are balanced to optimum performance capabilities within design and installation limits.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 01.

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible, and their controls are connected and functioning.

L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine strainers for clean screens and proper perforations.

N. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

P. Examine system pumps to ensure absence of entrained air in the suction piping.

Q. Examine equipment for installation and for properly operating safety interlocks and controls.

R. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

S. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.

6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," as applicable, and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:
    a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Obtain approval from Owners Representative for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes at no additional cost.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer’s written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.

2. Motor horsepower rating.

3. Motor rpm.

4. Efficiency rating.

5. Nameplate and measured voltage, each phase.

6. Nameplate and measured amperage, each phase.

7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.07 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.08 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.09 PROCEDURES FOR COMMERCIAL KITCHEN HOODS

A. Measure, adjust, and record the airflow of each kitchen hood. For kitchen hoods designed with integral makeup air, measure and adjust the exhaust and makeup airflow. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, provide an explanation in the report of the reason(s) why and also the reason why the method used was chosen.

1. Install welded test ports in the sides of the exhaust duct for the duct Pitot-tube traverse. Install each test port with a threaded cap that is liquid tight.

B. After balancing is complete, do the following:

1. Measure and record the static pressure at the hood exhaust-duct connection.

2. Measure and record the hood face velocity. Make measurements at multiple points across the face of the hood. Perform measurements at a maximum of 12 inches (300 mm) between points and between any point and the perimeter. Calculate the average of the measurements recorded. Verify that the hood average face velocity complies with the Contract Documents and governing codes.

3. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to room airflow patterns to achieve optimum results.

C. Visually inspect the hood exhaust duct throughout its entire length in compliance with authorities having jurisdiction. Begin at the hood connection and end at the point it discharges outdoors. Report findings.

1. Check duct slopes as required.

2. Verify that duct access is installed as required.

3. Verify that point of termination is as required.

4. Verify that duct air velocity is within the range required.

5. Verify that duct is within a fire-rated enclosure.

D. Report deficiencies.

3.10 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.

2. Measure motor voltage and amperage. Compare the values to motor nameplate information.

3. Check the refrigerant charge.

4. Check the condition of filters.

5. Check the condition of coils.

6. Check the operation of the drain pan and condensate drain trap.

7. Check bearings and other lubricated parts for proper lubrication.

8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
4. Air balance each air outlet.

3.11 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.12 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.
3. Heating-Water Flow Rate: 0 to minus 10 percent.
4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.13 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Architect/Engineer's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB firm who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

3.14 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION

23 07 13 DUCT INSULATION

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes semi-rigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

1.03 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

C. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.06 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.07 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mineral-Fiber Insulation:

a. CertainTeed Manson.

b. Knauf FiberGlass GmbH.

c. Owens-Corning Fiberglas Corp.

d. Schuller International, Inc.

2. Flexible Elastomeric Thermal Insulation:

a. Armstrong World Industries, Inc.

b. Rubatex Corp.

2.02 INSULATION MATERIALS

A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film. (ASTM C612, Type III for operating temperatures higher than 850 F (454 C)).

B. Mineral-Fiber Blanket Thermal Insulation: 0.75 lb./ft^3, glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film. (ASTM C553, Type V for operating temperatures higher than 850 F (454 C)).

C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.

2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

D. Calcium Silicate Insulation: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a nonasbestos fibrous reinforcement. Comply with ASTM C533, Type I (ASTM C533, Type II for temperatures higher than 1200 F (649 C) up to 1700 F (927 C)).

2.03 FIELD-APPLIED JACKETS

A. General: ASTM C921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.

2. PVC Jacket Color: White.

D. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B209 (ASTM B209M), and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section.

1. Finish: Smooth finish.

2. Moisture Barrier: 1-mil (0.025-mm) thick, heat-bonded polyethylene and kraft paper.

E. Stainless-Steel Jacket: Deep corrugated sheets of stainless steel complying with ASTM A666, Type 304 or 316; 0.10 inch (2.5 mm) thick; and roll stock ready for shop or field cutting and forming to indicated sizes.

1. Moisture Barrier for Corrosive Atmospheres: 1-mil (0.025-mm) thick, heat-bonded polyethylene and kraft paper.

2. Moisture Barrier for Non-Corrosive Atmospheres: 3-mil (0.075-mm) thick, heat-bonded polyethylene and kraft paper.

3. Jacket Bands: Stainless steel, Type 304, 3/4 inch (19 mm) wide.

2.04 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

1. Tape Width: 4 inches (100 mm).

B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A66, Type 304; 0.020 inch (0.5 mm) thick.

2. Galvanized Steel: 0.005 inch (0.13 mm) thick.

3. Aluminum: 0.007 inch (0.18 mm) thick.

4. Brass: 0.010 inch (0.25 mm) thick.

5. Nickel-Copper Alloy: 0.005 inch (0.13 mm) thick.

C. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

D. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.05 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.04 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.

b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.

c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

4. Impale insulation over anchors and attach speed washers.

5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.

7. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches (450 mm) o.c.

8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch (150-mm) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.

10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Space anchor pins as follows:

a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.

b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.

c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.

6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch (150-mm) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.

8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.05 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to ducts and plenums as follows:

1. Follow the manufacturer's written instructions for applying insulation.

2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct and plenum surface.

3.06 CALCIUM SILICATE INSULATION APPLICATION

A. Apply insulation according to the manufacturer's written instructions and as follows:

1. Secure single layer of insulation to duct with stainless-steel bands. Tighten bands without deforming the insulation material.

2. Apply two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm), soft-annealed, stainless-steel wire. Secure outer layer with stainless-steel bands.

3. On exposed applications, without metal jacket, finish insulation with a skim coat of mineral-fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

3.07 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.

2. Embed glass cloth between two 0.062-inch (1.6-mm) thick coats of jacket manufacturer's recommended adhesive.

3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.08 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 09.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect/Engineer. Vary first and second coats to allow visual inspection of the completed Work.

3.09 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:

1. Indoor concealed supply-, return-, and outside-air ductwork.

2. Indoor exposed supply-, return-, and outside-air ductwork.

3. Indoor concealed range-hood exhaust ductwork.

4. Indoor concealed oven and dishwasher ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Fibrous-glass ducts.

2. Metal ducts with duct liner.

3. Factory-insulated flexible ducts.

4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.

5. Flexible connectors.

6. Vibration-control devices.

7. Testing agency labels and stamps.

8. Nameplates and data plates.

9. Access panels and doors in air-distribution systems.

3.10 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Round and rectangular, supply-air ducts, concealed.
   1. Material: Mineral-fiber blanket.
   2. Thickness: 2 inches (50mm).
   3. Number of Layers: One.
   4. Field-Applied Jacket: None.
   5. Vapor Retarder Required: Yes.

B. Service: Round and rectangular, supply-air ducts, exposed.
   1. Material: Mineral-fiber board.
   2. Thickness: 1-1/2 inch (38 mm).
   3. Number of Layers: One.
   4. Field-Applied Jacket: Glass cloth.
   5. Vapor Retarder Required: Yes.

C. Service: Rectangular, range-hood exhaust ducts, concealed.
   1. Material: Calcium silicate.
   2. Thickness: 2 inches (50 mm).
   3. Number of Layers: As required.
   4. Field-Applied Jacket: None.
   5. Vapor Retarder Required: No.

D. Service: Round and rectangular, dishwasher exhaust ducts, concealed.
   1. Material: Mineral-fiber blanket.
   2. Thickness: 1 inch (25 mm).
   3. Number of Layers: One.
   4. Field-Applied Jacket: None.
   5. Vapor Retarder Required: Yes.

END OF SECTION

23 09 23 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC

1.00 GENERAL

1.01 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(2012) Laboratory Methods of Testing Dampers for Rating

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135	(2012; Errata 1 2013; INT 1-9 2013; Errata 2 2013; INT 10-12 2014; Errata 3 2014) BACnet— A Data Communication Protocol for Building Automation and Control Networks

ARCNET TRADE ASSOCIATION (ATA)

ATA 878.1	(1999) Local Area Network: Token Bus ASME INTERNATIONAL (ASME)
ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	(2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(2013) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
ASME B31.1	(2014; INT 1-47) Power Piping
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC	(2010) Boiler and Pressure Vessels Code

ASTM INTERNATIONAL (ASTM)

ASTM A126	(2004; R 2014) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B75/B75M	(2011) Standard Specification for Seamless Copper Tube
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2013) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM D1238	(2013) Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D1693	(2013) Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D635	(2010) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D638	(2010) Standard Test Method for Tensile Properties of Plastics
ASTM D792	(2013) Density and Specific Gravity (Relative Density) of Plastics by Displacement

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-D	(2014) Control Network Protocol Specification

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13	(2008; INT 2009) Standard Requirements for Instrument Transformers
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.45	(2002; R 2008) Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000v and less) AC Power Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8802-3	(2000) Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA/ANSI C12.10	(2011) Physical Aspects of Watthour Meters - Safety Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 22013; Errata 2 2013; AMD 3 2014; Errata 3 2014) National Electrical Code
NFPA 72	(2013) National Fire Alarm and Signaling Code
NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

UNDERWRITERS LABORATORIES (UL)

UL 1449	(2014) Surge Protective Devices
UL 506	(2008; Reprint Oct 2013) Specialty Transformers
UL 508A	(2013; Reprint Jan 2014) Industrial Control Panels
UL 916	(2007; Reprint Aug 2014) Standard for Energy Management Equipment

1.02 DEFINITIONS

A. ANSI/ASHRAE Standard 135

1. ANSI/ASHRAE Standard 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks, referred to as "BACnet". ASHRAE developed BACnet to provide a method for diverse building automation devices to communicate and share data over a network.

B. ARCNET

1. ATA 878.1 - Attached Resource Computer Network. ARCNET is a deterministic LAN technology; meaning it's possible to determine the maximum delay before a device is able to transmit a message.

C. BACnet

1. Building Automation and Control Network; the common name for the communication standard ASHRAE 135. The standard defines methods and protocol for cooperating building automation devices to communicate over a variety of LAN technologies.

D. BACnet/IP

1. An extension of BACnet, Annex J, defines this mechanism using a reserved UDP socket to transmit BACnet messages over IP networks.A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.See also "BACnet Broadcast Management Device".

E. BACnet Internetwork

1. Two or more BACnet networks, possibly using different LAN technologies, connected with routers. In a BACnet internetwork, there exists only one message path between devices.

F. BACnet Network

1. One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

G. BACnet Segment

1. One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

H. BBMD

1. BACnet Broadcast Management Device (BBMD). A communications device, typically combined with a BACnet router. A BBMD forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs connected to the same BACnet/IP network. Every IP subnetwork that is part of a BACnet/IP network must have only one BBMD. See also "BACnet/IP".

I. BAS

1. Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

J. BAS Owner

1. The regional or local user responsible for managing all aspects of the BAS operation, including: network connections, workstation management, submittal review, technical

support, control parameters, and daily operation. The BAS Owner for this project is Texas Military Department.

K. BIBBs

1. BACnet Interoperability Building Blocks. A collection of BACnet services used to describe supported tasks. BIBBs are often described in terms of "A" (client) and "B" (server) devices. The “A” device uses data provided by the "B" device, or requests an action from the “B” device.

L. BI

1. BACnet International, formerly two organizations: the BACnet Manufacturers Association (BMA) and the BACnet Interest Group - North America (BIG-NA).

M. BI/BTL

1. BACnet International/BACnet Testing Laboratories (Formerly BMA/BTL).The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

N. Bridge

1. Network hardware that connects two or more network (or BACnet internetwork) segments at the physical and data link layers. A bridge may also filter messages.

O. Broadcast

1. A message sent to all devices on a network segment.

P. Device

1. Any control system component, usually a digital controller that contains a BACnet Device Object and uses BACnet to communicate with other devices. See also "Digital Controller".

Q. Device Object

1. Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

R. Device Profile

1. A collection of BIBBs determining minimum BACnet capabilities of a device, defined in ASHRAE Standard 135-2004, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing BIBBs supported.

S. Digital Controller

1. An electronic controller, usually with internal programming logic and digital and analog input/output capability, which performs control functions. In most cases, synonymous with a BACnet device described in this specification. See also "Device".

T. Direct Digital Control (DDC)

1. Digital controllers performing control logic. Usually the controller directly senses physical values, makes control decisions with internal programs, and outputs control signals to directly operate switches, valves, dampers, and motor controllers.

U. DDC System

1. A network of digital controllers, communication architecture, and user interfaces. A DDC system may include programming, sensors, actuators, switches, relays, factory controls, operator workstations, and various other devices, components, and attributes.

V. Ethernet

1. A family of local-area-network technologies providing high-speed networking features over various media.

W. Firmware

1. Software programmed into read only memory (ROM), flash memory, electrically erasable programmable read only memory (EEPROM), or erasable programmable read only memory (EPROM) chips.

X. Gateway

1. Communication hardware connecting two or more different protocols, similar to human language translators. The Gateway translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

Y. Half Router

1. A device that participates as one partner in a BACnet point-to-point (PTP) connection. Two half-routers in an active PTP connection combine to form a single router.

Z. Hub

1. A common connection point for devices on a network.

AA. Internet Protocol (IP, TCP/IP, UDP/IP)

1. A communication method, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying and routing packets of information over various LAN media. Two common protocols using IP are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

BB. Input/Output (I/O)

1. Physical inputs and outputs to and from a device, although the term sometimes describes software, or "virtual" I/O. See also "Points".

CC. I/O Expansion Unit

1. An I/O expansion unit provides additional point capacity to a digital controller.

DD. IP subnet

1. Internet protocol (IP) identifies individual devices with a 32-bit number divided into four groups from 0 to 255. Devices are often grouped and share some portion of this number. For example, one device has IP address 209.185.47.68 and another device has IP address 209.185.47.82. These two devices share Class C subnet 209.185.47.00

EE. Local-Area Network (LAN)

1. A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

FF. LonTalk

1. CEA-709.1-D. A communication protocol developed by Echelon Corp. LonTalk is an optional physical and data link layer for BACnet.

GG. MAC Address

1. Media Access Control address. The physical node address that identifies a device on a Local Area Network.

HH. Master-Slave/Token-Passing (MS/TP)

1. ISO 8802-3. One of the LAN options for BACnet. MSTP uses twisted-pair wiring for relatively low speed and low cost communication (up to 4,000 ft at 76.8K bps).

II. Native BACnet Device

1. A device that uses BACnet as its primary, if not only, method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

JJ. Network

1. Communication technology for data communications. BACnet approved network types are BACnet over Internet Protocol (IP), Point to Point (PTP) Ethernet, ARCNET, MS/TP, and LonTalk®.

KK. Network Number

1. A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

LL. Object

1. The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

MM. Object Identifier

1. An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

NN. Object Properties

1. Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

OO. Peer-to-Peer

1. Peer-to-peer refers to devices where any device can initiate and respond to communication with other devices.

PP. Performance Verification Test (PVT)

1. The procedure for determining if the installed BAS meets design criteria prior to final acceptance. The PVT is performed after installation, testing, and balancing of mechanical systems. Typically the PVT is performed by the Contractor in the presence of the Government.

QQ. PID

1. Proportional, integral, and derivative control; three parameters used to control modulating equipment to maintain a setpoint. Derivative control is often not required for HVAC systems (leaving "PI" control).

RR. PICS

1. Protocol Implementation Conformance Statement (PICS), describing the BACnet capabilities of a device. See BACnet, Annex A for the standard format and content of a PICS statement.

SS. Points

1. Physical and virtual inputs and outputs. See also "Input/Output".

TT. PTP

1. Point-to-Point protocol connects individual BACnet devices or networks using serial connections like modem-to-modem links.

UU. Repeater

1. A network component that connects two or more physical segments at the physical layer.

VV. Router

1. A BACnet router is a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

WW. Stand-Alone Control

1. Refers to devices performing equipment-specific and small system control without communication to other devices or computers for physical I/O, excluding outside air and other common shared conditions. Devices are located near controlled equipment, with physical input and output points limited to 64 or less per device, except for complex individual equipment or systems. Failure of any single device will not cause other network devices to fail. BACnet "Smart" actuators (B-SA profile) and sensors (B-SS

profile) communicating on a network with a parent device are exempt from stand-alone requirements.

1.03 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC DESCRIPTION

A. Scope Description

1. For the BASE BID:

a. Provide a Tridium Niagara N4 framework global building controller (as described in Part 1.03.B) for integration of new energy meters.

2. If SECO BID OPTION #2 is selected:

a. Utilize the global building controller specified in Part 1.03.A.1 above in addition to the requirements therein.

b. Provide a new totally native BACnet based systems including a Microsoft 10 compatible operators workstation, associated equipment and accessories. The operator’s workstation, all building controllers, application controllers, and all input/output devices shall be accessible using a Web browser interface and shall communicate using the protocols and network standards as defined by the latest version of the ANSI/ASHRAE Standard 135, BACnet. In other words, all workstations and controllers, including unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section unless gateways are shown on the design drawings and specifically requested by the Government. Gateways may be used for communication to existing systems or to systems installed under other sections. Where gateways are allowed, they must support ASHRAE 135, including all object properties and read-write services shown on Government approved interoperability schedules. Manufacturer's products, including design, materials, fabrication, assembly, inspection, and testing shall be in accordance with ASHRAE 135, ASME B31.1, and NFPA 70, except where indicated otherwise.

B. The Global Building Controller shall be based on a Tridium Niagara N4 framework and shall be able to communicate with a Niagara N4 or AX Supervisor system. The Niagara AX Supervisor system will be provided under a separate contract and will be located in Building 18 at Camp Mabry. Provide the required Niagara N4 License to allow the N4 Global Building Controller to communicate with a Niagara AX system.

C. The Owner shall own and shall have full rights to all features of the Niagara AX software.

D. Provide all necessary BACnet-compliant hardware and software to meet the system’s functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers

E. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

F. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

G. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

H. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

I. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

J. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

K. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

L. Provide a comprehensive operator and technician training program as described herein.

M. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

N. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.

1.04 DESIGN REQUIREMENTS

A. Control System Drawings Title Sheet

1. Provide a title sheet for the control system drawing set. Include the project title, project location, contract number, the controls contractor preparing the drawings, an index of the control drawings in the set, and a legend of the symbols and abbreviations used throughout the control system drawings.

B. List of I/O Points

1. Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Binary Output (BO), Binary Input (BI)), point sensor range, point actuator range, point address, BACnet object, associated BIBBS (where applicable), and point connection terminal number. Typical schedules for multiple

identical equipment are allowed unless otherwise requested in design or contract criteria.

C. Control System Components List

1. Provide a complete list of control system components installed on this project. Include for each controller and device: control system schematic name, control system schematic designation, device description, manufacturer, and manufacturer part number. For sensors, include point name, sensor range, and operating limits. For valves, include body style, Cv, design flow rate, pressure drop, valve characteristic (linear or equal percentage), and pipe connection size. For actuators, include point name, spring or non-spring return, modulating or two-position action, normal (power fail) position, nominal control signal operating range (0-10 volts DC or 4-20 milliamps), and operating limits.

D. Control System Schematics

1. Provide control system schematics. Typical schematics for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. Include the following:

a. Location of each input and output device

b. Flow diagram for each piece of HVAC equipment

c. Name or symbol for each control system component, such as V-1 for a valve

d. Setpoints, with differential or proportional band values

e. Written sequence of operation for the HVAC equipment

f. Valve and Damper Schedules, with normal (power fail) position

E. HVAC Equipment Electrical Ladder Diagrams

1. Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

F. Component Wiring Diagrams

1. Provide a wiring diagram for each type of input device and output device. Indicate how each device is wired and powered; showing typical connections at the digital controller and power supply. Show for all field connected devices such as control relays, motor starters, actuators, sensors, and transmitters.

G. Terminal Strip Diagrams

1. Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

H. BACnet Communication Architecture Schematic

1. Provide a schematic showing the project's entire BACnet communication network, including addressing used for LANs, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connection to existing networks.

1.05 SUBMITTALS

A. Submit detailed and annotated manufacturer's data, drawings, and specification sheets for each item listed, that clearly show compliance with the project specifications. Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00.

1. SD-01 Firm & Installer Qualifications:

a. Address of local office from where the site will be serviced.

b. Address of local support facility that will be to supply parts and inventory for the site.

c. List of similar sized projects completed by firm in past three (3) years. List start and finish dates, scope of controls and list of systems programmed.

d. Name and qualification of the full-time, on-site experienced project manager for each site.

e. Name and qualifications of manufacturer authorized and trained personnel who will be working on these sites.

f. Additional supporting documents to demonstrate compliance with section 1.06/F of this document.

2. SD-02 Shop Drawings: Include the following in the project's control system drawing set:

a. Control system drawings title sheet.

b. List of I/O Points.

c. Control System Components List.

d. Control system schematics.

e. HVAC Equipment Electrical Ladder diagrams.

f. Component wiring diagrams.

g. Terminal strip diagrams.

h. BACnet communication architecture schematic.

3. SD-03 Product Data

a. Direct Digital Controllers: Include BACnet PICS for each controller/device type, including smart sensors (B-SS) and smart actuators (B-SA).

b. BACnet Gateways: Include BACnet and workstation display information; bi-directional communication ability; compliance with interoperability schedule; expansion capacity; handling of alarms, events, scheduling and trend data; and single device capability (not depending on multiple devices for exchanging information from either side of the gateway).

c. BACnet Protocol Analyzer: Include capability to store and report data traffic on BACnet networks, measure bandwidth usage, filter information, and identify BACnet devices.

d. DDC Software.

e. BACnet Operator Workstation.

f. BACnet Operator Workstation DDC Software. Include BACnet PICS for Operator Workstation software.

g. Notebook Computer.

h. Sensors and Input Hardware.

i. Output Hardware.

j. Surge and transient protection.

k. Indicators.

l. Duct smoke detectors.

4. SD-05 Design Data

a. Performance Verification Testing Plan.

b. Pre-Performance Verification Testing Checklist.

5. SD-06 Test Reports

a. Performance Verification Testing Report.

6. SD-07 Certificates

    a. Contractor's Qualifications.

7. SD-09 Manufacturer's Field Reports

    a. Pre-PVT Checklist.

8. SD-10 Operation and Maintenance Data: Comply with requirements for data packages in Section 01 78 23 OPERATION AND MAINTENANCE DATA, except as supplemented and modified in this specification.

    a. BACnet Direct Digital Control Systems, Data Package 4.

    b. Controls System Operators Manuals, Data Package 4.

9. SD-11 Closeout Submittals

    a. Training documentation.

1.06 QUALITY ASSURANCE

A. Standard Products

1. Provide material and equipment that are standard manufacturer's products currently in production and supported by a local service organization.

2. Materials and equipment shall be manufacturer's latest standard design that complies with the specification requirements. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled

B. Delivery, Storage, and Handling

1. Handle, store, and protect equipment and materials to prevent damage before and during installation according to manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

C. Operating Environment

1. Protect components from humidity and temperature variation, dust, and contaminants. If components are stored before installation, keep them within the manufacturer's limits.

D. Finish of New Equipment

1. New equipment finishing shall be factory provided. Manufacturer's standard factory finishing shall be proven to withstand 125 hours in a salt-spray fog test. Equipment located outdoors shall be proven to withstand 500 hours in a salt-spray fog test.

2. Salt-spray fog test shall be according to ASTM B117, with acceptance criteria as follows: immediately after completion of the test, the finish shall show no signs of degradation or loss of adhesion beyond 0.125 inch on either side of the scratch mark.

E. Verification of Dimensions

1. The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

F. Contractor's Qualifications

1. The Building Automation System (BAS) system shall be designed, installed, commissioned, and serviced by manufacturer authorized and trained personnel. System provider shall have an in-place support facility within 2 hours response time of the site with technical staff, spare parts inventory, and necessary test and diagnostic equipment.

2. The contractor shall provide full-time, on-site, experienced project manager for this work, responsible for direct supervision of the design, installation, start-up and commissioning of the BAS system.

3. The Bidder shall be regularly engaged in the design, installation and maintenance of BAS systems and shall have demonstrated technical expertise and experience in the design, installation and maintenance of BAS systems similar in size and complexity to this project.

4. Control system shall be engineered, programmed and supported completely by representative’s local office that must be within 100 miles of project site.

5. Submit documentation supporting the above requirements and certifying the controls Contractor performing the work has completed at least three DDC systems installations of a similar design to this project, and programmed similar sequences of operation for at least two years. Controls Contractor shall provide a list of at these projects with project information and references.

G. Modification of References

1. The advisory provisions in ASME B31.1 and NFPA 70 are mandatory. Substitute "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Contracting Officer.

H. Project Sequence

1. The control system work for this project shall proceed in the following order:

    a. Submit and receive approval on the Shop Drawings, Product Data, and Certificates specified under the paragraph entitled "SUBMITTALS."

    b. Perform the control system installation work, including all field check-outs and tuning.

    c. Provide support to TAB personnel as specified under the paragraph "TEST AND BALANCE SUPPORT."

    d. Submit and receive approval of the Controls System Operators Manual specified under the paragraph "CONTROLS SYSTEM OPERATORS MANUALS."

    e. Submit and receive approval of the Performance Verification Testing Plan and the Pre-PVT Checklist specified under the paragraph "PERFORMANCE VERIFICATION TESTING."

    f. Perform the Performance Verification Testing.

    g. Submit and receive approval on the PVT Report.

    h. Submit and receive approval on the Training Documentation specified under the paragraph "INSTRUCTION TO GOVERNMENT PERSONNEL". Submit at least 30 days before training.

    i. Deliver the final Controls System Operators Manuals.

    j. Conduct Training.

    k. Submit and receive approval of Closeout Submittals.

2.00 PRODUCTS

2.01 DDC SYSTEM

Provide a networked DDC system for stand-alone control in compliance with the latest revision of the ANSI/ASHRAE Standard 135 BACnet. Include all programming, objects, and services required to meet the sequence of control. Provide BACnet communications between the DDC system and native BACnet devices furnished with HVAC equipment and plant equipment including boilers, chillers, and variable frequency drives.

Provide an operator workstation laptop with complete interface software capable of programming, configuring, and monitoring the digital controllers.

A. Direct Digital Controllers

1. Direct digital controllers shall be UL 916 rated.

B. I/O Point Limitation

1. The total number of I/O hardware points used by a single stand-alone digital controller, including I/O expansion units, shall not exceed 64, except for complex individual equipment or systems. Place I/O expansion units in the same cabinet as the digital controller.

C. Environmental Limits

1. Controllers shall be suitable for, or placed in protective enclosures suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

D. Stand-Alone Control

1. Provide stand-alone digital controllers.

E. Internal Clock

1. Provide internal clocks for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

F. Memory

1. Provide sufficient memory for each controller to support the required control, communication, trends, alarms, and messages. Protect programs residing in memory with EEPROM, flash memory, or by an uninterruptible power source (battery or uninterruptible power supply). The backup power source shall have capacity to maintain the memory during a 72-hour continuous power outage. Rechargeable power sources shall be constantly charged while the controller is operating under normal line power. Batteries shall be replaceable without soldering. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long.

G. Immunity to Power Fluctuations

1. Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

H. Transformer

1. The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

I. Wiring Terminations

1. Use screw terminal wiring terminations for all field-installed controllers. Provide field-removable modular terminal strip or a termination card connected by a ribbon cable for all controllers other than terminal units.

J. Input and Output Interface

1. Provide hard-wired input and output interface for all controllers as follows:

a. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage.

b. Binary Inputs: Binary inputs shall have a toggle switch and monitor on and off contacts from a "dry" remote device without external power, and external 5-24 VDC voltage inputs.

c. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and accumulate pulses at a resolution suitable to the application.

d. d. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 VDC), current (4-20 mA), or resistance (thermistor or RTD) signals.

e. Binary Outputs: Binary outputs shall have a toggle switch and send a pulsed 24 VDC low-voltage signal for modulation control, or provide a maintained open-closed position for on-off control. For HVAC equipment and plant controllers, provide for manual overrides, either with three-position (on-off-auto) override switches and status lights, or with an adjacent operator display and interface. Where appropriate, provide a method to select normally open or normally closed operation.

f. Analog Outputs: Analog outputs shall send modulating 0-10 VDC or 4-20 mA signals to control output devices.

g. Tri-State Outputs: Tri-State outputs shall provide three-point floating control of terminal unit electronic actuators.

K. Digital Controller BACnet Internetwork

1. Provide a BACnet internetwork with control products, communication media, connectors, repeaters, hubs, and routers. Provide intermediate gateways, only when requested by the Government and shown on the contract drawings, to connect existing non-BACnet devices to the BACnet internetwork. Controller and operator interface communication shall conform to ASHRAE 135, BACnet. Coordinate connections to existing Ethernet backbones with the BAS Owner and LAN administrator. If a controller becomes non-responsive, the remaining controllers shall continue operating and not be affected by the failed controller.

L. Communications Ports

1. Direct-Connect Interface Ports: Provide at least one extra communication port at each local BACnet network for direct connecting a notebook computer or BACnet hand-held terminal so all network BACnet objects and properties may be viewed and edited by the operator.

M. BACnet Gateways

1. Provide BACnet communication ports, whenever available as a plant equipment OEM standard option, for DDC integration via a single communication cable. Typical BACnet controlled plant equipment includes, but is not limited to, boilers, chillers, and variable frequency motor drives.

2. Provide gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC controlled plant equipment, only when specifically requested and approved by the Government, and shown on the Government approved BACnet Communication Architecture Schematic. Provide with each gateway an interoperability schedule [Use gateway interoperability schedules shown on design drawings or other project documents], showing each point or event on the legacy side that the BACnet "client" will read, and each parameter that the BACnet network will write to. Describe this interoperability in terms of BACnet services, or Interoperability Building Blocks (BIBBS), defined in ASHRAE 135 Annex K. Provide two-year minimum warranty for each gateway, including parts and labor.

3. The following minimum capabilities are required:

   a. Gateways shall be able to read and view all readable object properties listed in the interoperability schedule on the non-BACnet network to the BACnet network and vice versa where applicable.

   b. Gateways shall be able to write to all writeable object properties listed in the interoperability schedule on the non-BACnet network from the BACnet network and vice versa where applicable.

   c. Gateways shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.

   d. Gateways shall meet the requirements of Data Sharing Read Property (DS-RP-B), Data Sharing Write Property (DS-WP-B), Device Management Dynamic Device Binding-B (DM-DDB-B), and Device Management Communication Control (DM-DCC-B) BIBBs, in accordance with ASHRAE 135.

e. Gateways shall include all hardware, software, software licenses, and configuration tools for operator-to-gateway communications. Provide backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

N. Digital Controller Cabinet

1. Provide each digital controller in a factory fabricated cabinet enclosure. Cabinets located indoors shall protect against dust and have a minimum NEMA 1 rating, except where indicated otherwise. Cabinets located outdoors or in damp environments shall protect against all outdoor conditions and have a minimum NEMA 4 rating. Outdoor control panels and controllers must be able to withstand extreme ambient conditions, without malfunction or failure, whether or not the controlled equipment is running. If necessary, provide a thermostatically controlled panel heater in freezing locations, and an internal ventilating fan in locations exposed to direct sunlight. Cabinets shall have a hinged lockable door and an offset removable metal back plate, except controllers integral with terminal units, like those mounted on VAV boxes. Provide like-keyed locks for all hinged panels provided and a set of two keys at each panel, with one key inserted in the lock.

O. Main Power Switch and Receptacle

1. Provide each control cabinet with a main external power on/off switch located inside the cabinet. Also provide each cabinet with a separate 120 VAC duplex receptacle.

2.02 SOFTWARE

A. Programming

1. Provide programming to execute the sequence of operation indicated. Provide all programming and tools to configure and program all controllers. Provide programming routines in simple, easy-to-follow logic with detailed text comments describing what the logic does and how it corresponds to the project's written sequence of operation.

a. The Owner shall own and shall have full rights to all features of the software.

b. Graphic-based programming shall use a library of function blocks made from pre-programmed code designed for BAS control. Function blocks shall be assembled with interconnecting lines, depicting the control sequence in a flowchart. If providing a computer with device programming tools as part of the project, graphic programs shall be viewable in real time showing present values and logical results from each function block.

c. Menu-based programming shall be done by entering parameters, definitions, conditions, requirements, and constraints.

d. For line-by-line and text-based programming, declare variable types (local, global, real, integer, etc.) at the beginning of the program. Use descriptive comments frequently to describe the programming.

e. If providing a computer with device programming tools as part of the project, provide a means for detecting program errors and testing software strategies with a simulation tool. Simulation may be inherent within the programming software suite, or provided by physical controllers mounted in a NEMA 1 test enclosure. The test enclosure shall contain one dedicated controller of each type provided under this contract, complete with power supply and relevant accessories.

B. Parameter Modification

1. All writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable for devices at any network level, including those accessible with web-browser communication, and regardless of programming methods used to create the applications.

C. Short Cycling Prevention

1. Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

D. Equipment Status Delay

1. Provide an adjustable delay from when equipment is commanded on or off and when the control program looks to the status input for confirmation.

E. Run Time Accumulation

1. Use the Elapsed Time Property to provide re-settable run time accumulation for each Binary Output Object connected to mechanical loads greater than 1 HP, electrical loads greater than 10 KW, or wherever else specified.

F. Timed Local Override

1. Provide an adjustable override time for each push of a timed local override button.

G. Time Synchronization

1. Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

H. Scheduling

1. Provide operating schedules as indicated, with equipment assigned to groups. Changing the schedule of a group shall change the operating schedule of all equipment in the

group. Groups shall be capable of operator creation, modification, and deletion. Provide capability to view and modify schedules in a seven-day week format. Provide capability to enter holiday and override schedules one full year at a time.

I. Object Property Override

1. Allow writeable object property values to accept overrides to any valid value. Where specified or required for the sequence of control, the Out-Of-Service property of Objects shall be modifiable using BACnet's write property service. When documented, exceptions to these requirement are allowed for life, machine, and process safeties.

J. Alarms and Events

1. Alarms and events shall be capable of having programmed time delays and high-low limits. When a computer workstation or web server is connected to the BACnet internetwork, alarms/events shall report to the computer, printer, e-mail, cell phone, as defined by an authorized operator. Otherwise alarms/events shall be stored within a device on the BACnet network until connected to a user interface device and retrieved. Provide alarms/events in agreement with the point schedule, sequence of operation, and the BAS Owner. At a minimum, provide programming to initiate alarms/events any time a piece of equipment fails to operate, a control point is outside normal range or condition shown on schedules, communication to a device is lost, a device has failed, or a controller has lost its memory.

K. Trending

1. Provide BACnet trend services capable of trending all object present values set points, and other parameters indicated for trending on project schedules. Trends may be associated into groups, and a trend report may be set up for each group. Trends are stored within a device on the BACnet network, with operator selectable trend intervals from 10 seconds up to 60 minutes. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, the most recent data shall overwrite the oldest data.

2. The operator workstation shall upload trends automatically upon reaching 3/4 of the device buffer limit (via Notification Threshold property), by operator request, or by time schedule for archiving. Archived and real-time trend data shall be available for viewing numerically and graphically for at the workstation and connected notebook computers.

L. Device Diagnostics

1. Each controller shall have diagnostic LEDs for power, communication, and device fault condition. The DDC system shall recognize and report a non-responsive controller.

M. Power Loss

1. Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

2.03 BACNET OPERATOR WORKSTATION

The workstation shall be capable of accessing all DDC system devices and communicate using the BACnet protocol. The workstation shall be capable of displaying, modifying, creating, archiving, and deleting (as applicable): all points, objects, object properties, programming, alarms, trends, messages, schedules, and reports.

A. BACnet Operator Workstation Hardware

1. Configure according to system manufacturer's specifications and conforming to BACnet Operator Workstation (B-OWS) device standards found in ASHRAE 135, Annex L. Install to permit complete monitoring and troubleshooting of the DDC system.

2. The operator workstation shall comply with the following specifications:

a. Dell Latitude 5285 2 in 1 Tablet

b. 12.3 inch IPS Display with FHD (1920 x 1080) resolution with 10-pt capacitive touch

c. Microsoft Windows 10 Pro 64 Operating System

d. 64-bit English/French Intel® HD Graphics 620

e. 16GB LPDDR3 1600MHz Memory

f. 360GB Solid State Storage

g. Qualcomm QCA61x4A 802.11ac Dual Band (2x2) Wireless Adapter+ Bluetooth 4.1

h. No DDPE Encryption Software

i. Dell Tablet Dock v2.0 with Gigabit Ethernet

j. Dell Tablet Keyboard – Mobile Documentation

k. Dell Active Stylus

l. Dell WM524 Wireless Travel Mouse

m. Dell Urban 2.0 Top load Carrying Case -15.6”

n. SCM SCR3310V2 Smart USB Card Reader

o. Targus Dell Latitude 13 Laptop Auto/Air Charger

p. 1M High Speed HDMI to HDMI Micro Cable with Ethernet (3.3ft)

q. Dell Adapter – USB 3.0 to Ethernet PXE Boot

r. C2G HDMI Micro to VGA and Stereo Audio Adapter Converter Dongle - Video converter - black Intel® Core™ M-5Y71 vPro™ processor

s. McAfee Security Center 12 month Subscription

t. Intel vPro™ Technology's Advanced Management Features

u. 38Whr Battery

v. Intel Core M-5Y71, 8GB, Wifi/WWAN near Field Communications

w. Integrated 2MP HD Webcam (front) / 8MP (back) Software Driver

x. TPM 1.2 hardware security Regulatory Label

y. 24 Watt AC Adapter

z. Manufacturer’s 3 Year Hardware Service with Onsite Service after Remote Diagnosis

aa. Manufacturer’s 3-year next business day on-site warranty with the Government listed as the warranty owner

bb. Include all original licenses, installation media, documentation, and recovery CDs capable of restoring the original configuration in a three binder with the project information and site location on cover. Include a table of contents as the first page of the binder. The Binder shall be handed over the Owner.

B. Password Protection

1. Provide at least five levels of password protection for operator interfaces. The lowest level only allow viewing graphics. The second level allows viewing graphics and changing space temperature setpoints. The third level allows the previous level's capability, plus changing operating schedules. The fourth level allows access to all functions except passwords. The highest level provides all administrator rights and allows full access to all programming, including setting new passwords and access levels. Provide the BAS Owner with the highest level password access. Provide automatic log out if no keyboard or mouse activity is detected after a user-defined time delay.

C. BACnet Operator Workstation DDC Software

1. Provide the workstation software with the manufacturer's installation CDs and licenses. Configure the software according to the DDC system manufacturer's specifications and in agreement with BACnet Operator Workstation (B-OWS) device standards found in ASHRAE 135, Annex L.

2. The workstation software shall permit complete monitoring, modification, and troubleshooting interface with the DDC system. The operator interface with the software shall be menu-driven with appropriate displays and menu commands to manipulate the DDC system's objects, point data, operating schedules, control routines, system configuration, trends, alarms, messages, graphics, and reports. Trends shall be capable of graphic display in real time, with variables plotted as functions of time. Each alarmed point shall be capable of displaying its alarm history, showing when it went into alarm, if and when it was acknowledged, and when it went out of alarm. The modification of DDC system parameters and object properties shall be accomplished with "fill in the blank" and/or "point and drag" methods. Modifications shall download to the appropriate controllers at the operator's request.

3. The Owner shall own and shall have full rights to all features of the software.

D. Graphics Software

1. Provide web-based system graphics viewable on latest versions of browsers such as Internet Explorer, Chrome, etc. using an industry-standard file format such as HTML, BMP, JPEG, or GIF.

2. Graphic displays shall have full-screen resolution when viewed on the workstation and notebook computers. Dynamic data on graphics pages shall refresh within 10 seconds using an Internet connection, or 30 seconds using a dial-up modem connection. Graphics viewing shall not require additional "plug-in" software like Java, Shockwave and Flash applications unless the software is readily available for free over the Internet, and certified for use with Reserve Component Automation System (RCAS) computers.

3. The graphics shall show the present value and object name for each of the project's I/O points on at least one graphic page. Arrange point values and names on the graphic displays in their appropriate physical locations with respect to the floor plan or equipment graphic displayed. Graphics shall allow the operator to monitor current status, view zone and equipment summaries, use point-and-click navigation between graphic pages, and edit setpoints and parameters directly from the screens. Items in alarm shall be displayed using a different color or other obvious visual indicator. Provide graphics with the following:

a. Graphic Types: Provide at least one graphic display for each piece of HVAC equipment, building floor, and controlled zone. Indicate dynamic point values, operating statuses, alarm conditions, and control setpoints on each display. Provide summary pages where appropriate.

1). Building Elevation: For buildings more than one story, provide an elevation view of the building with links to each of the building's floor plans. Simulate the

building's architecture and include the building number and floor numbers. If possible, use an actual photograph of the building.

2). Building Floor Plans: Provide a floor plan graphic for each of the building's floors [and roof] with dynamic display of space temperature and other important data. If used, indicate and provide links to sub-plan areas. If possible, use the project's electronic drawing files for the graphic backgrounds. Provide clear names for important areas, such as "Main Conference Room." Include room names and numbers where applicable. Include features such as stairwells, elevators, and main entrances. Where applicable, include the mechanical room, HVAC equipment, and control component locations, with corresponding links to the equipment graphics.

3). Sub-plan Areas: Where a building's floor plan is too large to adequately display on the screen, sub-divide the plan into distinct areas, and provide a separate graphic display for each area. Provide same level of detail requested in building floor plan section above.

4). HVAC Equipment: Provide a graphic display for each piece of HVAC equipment, such as a fan coil unit, VAV terminal, or air handling unit. Equipment shall be represented by a two or three-dimensional drawing. Where multiple pieces of equipment combine to form a system, such as a central chiller plant or central heating plant, provide one graphic to depict the entire plant. Indicate the equipment, piping, ductwork, dampers, and control valves in the installed location. Include labels for equipment, piping, ductwork, dampers, and control valves. Show the direction of air and water flow. Include dynamic display of applicable object data with clear names in appropriate locations.

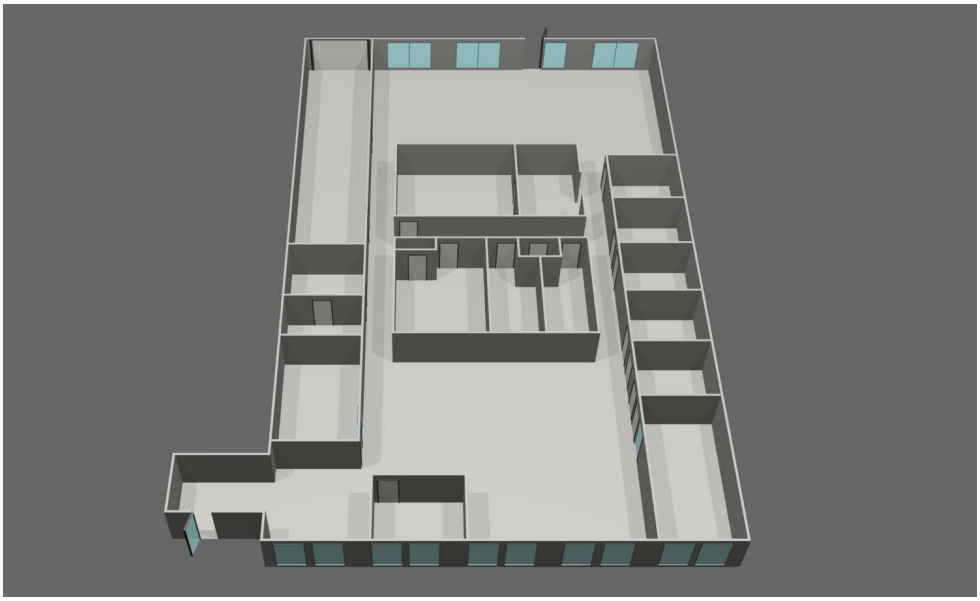
5). Sequence of Operation: Provide a graphic screen displaying the written out full sequence of operation for each piece of HVAC equipment. Provide a link to the sequence of operation displays on their respective equipment graphics.

6). The Contractor shall utilize standard Niagara AX graphics from Tridium. These graphics shall be modified or altered to match the systems and equipment in the project.

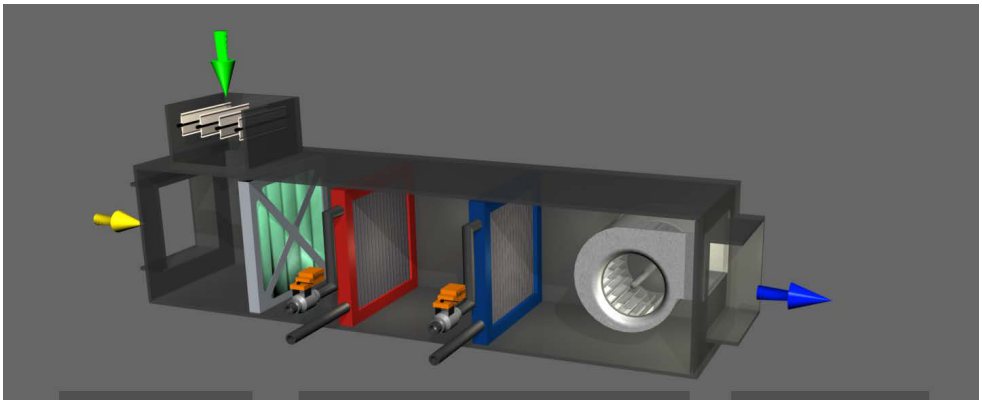
7). The BAS system shall be provided a library of graphics which may be used unaltered or modified by the operator. BAS shall include a library of equipment graphic components to assemble custom graphics. Systems that do not allow customization or creation of new graphic objects by the operator (or with third-party software) shall not be allowed.

8). Sample of Graphics:

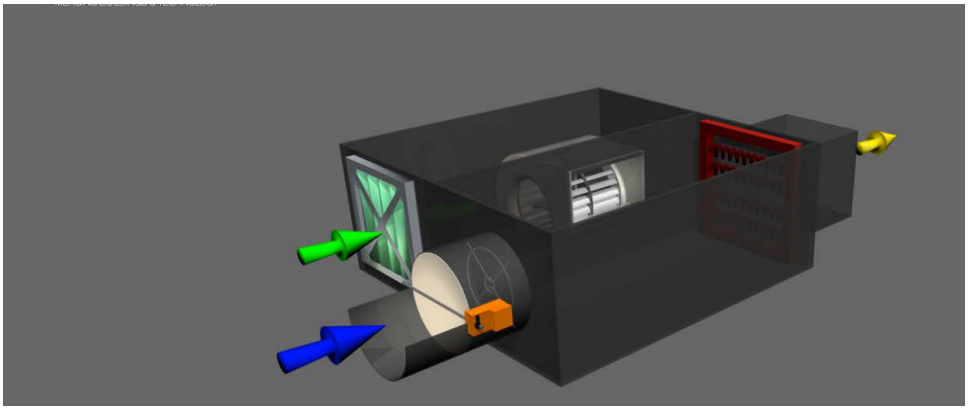
a). Floorplan.



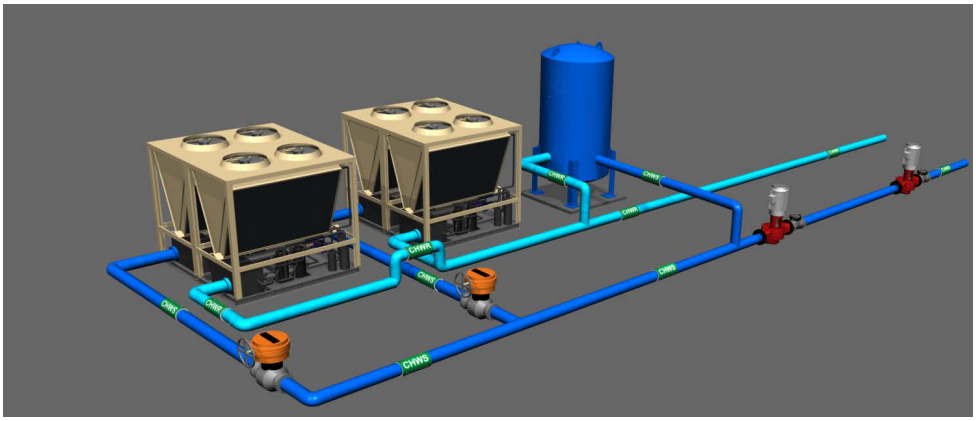
b). Air Handler (will resemble actual equipment type and configuration).



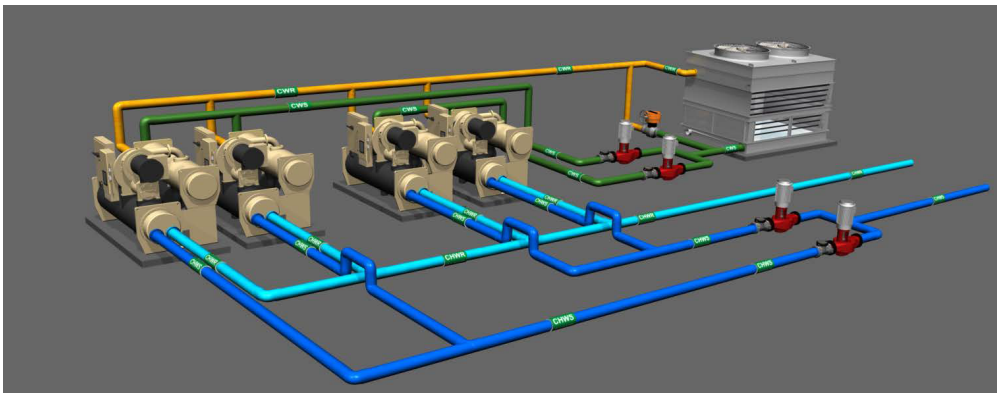
c). VAV Box (will resemble actual equipment type and configuration).



d). Air Cooled Chiller (will resemble actual equipment type and configuration).



e). Chilled Water Plant (will resemble actual equipment type and configuration).



b. Graphic Title: Provide a prominent, descriptive title on each graphic page.

c. Dynamic Update: When the workstation is on-line, all graphic I/O object values shall update with change-of-value services, or by operator selected discrete intervals.

d. Graphic Linking: Provide forward and backward linking between floor plans, sub-plans, and equipment.

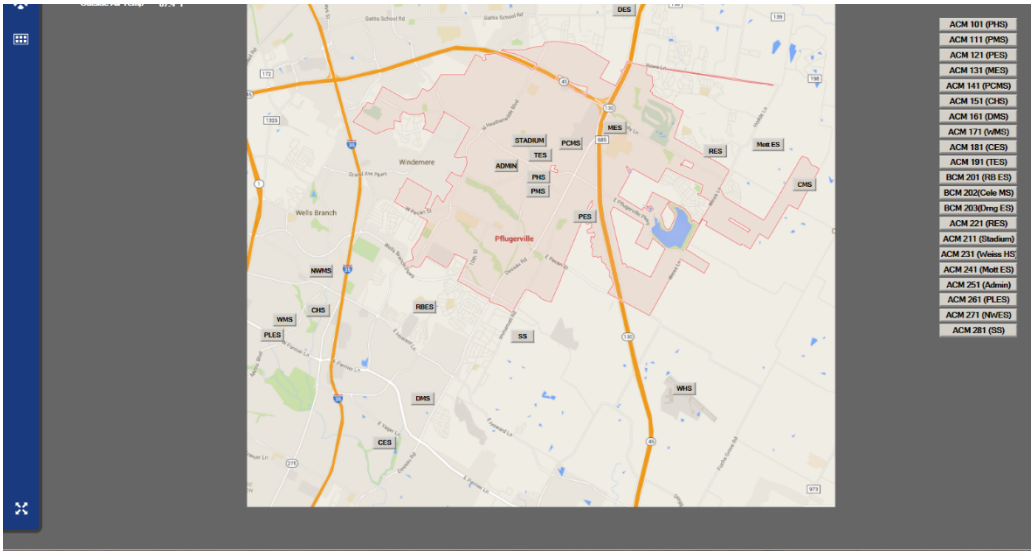
e. Graphic Editing: Provide installed software to create, modify, and delete the DDC graphics. Include the ability to store graphic symbols in a symbol directory and import these symbols into the graphics.

f. Dynamic Point Editing: Provide full editing capability for deleting, adding, and modifying dynamic points on the graphics.

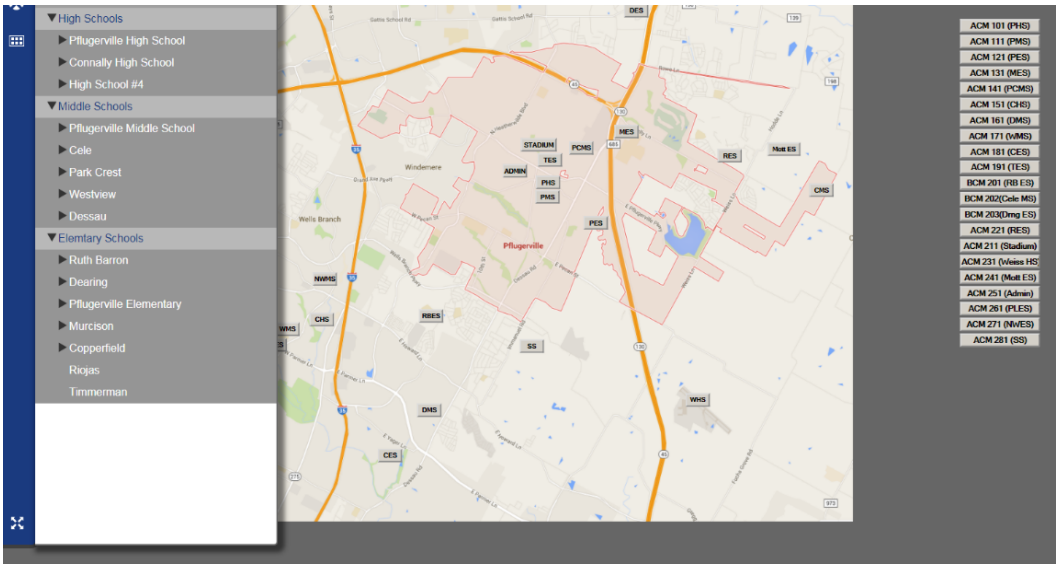
g. Character Limit < 24 characters: With new control systems the limit on the number of characters can range from 30-255 but they should be limited to less than 24 for space constraints in displays and unknown limits that may be imposed from other interfacing systems.

h. Example Front End Graphics Home Page:

1). Front End Home Page.



2). Front End Home Page with Navigation Tree.



i. Point Naming Conventions: Existing systems point names vary by system capabilities and site conventions. The site naming convention must be followed where possible. Approval is required from HNC prior to alternative point name creation. This is to ensure there are no conflicts with the MDMS gateway requirements.

1). Primary equipment names:

a). Servers are named EEDRS. However, the local data center server naming convention takes priority.

b). Building/Facility Point of Connection (BPOC/FPOC). Name is by site and building. Use no space, period or dash unless system constraints dictate otherwise: SiteBuilding#. Example: FTBRAGG3720

c). LON TP/FT10 channel names. Name in this order: Protocol Site Building#. Example: LON Bragg 100. Note that here a space is used to separate.

2). The following point naming conventions are approved for new system installations:

a). SiteName is the Post name.

b). Building# - is the building number containing the meter; it is always the number of the building, although that building number may include a letter.

c). Meter - is the meter type within the building: electric, gas, water, steam; use the word METER for electric meters and the words GAS, WATER, STEAM, BTU for the other types of meters.

d). Meter # - is the meter number (the nth number) within the building.

e). Parameter - is the name of the measured variable

For single site systems:

Building#_Meter_Meter#_Parameter

Building#.Meter_Meter#.Parameter

Example:

BLDG_2315_METER_2_VOLTS_A_B

BLDG_2315.METER_2.VOLTS_A_B

For multi-site systems, where a regional host exists:

SiteName_Building#_Meter_Meter#_Parameter

Sitename.Building#.Meter_Meter#.Parameter

Example:

HOOD_2315_METER_2_KW

HOOD_2315.METER_2.KW

Where a site area designator is required:

SiteName_Area_Building#_METER_Meter#_Parameter

Example:

Hood_A_2315_METER_2_KW

Hood_A.2315.METER_2.KW

Note: Some UMCS host software may automatically attach the Building/Facility Point of Connection (JACEx or NAE) to the point name.

4. Object Naming Conventions: The following naming conventions shall be used:

Systems & Actions	Abbreviation
Adjustment	Adj
Air	Air
Air Flow	AirFlow
Alarm	Alm
Basin	Basin
Breakglass	Breakglass
Building	Bldg
Bypass	Bypass
Carbon Dioxide	Co2
Carbon Dioxide	CO2
Carbon Monoxide	CO
Chilled	Ch
Chilled Water	CHW
Circuit	Ckt
Circuit	Circuit
Closed	Clo
Cold	Cld
Cold Deck	CldDk
Command	Cmd
Condenser	Cd
Condenser Water	CDW
Control	Control
Cooler	Cooler
Cooling	Clg
Cubic Feet per Minute	Cfm
Current	Current
Cut Out	CutOut
Damper	Dmpr
Deck	Dk
Differential	Diff
Differential Pressure	DP
Discharge	Disch
Domestic	Dom
Domestic Cold Water	DCW
Domestic Hot Water	DHW
Duct Smoke Detector	Dsd
Enable	Ena
Energy	Energy
Entering	Ent
Exhaust	Exh
Fan	Fan
Fault	Flt
Filter	Filter
Flow	Flow
Flow Switch	FlowSwitch

Systems & Actions	Abbreviation
Freeze	Freeze
Freezer	Freezer
Gas	Gas
Heat	H
Heater	Heater
Heating	Htg
Heating Hot Water	HHW
High Static	HighStatic
Hot	Hot
Hot Deck	HotDeck
Hot Gas	HotGas
Hot Gas Bypass	HotGasBypass
Hot Water	HW
Relative Humidity	RH
Inlet	Inlet
Isolation	ISO
Leaving	Lvg
Lighting	Ltg
Meter	Meter
Mixed	Mixed
Mixing	Mixing
Occupancy	Occ
Open	Opn
Outlet	Outlet
Outside Air	OA
Override	Ovr
Position	Pos
Potable	Pot
Power	Power
Pre Filter	PreFilter
Preheat	Preheat
Pressure	Press
Primary	Pri
Pulse	Pulse
Recovery	Recovery
Relative Humidity	RH
Re-Heat	ReHeat
Return	Ret
Roof Top	Rooftop
Secondary	Sec
Sensor	Sensor
Setpoint	Stpt
Signal	Signal
Smoke	Smoke
Space	Space

Systems & Actions	Abbreviation
Speed	Speed
Stage	Stage
Start Stop	StartStop
Static	S
Status	Status
Supervisory	Sup
Supply	Supply
System	Sys
Temperature	Temp
Tower	Twr
Trouble	Tbl
Valve	Vlv
Variable	V
Variable Frequency Drive	VFD
Volume	V
Warning	Warn
Water	W
Wheel	Wheel
Zone	Zone

Object Naming Conventions (Contd.)

Equipment & Devices	Abbreviation	Followed by Equipment #
Air Handling Unit	AHU	Yes
Boiler	B	Yes
Chilled Water Pump	CHWP	Yes
Chiller	CH	Yes
Condenser Water Pump	CDWP	Yes
Cooling Tower	CT	Yes
Energy Recovery Unit	ERU	Yes
Exhaust Air Damper	EAD	
Exhaust Fan	EF	Yes
Fan Coil Unit	FCU	Yes
Freezer	Freezer	Yes
Heatpump - Air Rooftop	RTHP	Yes
Heatpump - water	WSHP	Yes
Heatpump Air Split	SSHP	Yes
Hot Water Pump	HWP	Yes
Make Up Air Unit	MUA	Yes
Mixed Air Damper	MAD	
Outside Air Damper	OAD	
Outside Air Unit	OAU	Yes
Primary Chilled Water Pump	PCHWP	
Pump	P	Yes
Return Air Damper	RAD	
Rooftop AC Unit	RTAC	Yes
Secondary Chilled Water Pump	SCHWP	Yes
Split Unit AC	AC	Yes
Supply Air Damper	SAD	
SupplyFan	SF	Yes
Unit Heater	UH	Yes
Variable Air Volume	VAV	Yes

Units	Abbreviation
AC Volts	VAC
Amps	Amps
DC Volts	VDC
Gauge Pressure	PSIG
Kilowatt (real power)	Kw
Kilovolt-Amp (apparent power)	Kva
Milliamps	Ma
Power Factor	Pf
Volts	Volts

Units should always be in the Unit property or facets. These abbrevaitions are used only to differntiate points with simialr names such as as a meter with multiple units example: OutputVAC and OutputKw

Object Name Examples:

Example of Object Name using Recommended Abbreviations	Include Equipment # in Object Name
ANALOG INPUTS - Object Names	
AirFlow	
B3RetTemp	Yes
B3SupplyTemp	Yes
BldgDP	
BldgDPSPress	
CldDkSPress	
CldDkSupplyAirTemp	
CH3DP	Yes
CH3RetAirTemp	Yes
CH3SupplyAirTemp	Yes
CHWDP	
CHWRetTemp	
CHWSupplyTemp	
CoolerTemp	
CT2RetTemp	Yes
CT2SupplyTemp	Yes
CDWRetTemp	
CDWSupplyTemp	
DischAirTemp	
FreezerTemp	
HWRetTemp	
HWSupplyTemp	
KWPulse	
KwhPulse	
MixedAirTemp	
OARH	
OATemp	
PriCHW	
PreHeatTemp	
RetAirCO2	
RetAirRH	
RetAirTemp	
SpaceTemp	
SupplyAirTemp	
SpaceCO2	
SpaceRH	
ZoneSpaceCO2	
ZoneSpaceRH	
ZoneSpaceTemp	
CHWPriSupplyTemp	
CHWPriRetTemp	
CHWSecSupplyTemp	
CHWSecRetTemp	
CT2CDWHotBasinTemp	

Example of Object Name using Recommended Abbreviations	Include Equipment # in Object Name
ANALOG INPUTS - Object Names	
DHWBldgSupplyTemp	
DHWBldgRetTemp	
Meter23Current	Yes
Meter24Volts	Yes
CHWP2Speed	Yes
CHWP2Power, Kw, etc.	Yes
CH2IsoVlvPos	Yes
BINARY INPUTS - Object Names	
B1Alm	Yes
B1Status	Yes
BreakGlassAlm	
CldDkHighStaticCutOutAlm	
CH2Alm	Yes
CH2FlowSwitchAlm	Yes
CH2Status	Yes
CHWP1Status	Yes
CT2FanStatus	Yes
CDWP1Status	Yes
DmprPosStatus	
DuctSmokeDetectorAlm	
EF5Status	Yes
FilterDPStatus	
FanStatus	
FreezeAlm	
HighStaticCutOutAlm	
HWPStatus	
HotDkStaticCutOutAlm	
OccStatus	
PCHWP2Status	Yes
PreFilterDPStatus	
SpaceTempOvrStatus	
RetAirDsdAlm	
SupplyAirDsdAlm	
SCHWP2Status	Yes
ZoneTempOvrStatus	
BINARY OUTPUTS - Object Names	
B2StartStop	Yes
CH2StartStop	Yes
CH2IsoVlvCmd	Yes
CHWBypassVlvStartStop	
CHWP2StartStop	Yes
CT2FanStartStop	Yes
CT2IsoVlvCmd	Yes
CDWP1StartStop	Yes

Example of Object Name using Recommended Abbreviations	Include Equipment # in Object Name
BINARY OUTPUTS - Object Names	
CHWPIsoVlvCmd	Yes
DmprOpnCmd	
EF2StartStop	Yes
FanStartStop	
HotGasBypassCmd	
HWP2StartStop	Yes
HWP2IsoVlvCmd	Yes
LtgCktStartStop	Yes
OADOpnCmd	
PriCHWP2StartStop	Yes
RADOpnCmd	
SupplyAirFanCmd	
SCHWP2StartStop	Yes
Stage2ClgCmd	Yes
Stage2HtgCmd	Yes
ANALOG OUTPUTS - Object Names	
BypassDmprSignal	
CWP2VFDSignal	Yes
CHWVlvSignal	
CT2BasinVlvSignal	Yes
CDWP3SpeedSignal	Yes
CHWBypassVlvSignal	
DmprSignal	
EADSignal	
HWMixingVlvSignal	
HWPMixingVlvSignal	
HWVlvSignal	
OADSignal	
PCHWP2SpeedSignal	Yes
PreheatVlvSignal	
RADSignal	
ReheatVlvSignal	
SFSpeedControl	
SCHWP2SpeedSignal	Yes
Zone3DmprSignal	Yes

a. Character-Object Formatting Rules:

1). Must start with Alpha character

2). No special characters are to be used. The only special character that can be use is an underscore '_' in special cases.

3). Separate naming parts using camelback notation where the first letter is capitalized for each part. Example: DischAirTemp.

4). Specified abbreviations can be in all caps for their part. Example: OATemp

5). Whenever using the names Supply and Return on chilled and condenser water systems. Supply refers to the coldest water and return refers to the warmest water.

6). When naming the temperature output from a thermistor sensing device such as a space temperature sensor ensure the word Sensor is added to the object name, for instance SpaceTempSensor or SupplyAirTempSensor. This identifies the output as coming from the sensor before any offset or calibration. The displayed value after offset or calibration would be an AV and would be labeled as SpaceTemp or SupplyAirTemp. This approach helps to avoid confusion as to where the value comes from during searches for the temperature from thermistor devices. This rule will also apply to any other type of sensor where a raw value is brought in before correction or conversion.

2.04 BACNET PROTOCOL ANALYZER

A. Provide a BACnet protocol analyzer and required cables and fittings for connection to the BACnet network. The analyzer shall include the following minimum capabilities:

1. Capture and store to a file data traffic on all network levels.

2. Measure bandwidth usage.

3. Filtering options with ability to ignore select traffic.

2.05 SENSORS AND INPUT HARDWARE

A. Coordinate sensor types with the BAS Owner to keep them consistent with existing installations.

B. Field-Installed Temperature Sensors

1. Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary.

2. Thermistors

    a. Precision thermistors may be used in applications below 200 degrees F. Sensor accuracy over the application range shall be 0.36 degree F or less between 32 to 150 degrees F. Stability error of the thermistor over five years shall not exceed 0.25 degrees F cumulative. A/D conversion resolution error shall be kept to 0.1 degrees F. Total error for a thermistor circuit shall not exceed 0.5 degrees F.

3. Resistance Temperature Detectors (RTDs)

    a. Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32 degrees F. Temperature sensor stability error over five years shall not exceed 0.25 degrees F cumulative. Direct connection of RTDs to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25 degrees F. The total error for a RTD circuit shall not exceed 0.5 degrees F.

4. Temperature Sensor Details

    a. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor. Provide room temperature sensors with timed override button, setpoint adjustment lever, digital temperature display. Provide a communication port or 802.11x wireless support for a portable operator interface like a notebook computer or PDA.

    b. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.

    c. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 feet.

    d. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.

    e. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.

2.06 TRANSMITTERS

A. Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a year.

1. Relative Humidity Transmitters

a. Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90 percent scale, and less than one percent drift per year. Sensing elements shall be the polymer type.

B. Pressure Transmitters

1. Provide transmitters integral with the pressure transducer.

C. Current Transducers

1. Provide current transducers to monitor motor amperage, unless current switches are shown on design drawings or point tables.

2. Air Quality Sensors

a. Provide power supply for each sensor.

3. CO2 Sensors

a. Provide photo-acoustic type CO2 sensors with integral transducers and linear output. The devices shall read CO2 concentrations between 0 and 2000 ppm with full scale accuracy of at least plus or minus 100 ppm.

D. Air Quality Sensors

1. Provide full spectrum air quality sensors using a hot wire element based on the Taguchi principle. The sensor shall monitor a wide range of gaseous volatile organic components common in indoor air contaminants like paint fumes, solvents, cigarette smoke, and vehicle exhaust. The sensor shall automatically compensate for temperature and humidity, have span and calibration potentiometers, operate on 24 VDC power with output of 0-10 VDC, and have a service rating of 32 to 140 degrees F and 5 to 95 percent relative humidity.

2.07 INPUT SWITCHES

A. Timed Local Overrides

1. Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24 hour continuous operation.

2.08 FREEZE PROTECTION THERMOSTATS

A. Provide special purpose thermostats with flexible capillary elements 20 feet minimum length for coil face areas up to 40 square feet. Provide longer elements for larger coils at 1-foot of element for every 4 square feet of coil face area, or provide additional thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

2.09 AIR FLOW MEASUREMENT STATIONS

A. Air flow measurement stations shall have an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be the RTD or thermistor type, traversing the ducted air in at least two directions. The air flow pressure drop across the station shall not exceed 0.08 inch water gage at a velocity of 2,000 fpm. The station shall be suitable for air flows up to 5,000 fpm, and a temperature range of 40 to 120 degrees F. The station's measurement accuracy over the range of 125 to 2,500 fpm shall be plus or minus 3 percent of the measured velocity. Station transmitters shall provide a linear, temperature-compensated 4 to 20 mA or 0 to 10 VDC output. The output shall be capable of being accurately converted to a corresponding air flow rate in cubic feet per minute. Transmitters shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the measurement.

2.10 ENERGY METERING

A. Electric Meters

1. Provide kilowatt-hour (kWh) meter(s) shown in accordance with NEMA/ANSI C12.10, suitable for the intended voltage, phases, and wye/delta configuration, with three current transformers and an output signal compatible with the DDC system. The meter shall have a box-mounted socket and an automatic circuit-closing bypass. Provide the meter with at least four pointer-type kWh registers, provisions for pulse initiation, and universal Class 2 indicating maximum kW demand register, sweep pointer indicating type, and at minimum a 15-minute interval. The meter accuracy shall be within plus or minus one percent of the actual kWh. Provide the correct multiplier on the meter face. Provide the current transformers in accordance with IEEE C57.13, with 600-volt insulation, and rated for metering with voltage, IL, momentary, and burden ratings

coordinated with the ratings of corresponding meters. Provide butyl-molded donut or window type transformers mounted on a bracket to allow secondary cables to connect to the transformer bushings. Provide wiring identification of the current transformer secondary feeders to permit field measurements to be taken with hook-on ammeters.

2. Electric meter shall be interfaced to the building automation system via BACnet MS/TP. Controls vendor to provide required communication device(s) to interface to the BACnet MS/TP trunk.

B. Gas Service Sub-Meters

1. Smart Sub-Meters: AGA/IAS-listed, positive displacement rotary type, gas meter with built-in diagnostics, compact size, no moving parts, high resolution large LCD screen, pressure compensating, non-temperature compensating, aluminum allow NEMA 3R enclosure, including a commercial grade electronic transmitter/counter and strainer. Factory set meter pressure for 5 psig. Pulse meter output set at 100 cubic feet per pulse. Powered by a replaceable lithium battery with 20-year minimum anticipated life. Provide interface interlocks with BacNet building automation system in the mechanical room. Provide a metering transmitting recording smart meter system including all required appurtenances, devices, fittings for a complete, operable system. Acceptable manufacturer and Model: Meter – Romet, RM3000, or approved equal; with electronic transmitter/counter – Romet, Adem-S, or approved equal; with Pulse output and Cable, 1 pulse = 100CF.

C. Water Meters

1. Smart Sub-Meters: Direct Couple Floating Rotor turbine meter, lead free bronze alloy housing complying with NSF/ANSI Standards 61 and 372. Meters meet or exceed registration accuracy for the low flow rates (95%), normal operating flow rates (100 ± 1.5%), and maximum continuous operation flow rates as specifically stated in AWWA Standard C700. Max. working pressure shall be 150 PSIG. Provide with register as described in paragraph 2 below. Acceptable Manufacturer and Model: Badger Meter Recordall Turbine Meter, or approved equal.

2. Register/Encoder: Electronic flow rate encoder with instant flow rate and accumulated total, and with Scaleable 4-20 mA analog output proportional to flow rate, battery operated. The 4-20mA output of this Register shall be used as the input to the Flow Monitor described in paragraph 3 below. Acceptable Manufacturer and Model: Badger Meter Recordall Encoder, Model HR-LCD 4-20; or approved equal.

3. Flow Monitor: Flow Monitor shall receive the 4-20mA output of the Register via connection cabling (twisted shielded pair). Provide with power supply accessory. Mount monitor near BAS Cabinet on wall at 5’-0”AFF. 120 V electrical power is required for the power supply accessory. Monitor shall be interlocked with and shall communicate with

BacNet building automation system via RS-485 MSTP BACnet MS/TP. Acceptable Manufacturer and Model: Badger Impeller Industrial Flow Monitor, Series 3000-11; or approved equal. Provide with Badger A1028 power supply; or approved equal.

D. BACnet MS/TP Interface

1. All meters shall be interfaced to the building automation system via BACnet MS/TP. Controls vendor to provide required communication device(s) to interface all digital meters to the BACnet MS/TP trunk interfaced to the building level controller.

E. Contactor shall comply with the requirements of the UMCS-MCX Army Metering Program Guidance for Advance Meters Dated 26 May 2016 (Revision 8). A copy of the document is included at the end of this section.

2.11 OUTPUT HARDWARE

A. Control Dampers

1. Refer to 23 33 00 “Air Duct Accessories”. Provide factory manufactured stainless steel dampers where indicated. Control dampers shall comply with SMACNA 1966 except as modified or supplemented by this specification. Published damper leakage rates and respective pressure drops shall have been verified by tests in compliance with AMCA 500-D requirements.

B. Provide damper assembly frames constructed of 0.064 inch minimum thickness stainless steel channels with mitered and welded corners. Damper axles shall be 0.5 inches minimum diameter plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings.

C. Dampers shall be rated for not less than 2000 fpm air velocity. The pressure drop through each damper when full-open shall not exceed 0.04 inches water gage at 1000 fpm face velocity. Damper assemblies in ductwork subject to above 3-inch water gauge static air pressure shall be constructed to meet SMACNA Seal Class "A" construction requirements.

D. Provide the damper operating linkages outside of the air stream, including crank arms, connecting rods, and other hardware that transmits motion from the damper actuators to the dampers, shall be adjustable. Additionally, operating linkages shall be designed and constructed to have a 2 to 1 safety factor when loaded with the maximum required damper operating force. Linkages shall be brass, bronze, galvanized steel, or stainless steel.

E. Provide access doors or panels in hard ceilings and walls for access to all concealed damper operators and damper locking setscrews.

F. For field-installed control dampers, a single damper section shall have blades no longer than 48 inches and no higher than 72 inches. The maximum damper blade width shall be 12 inches. Larger sized dampers shall be built using a combination of sections.

G. Frames shall be at least 2 inches wide. Flat blades shall have edges folded for rigidity. Blades shall be provided with compressible gasket seals along the full length of the blades to prevent air leakage when closed.

H. The damper frames shall be provided with jamb seals to minimize air leakage. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F.

I. The leakage rate of each damper when full-closed shall be no more than 4 cfm per sq. foot of damper face area at 1.0 inches water gage static pressure.

2.12 ACTUATORS

A. Provide direct-drive electric actuators for all control applications, except where indicated otherwise.

B. Electric Actuators

1. Each actuator shall deliver the torque required for continuous uniform motion and shall have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators shall function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds. Provide two-position actuators of single direction, spring return, or reversing type. Provide modulating actuators capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Thermal type actuators may only be used on terminal fan coil units, terminal VAV units, convectors, and unit heaters. Spring return actuators shall be provided on all control dampers and all control valves except terminal fan coil units, terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between.

C. Output Switches

1. Control Relays

a. Field installed and DDC panel relays shall be double pole, double throw, UL listed, with contacts rated for the intended application, indicator light, and dust proof

enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.13 ELECTRICAL POWER AND DISTRIBUTION

A. Transformers

1. Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

B. Surge and Transient Protection

1. Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.

2.14 POWER LINE SURGE PROTECTION

A. Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:

1. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.

2. The device shall react within 5 nanoseconds and automatically reset.

3. The voltage protection threshold, line to neutral, shall be no more than 211 volts.

4. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.

5. The primary suppression system components shall be pure silicon avalanche diodes.

6. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.

7. The device shall have an indication light to indicate the protection components are functioning.

8. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.

9. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.

10. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.

11. The device shall be capable of operating between minus 20 degrees F and plus 122 degrees F.

B. Telephone and Communication Line Surge Protection

1. Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines, in accordance with the following:

a. The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges.

b. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology.

c. The device shall be installed at the distance recommended by its manufacturer.

C. Controller Input/Output Protection

1. Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.

2.15 WIRING

Provide complete electrical wiring for the DDC System, including wiring to transformer primaries. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in enclosed spaces. Examples of these spaces include HVAC plenums, within walls, above suspended ceilings, in attics, and within ductwork.

A. Power Wiring

1. The following requirements are for field-installed wiring:

a. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.

b. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

B. Analog Signal Wiring

1. Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

3.00 EXECUTION

3.01 INSTALLATION

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.

A. BACnet Naming and Addressing

1. Coordinate with the BAS Owner and provide unique naming and addressing for BACnet networks and devices.

a. MAC Address

1). Every BACnet device shall have an assigned and documented MAC Address unique to its network. For Ethernet networks, document the MAC Address assigned at its creation. For ARCNET or MS/TP, assign from 00 to 64.

b. Network Numbering

1). Assign unique numbers to each new network installed on the BACnet internetwork. Provide ability for changing the network number; either by device switches, network computer, or field operator interface. The BACnet internetwork (all possible connected networks) can contain up to 65,534 possible unique networks.

c. Device Object Identifier Property Number

1). Assign unique Device "Object_Identifier" property numbers or device instances for each device on the BACnet internetwork. Provide for future modification of the device instance number; either by device switches, network computer, or field interface. BACnet allows up to 4,194,302 possible unique devices per internetwork.

d. Device Object Name Property Text

1). The Device Object Name property field shall support 32 minimum printable characters. Assign unique Device "Object_Name" property names with plain-English descriptive names for each device

2). For example:

3). The Device Object Name that for the device controlling the chiller plant at Building 3408 would be: Device Object_Name = CW System B3408

4). A Device Object Name for a VAV box controller might be: Device Object_Name = VAV BOX25

e. Object Name Property Text (Other than Device Objects)

1). The Object Name property field shall support 32 minimum printable characters. Assign Object Name properties with plain-English names descriptive of the application. Examples include "Zone 1 Temperature" and "Fan Start/Stop".

f. Object Identifier Property Number (Other than Device Objects)

1). Assign Object Identifier property numbers according to design drawings or tables if provided. If not provided, Object Identifier property numbers may be assigned at the Contractor's discretion but must be approved by the Government. In this case they must be documented and unique for like object types within the device.

B. Minimum BACnet Object Requirements

1. Use of Standard BACnet Objects

a. For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and all relevant object properties can be modified using BACnet's Write Property Service: all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

b. BACnet Object Description Property

1). The Object Description property shall support 32 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.

c. Analog Input, Output, and Value Objects

1). Support and provide Description and/or Device Type text strings matching signal type and engineering units shown on the points list.

d. Binary Input, Output, and Value Objects

1). Support and provide Inactive Text and Active Text property descriptions matching conditions shown on the points list.

e. Calendar Object

1). For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. All operators may view Calendar Objects; authorized operators may make modifications from a workstation. Enable the writeable Date List property and support all calendar entry data types.

f. Schedule Object

1). Use Schedule Objects for all building system scheduling. All operators may view schedule entries; authorized operators may modify schedules from a workstation.

g. Loop Object or Equal

1). Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint, Proportional Constant, Integral Constant, and Derivative Constant using BACnet read/write services.

C. Minimum BACnet Service Requirements

1. Command Priorities: Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below. If the sequence of operation requires a different priority, obtain approval from the Contracting Officer.

Priority Level	Application
1	Manual-Life Safety
2	Automatic-Life Safety
3	(User Defined)
4	(User Defined)
5	Critical Equipment Control
6	Minimum On/Off
7	(User Defined)
8	Manual Operator
9	(User Defined)

10	(User Defined)
11	Load Shedding
12	(User Defined)
13	(User Defined)
14	(User Defined)
15	(User Defined)
16	(User Defined)

2. Alarming

    a. Alarm Priorities - Coordinate alarm and event notification with the BAS Owner.

    b. Notification Class - Enable writeable Priority, Ack Required, and Recipient List properties of Notification Class objects.

    c. Event Notification Message Texts - Use condition specific narrative text and numerical references for alarm and event notification.

3. Updating Displayed Property Values

    a. Allow workstations to display property values at discrete polled intervals, or based on receipt of confirmed and unconfirmed Change of Value notifications. The COV increment shall be adjustable by an operator using BACnet services, and polled intervals shall be adjustable at the operator workstation.

D. Local Area Networks

1. Obtain Government approval before connecting new networks with existing networks. Network numbers and device instance numbers shall remain unique when joining networks. Do not change existing network addressing without Government approval. See also "BACnet Naming and Addressing".

E. BACnet Routers, Bridges, and Switches

1. Provide the quantity of BACnet routers, bridges, and switches necessary for communications shown on the BACnet Communication Architecture schematic. Provide BACnet routers with BACnet Broadcast Message Device (BBMD) capability on each BACnet internetwork communicating across an IP network. Configure each BACnet device and bridge, router, or switch to communicate on its network segment.

F. Wiring Criteria

1. Run circuits operating at more than 100 volts in rigid or flexible conduit, metallic tubing, covered metal raceways, or armored cable.

2. Do not run binary control circuit wiring in the same conduit as power wiring over 100 volts. Where analog signal wiring requires conduit, do not run in the same conduit with AC power circuits or control circuits operating at more than 100 volts.

3. Provide circuit and wiring protection required by NFPA 70.

4. Run all wiring located inside mechanical rooms in conduit.

5. Do not bury aluminum-sheathed cable or aluminum conduit in concrete.

6. Input/output identification: Permanently label each field-installed wire, cable, and pneumatic tube at each end with descriptive text using a commercial wire marking system that fully encircles the wire, cable, or tube. Locate the markers within 2 inches of each termination. Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the word "power" in the label. Number each pneumatic tube every six feet. Label all terminal blocks with alpha/numeric labels. All wiring and the wiring methods shall be in accordance with UL 508A.

7. For controller power, provide new 120 VAC circuits, with ground. Provide each circuit with a dedicated breaker, and run wiring in its own conduit, separate from any control wiring. Connect the controller's ground wire to the electrical panel ground; conduit grounds are not acceptable.

8. Surge Protection: Install surge protection according to manufacturer's instructions. Multiple controllers fed from a common power supply may be protected by common surge protector, properly sized for the total connected devices.

9. Grounding: Ground controllers and cabinets to a good earth ground as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Conduit grounding is not acceptable; all grounding shall have a direct path to the building earth ground. Ground sensor drain wire shields at the controller end.

10. The Contractor shall be responsible for correcting all associated ground loop problems.

11. Run wiring in panel enclosures in covered wire track.

G. Accessibility

1. Install all equipment so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install digital controllers, data ports, and concealed actuators, valves, dampers, and like equipment in locations freely accessible through access doors.

H. Digital Controllers

1. Install as stand alone control devices (see definitions).

2. Locate control cabinets at the locations shown on the drawings. If not shown on the drawings, install in the most accessible space, close to the controlled equipment.

I. Hand-Off-Auto Switches

1. Wire safety controls such as smoke detectors and freeze protection thermostats to protect the equipment during both hand and auto operation.

J. Temperature Sensors

1. Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.

K. Room Temperature Sensors

1. Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor at the heights indicated on drawings.

L. Duct Temperature Sensors

1. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.

2. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit, maximum 18 by 18 inches. For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.

M. Outside Air Temperature Sensors

1. Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.

N. Energy Meters

1. Locate energy meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage. Refer to design drawings for more information.

O. Damper Actuators

1. Where possible, mount actuators outside the air stream in accessible areas.

P. Thermometers and Gages

1. Mount devices to allow reading while standing on the floor or ground, as applicable.

Q. Pressure Sensors

1. Locate pressure sensors as indicated.

R. Component Identification Labeling

1. Using an electronic hand-held label maker with white tape and bold black block lettering, provide an identification label on the exterior of each new control panel, control device, actuator, and sensor. Also provide labels on the exterior of each new control actuator indicating the (full) open and (full) closed positions. For labels located outdoors, use exterior grade label tape, and provide labels on both the inside and outside of the panel door or device cover. Acceptable alternatives are white plastic labels with engraved bold black block lettering permanently attached to the control panel, control device, actuator, and sensor. Have the labels and wording approved by the BAS Owner prior to installation.

S. Network and Telephone Communication Lines

1. When telephone lines or network connections by the Government are required, provide the Contracting Officer at least 60 days advance notice of need.

3.02 TEST AND BALANCE SUPPORT

A. The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel specified under Section 23 05 93 TESTING, ADJUSTING AND BALANCING. This support shall include:

1. On-site operation and manipulation of control systems during the testing and balancing.

2. Control setpoint adjustments for balancing all relevant mechanical systems, including VAV boxes.

3. Tuning control loops with setpoints and adjustments determined by TAB personnel.

3.03 CONTROLS SYSTEM OPERATORS MANUALS

A. Provide two electronic and printed copies of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.

B. Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable. Provide CDs in jewel case with printed and dated project-specific labels on both the CD and the case. For text and drawings, use Adobe Acrobat or MS Office file types. When approved by the Government, AutoCAD and Visio files are allowed. Give files descriptive English names and organize in folders.

C. Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:

1. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph "Submittals." Indicate all field changes and modifications.

2. A copy of the project's mechanical design drawings, including any official modifications and revisions.

3. A copy of the project's approved Product Data submittals provided under the paragraph "Submittals."

4. A copy of the project's approved Performance Verification Testing Plan and Report.

5. A copy of the project's approved final TAB Report.

6. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.

7. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.

8. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.

9. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical

manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.

10. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.

11. A written statement entitled "Technical Support" stating the control system manufacturer or authorized representative will provide toll-free telephone technical support at no additional cost to the Government for a minimum of two years from project acceptance, will be furnished by experienced service technicians, and will be available during normal weekday working hours. Include the toll-free technical support telephone number.

12. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Government for a minimum of two years from contract acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

D. Storage Cabinets

1. In each project mechanical room, provide a wall-mounted metal storage cabinet with hinged doors. In addition to the number of manuals specified above, provide an additional copy of the manuals in each of these mechanical room storage cabinets. Provide cabinets large enough to hold the entire set of Controls System Operators Manuals, and the HVAC operation and maintenance manuals provided under Division 15 MECHANICAL. Locate cabinets adjacent to DDC control panels where applicable. Have each cabinet's proposed installation site approved in advance by the Contracting Officer and the BAS Owner. Prominently label each cabinet with the wording "OPERATION AND MAINTENANCE MANUALS." Prominently label each binder with the wording "MECHANICAL ROOM COPY - DO NOT REMOVE."

3.04 PERFORMANCE VERIFICATION TESTING (PVT)

A. General

1. The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor and witnessed and approved by the Engineer and/or Government’s approved representative. If the project is phased, provide separate testing for each phase. A Pre-PVT meeting to review the Pre-PVT Checklist is required to coordinate all aspects of the PVT and shall include the Contractor's QA representative, the Contractor's PVT administrator, the Contracting Officer's representative, and the BAS Owner.

B. Performance Verification Testing Plan

1. Submit a detailed PVT Plan of the proposed testing for the Engineer and/or Government’s approved representative approval. Develop the PVT Plan specifically for the control system in this contract. The PVT Plan shall be a clear list of test items arranged in a logical sequence. Include the intended test procedure, the expected response, and the pass/fail criteria for every component tested.

2. The plan shall clearly describe how each item is tested, indicate where assisting personnel are required (like the mechanical contractor), and include what procedures are used to simulate conditions. Include a separate column for each checked item and extra space for comments. Where sequences of operations are checked, insert each corresponding routine from the project’s sequence of operation. For each test area, include signature and date lines for the Contractor's PVT administrator, the Contractor's QA representative, the Contracting Officer's representative, and the BAS Owner to acknowledge successful completion. The BAS Owner can provide sample PVT forms and procedures upon request.

C. PVT Sample Size

1. Test all central plant equipment and primary air handling unit controllers unless otherwise directed. Twenty percent sample testing is allowed for identical controllers typical of terminal control like VAV boxes and fan coil units. The Engineer and/or Government’s approved representative may require testing of like controllers beyond a statistical sample if sample controllers require retesting or do not have consistent results.

2. The Engineer and/or Government’s approved representative may witness all testing, or random samples of PVT items. When only random samples are witnessed, the Engineer and/or Government’s approved representative may choose which ones.

D. Pre-Performance Verification Testing Checklist

1. Submit the following as a list with items checked off once verified. Provide a detailed explanation for any items that are not completed or verified.

    a. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).

    b. Verify HVAC motors operate below full-load amperage ratings.

    c. Verify all required control system components, wiring, and accessories are installed.

    d. Verify the installed control system architecture matches approved drawings.

    e. Verify all control circuits operate at the proper voltage and are free from grounds or faults.

f. Verify all required surge protection is installed.

g. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.

h. Verify all DDC network communications function properly, including uploading and downloading programming changes.

i. Using the BACnet protocol analyzer (if provided or required in this specification), verify communications are error free.

j. Verify each digital controller's programming is backed up.

k. Verify all wiring, components, and panels are properly labeled.

l. Verify all required points are programmed into devices.

m. Verify all TAB work affecting controls is complete.

n. Verify all valve and actuator zero and span adjustments are set properly.

o. Verify all sensor readings are accurate and calibrated.

p. Verify each control valve and actuator goes to normal position upon loss of power.

q. Verify all control loops are tuned for smooth and stable operation.

1). View trend data where applicable.

r. Verify each controller works properly in stand-alone mode.

s. Verify all safety controls and devices function properly, including freeze protection and interfaces with building fire alarm systems.

t. Verify all electrical interlocks work properly.

u. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each workstation and notebook.

v. Verify the as-built (shop) control drawings are completed.

E. Conducting Performance Verification Testing

1. Conduct Engineer and/or Government's approved representative witnessed PVT after approval of the PVT Plan and the completed Pre-PVT Checklist. Notify the Engineer and/or Government's approved representative of the planned PVT at least 15 days prior to testing. Provide an estimated time table required to perform the testing. Furnish

personnel, equipment, instrumentation, and supplies necessary to perform all aspects of the PVT. Ensure that testing personnel are regularly employed in the testing and calibration of DDC systems. Using the project's as-built control system (shop) drawings, the project's mechanical design drawings, the approved Pre-PVT Checklist, and the approved PVT Plan, conduct the PVT.

2. During testing, identify any items that do not meet the contract requirements and if time permits, conduct immediate repairs and re-test. Otherwise, deficiencies shall be investigated, corrected, and re-tested later. Document each deficiency and corrective action taken.

3. If re-testing is required, follow the procedures for the initial PVT. The Government may require re-testing of any control system components affected by the original failed test.

F. Controller Capability and Labeling Test the following for each controller:

1. Memory: Demonstrate that programmed data, parameters, and trend/ alarm history collected during normal operation is not lost during power failure.

2. Direct Connect Interface: Demonstrate the ability to connect directly to each type of digital controller with a portable electronic device like a notebook computer or PDA. Show that maintenance personnel interface tools perform as specified in the manufacturer's technical literature.

3. Stand Alone Ability: Demonstrate controllers provide stable and reliable stand-alone operation using default values or other method for values normally read over the network.

4. Wiring and AC Power: Demonstrate the ability to disconnect any controller safely from its power source using the AC Power Table. Demonstrate the ability to match wiring labels easily with the control drawings. Demonstrate the ability to locate a controller's location using the BACnet Communication Architecture Schematic and floor plans.

5. Nameplates and Tags: Show the nameplates and tags are accurate and permanently attached to control panel doors, devices, sensors, and actuators.

G. Workstation and Software Operation: For every user workstation or notebook provided:

1. Show points lists agree with naming conventions.

2. Show that graphics are complete.

3. Show the UPS operates as specified.

H. BACnet Communications and Interoperability Areas

1. Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. If available or required in this specification, use a BACnet protocol analyzer to assist with identifying devices, viewing network traffic, and verifying interoperability. These requirements must be met even if there is only one manufacturer of equipment installed. Testing includes the following:

    a. Data Presentation: On each BACnet Operator Workstation, demonstrate graphic display capabilities.

    b. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.

    c. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters in the sequence of control or listed on project schedules. Modifications are made with BACnet messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.

    d. Peer-to-Peer Data Exchange: Show all BACnet devices are installed and configured to perform BACnet read/write services directly (without the need for operator or workstation intervention), to implement the project sequence of operation, and to share global data.

    e. Alarm and Event Management: Show that alarms/events are installed and prioritized according to the BAS Owner. Demonstrate time delays and other logic is set up to avoid nuisance tripping, e.g., no status alarms during unoccupied times or high supply air during cold morning start-up. Show that operators with sufficient privilege can read and write alarm/event parameters for all standard BACnet event types. Show that operators with sufficient privilege can change routing (BACnet notification classes) for each alarm/event including the destination, priority, day of week, time of day, and the type of transition involved (TO-OFF NORMAL, TO-NORMAL, etc.).

    f. Schedule Lists: Show that schedules are configured for start/stop, mode change, occupant overrides, and night setback as defined in the sequence of operations.

    g. Schedule Display and Modification: Show the ability to display any schedule with start and stop times for the calendar year. Show that all calendar entries and schedules are modifiable from any connected workstation by an operator with sufficient privilege.

h. Archival Storage of Data: Show that data archiving is handled by the operator workstation/server, and local trend archiving and display is accomplished with BACnet Trend Log objects.

i. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.

j. Device and Network Management: Show the following capabilities:

1). Display of Device Status Information

2). Display of BACnet Object Information

3). Silencing Devices that are Transmitting Erroneous Data

4). Time Synchronization

5). Remote Device Reinitialization

6). Backup and Restore Device Programming and Master Database(s)

7). Configuration Management of Half-Routers, Routers and BBMDs

I. Execution of Sequence of Operation

1. Demonstrate that the HVAC system operates properly through the complete sequence of operation. Use read/write property services to globally read and modify parameters over the internetwork.

J. Control Loop Stability and Accuracy

1. For all control loops tested, give the Engineer and/or Government's approved representative trend graphs of the control variable over time, demonstrating that the control loop responds to a 20 percent sudden change of the control variable set point without excessive overshoot and undershoot. If the process does not allow a 20 percent set point change, use the largest change possible. Show that once the new set point is reached, it is stable and maintained. Control loop trend data shall be in real-time with the time between data points 30 seconds or less.

K. Performance Verification Testing Report

1. Upon successful completion of the PVT, submit a PVT Report to the Engineer and/or Government's approved representative and prior to the Government taking use and possession of the facility. Do not submit the report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action

taken. Include a written certification that the installation and testing of the control system is complete and meets all of the contract's requirements.

3.05 TRAINING REQUIREMENTS

Provide a qualified instructor (or instructors) with two years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Contracting Officer and BAS Owner after receiving approval of the training course documentation. Training shall take place at the job site and/or a nearby Government-furnished location. A training day shall occur during normal working hours, last no longer than 8 hours and include a one-hour break for lunch and two additional 15-minute breaks. The project's approved Controls System Operators Manual shall be used as the training text. The Contractor shall ensure the manuals are submitted, approved, and available to hand out to the trainees before the start of training.

A. Training Documentation

1. Submit training documentation for review 30 days minimum before training. Documentation shall include an agenda for each training day, objectives, a synopses of each lesson, and the instructor's background and qualifications. The training documentation can be submitted at the same time as the project's Controls System Operators Manual.

B. Training

1. Provide a total of 80 hours of training to the Government. This shall be split into one (1) day onsite training, one (1) day classroom training and the remaining hours shall be distributed at 8 hours training session every quarter. The training hours shall not have an expiry date. The training session shall be conducted in a classroom environment with complete audio-visual aids provided by the contractor. The trainee shall have a laptop computer connected to the DDC system workstation Provide each trainee a printed 8.5 by 11 inch hard-copy of all visual aids used. Upon completion of the Training, each trainee should fully understand the project's DDC system fundamentals and system operation. The training session shall include the following:

a. BACnet fundamentals (objects, services, addressing) and how/where they are used on this project

b. This project's list of control system components

c. This project's list of points and objects

d. This project's device and network communication architecture

e. This project's sequences of control, and:

f. Alarm capabilities

g. Trending capabilities

h. Troubleshooting communication errors

i. Troubleshooting hardware errors

j. A walk-through tour of the mechanical system and the installed DDC components (controllers, valves, dampers, surge protection, switches, thermostats, sensors, etc.)

k. A discussion of the components and functions at each DDC panel c. Logging- in and navigating at each operator interface type

l. Using each operator interface to find, read, and write to specific controllers and objects

m. Modifying and downloading control program changes

n. Modifying setpoints

o. Creating, editing, and viewing trends

p. Creating, editing, and viewing alarms

q. Creating, editing, and viewing operating schedules and schedule objects

r. Backing-up and restoring programming and data bases

s. Modifying graphic text, backgrounds, dynamic data displays, and links to other graphics

t. Creating new graphics and adding new dynamic data displays and links

u. Alarm and Event management

v. Adding and removing network devices

3.06 UMCS-MCX ARMY METERING PROGRAM GUIDANCE FOR ADVANCED METERS

UMCS-MCX
Army Metering Program
Guidance for Advanced Meters

26 May 2016
Revision 8

Note: Revision 8 deletes the reference to AWWA C706 in Paragraph 3.5 Water Meter as it no longer exists and has no replacement.

Purpose:

a. The purpose of the following guidance is to achieve meter equipment compatibility with the Army Metering Program pursuant to Public Law 109-58, Section 103 of the Energy Policy Act of 2005. This does not replace the Unified Facility Guide Specifications on metering; additional technical and installation requirements and applicable references may be located there as needed. This guidance provides guidance to meet the minimum requirements for metering as established by public law and Army policy. The intent is for all advanced meters to report their data to an installation-centric energy reporting and management system such as a Utility Monitoring and Control System or Advanced Metering Data Management System (MDMS) Installation Level front end. This approach is consistent with UFC 1-200-02, High Performance and Sustainable Building Requirements**,** Paragraphs 2-4.4 and 3-4.3, Measurement, states: "All meters must be connected to a base wide energy and utility monitoring and control system using the installation's advanced metering protocols. The installation of meters is required per DoDI 4170.11." The advanced meters must provide data at least daily and measure at least hourly consumption of electricity in fifteen minute intervals.

b. General Theory of Operation: Utility Meters are installed to monitor electricity, gas, water, and steam usage. Typically, meters are connected to a field control network utilizing either LonTalk (ANSI 709.1-C) over TP/FT-10, Modbus RTU over EIA 485, or BACnet over EIA 485. Generally, meters communicate over a local building-level network to a building/facility point of connection (BPOC/FPOC) which then communicates via the installation's Network Enterprise Center (NEC) IP network to an "Installation Level Front End", often an existing Utility Monitoring and Control System/Energy Monitoring and Control System (UMCS/EMCS) Front-End server. Meter data is provided to the graphical user interface for display and to any associated UMCS applications programmed to optimize operations. The data is then stored in a Structured Query Language (SQL) database. The SQL database may be the database regularly used by the UMCS applications or a separate SQL database installed specifically for meter data. On a regular basis the MDMS Gateway, located in the DMZ (demilitarized zone) of the installation (outside the inner firewall), or RCC (Regional Cyber Center), retrieves data from the SQL database and sends it to the MDMS Enterprise Server.

Notes:

1) In some cases electric meters may be connected directly to an IP network, but this is considered a non-standard approach.

2) The approach detailed above is used for other (non-electrical) metering also, but generally only total consumption is measured for non-electricity meters, and non-electricity meters may provide a pulse output that is measured by an electric meter digital input or controller on the network in lieu of being connected to the network themselves. Electrical meters with additional external digital inputs are allowed for other meter data collection.

c. The means for meter data transmission using open-protocols such as ANSI/CEA 709.1-C, Modbus RTU, and BACnet over Government owned transport media (LAN, telephone carrier, wireless,

radio, microwave, or power line carrier, etc.) will be site specific and subject to the approval of the Network Enterprise Center (NEC). This guidance provides the flexibility needed to support the various data transmission system alternatives in addition to meeting the minimum standards for energy consumption data recording and reporting. A key element for success will be integrating these systems with the Army's Information Technology (IT) networks supported by Network Enterprise Centers (NEC).

Applicability: These requirements apply to all Army meters for use on facilities that meet the size and energy-consumption selection criteria regardless of the funding source and method of procurement (i.e. Military Construction Army (MCA) projects, Utility Privatization contracts, Energy Savings and Performance Contracts, or Sustainment Modernization and Repair projects).

Definitions:

a. Advanced Metering Data Management System Installation Level front end. This term as used in the guidance refers to the system that will collect, manage, and display the meter data for the local energy manager. It may be a new system or it may consist of the existing Legacy UMCS/EMCS and its associated building level controllers that have been upgraded with the necessary hardware/software as required. The intent of the Army Metering Program is to provide the metering data to the local engineering staff first within the building automation system that can execute application programs to affect savings, and then transmit to the Enterprise Meter Data Management System, when activated.

b. Advanced Meters. For this guidance, Advanced Meters are those that have the capability to measure and record interval data (at least hourly for electricity), and communicate the data to a remote location in a format that can be easily integrated into an advanced meter data management system. EPAct Section 103 requires at least daily data collection capability; and although the policy requires at least hourly, to best analyze rate data, a 15 minute recording interval is recommended. Most advanced meters offer additional features which may be attractive to system owners. Advanced meters do not offer two way communications or a kill switch for power to the facility. These functions are normally associated with smart meters.

References:

a. UFGS 25 10 10, Utility Monitoring and Control System (UMCS) Front End and Integration

b. UFGS 26 27 13.10 30, Electric Meters - prepared by the Air Force

c. UFGS 26 27 14.00 20, Electricity Metering - prepared by the Navy

d. UFGS 33 51 13.00 30, Natural-Gas Metering - prepared by the Air Force

e. UFGS 33 12 33.00 30, Water Utility Metering - prepared by the Air Force

f. UFGS 33 63 23, Exterior Aboveground Steam Distribution - prepared by the Navy

g. UFC 1-200-02, High Performance and Sustainable Buildings

With respect to the two Electrical Metering Guide specifications and although these are listed as Unified in the Construction Criteria Base, the preparing activity has focused on their specific requirements that may not fulfill the Army's needs. However, as this Mandatory Center of Expertise (MCX) guidance is not intended to provide the level of detail for contract requirements, the designer should refer to these as needed, edit for the specific project, and include the detail for completeness. The Navy specification has some excellent drawings/sketches that are useful. The goal is to create a truly unified Electrical Metering Specification in FY16.

h. Additional documentation noted below is available as separate electronic media files upon request. Contact the POC listed on last page.

1. Enterprise Energy Data Reporting System Security Functional Architecture Ver. 2.3.1
2. Advanced Meter Points List
3. I3A Technical Criteria Feb 2010

CONTENT OUTLINE

1.0 Installation Level Front End Computer
- 1.1 Open Protocol
- 1.2 Meter Data Storage and Point Naming Conventions
- 1.3 Meter Identification and Location Data
- 1.4 Storage of Metered Data
- 1.5 Workstation Display
- 1.6 Energy Reports

2.0 Communications
- 2.1 Between Meters and Installation Level Front End
- 2.2 Between Installation Level Front End and Enterprise MDMS System
- 2.3 Cybersecurity Requirements

3.0 Meters
- 3.1 Environmental Tolerances of Metering Devices
- 3.2 Advanced Meter Capability
  - 3.2.1 Communication Protocol and Methods
  - 3.2.2 Pulse Input Data Port Interface
  - 3.2.3 Data Storage and Trend Logs
  - 3.2.4 Meter Display
- 3.3 Electric Meter
  - 3.3.1 Power Systems

3.3.2 Measured Values (mandatory and optional)
3.3.3 Accuracy
3.3.4 Surge Protection
3.3.5 Instrumentation (CTs and PTs)
3.3.6 Disconnects and Shorting Blocks
3.4 Gas Meter
3.4.1 Requirements
3.4.2 Gas Meter Types
3.4.3 Valves and Regulators
3.4.4 Gas Meter Installation
3.4.5 Connections
3.4.6 Pressure and Leak Tests
3.5 Water Meter
3.5.1 Requirements
3.5.2 Water Meter Types
3.5.3 Water Meter Installation
3.5.4 Valves
3.5.5 Connections
3.5.6 Disinfection
3.5.7 Tests and Inspections
3.6 Steam Meter
3.6.1 Requirements
3.6.2 Steam Meter Types
3.6.3 Steam Meter Installation
3.6.4 Piping Tests
4.0 Execution
4.1 Installation
4.2 Drawings
4.3 Scheduling of Work and Outages
4.4 Field Applied Painting
4.5 Cleanup
5.0 Testing and Checkout
5.1 Performance Verification Test (PVT)
5.2 Contractor's Field Tests (CFT)
6.0 Training

1.0 INSTALLATION LEVEL FRONT END COMPUTER

1.1 Open Protocol. Where no existing UMCS/EMCS can satisfy the Advanced Metering Data Management System Installation Level requirements, the design shall include a LonWorks based, BACnet based, or Niagara Framework (Tridium) based Open System Host for the front end data

management system. The Open System Host shall be installed in accordance with UFGS 25 10 10, Utility Monitoring and Control System (UMCS) Front End and Integration. There are new open protocol building level specifications published at wbdg.org:

a. UFGS 23 09 00, Instrumentation and Control for HVAC;

b. UFGS 23 09 23.01, LonWorks Direct Digital Control for HVAC and Other Building Control Systems; and

c. UFGS 23 09 23.02, BACnet Direct Digital Control for HVAC and Other Building Control Systems.

These will all provide guidance on their specific communication media.

1.2 Meter Data Storage and Point Naming Conventions. The meter data shall be stored per the defined convention shown below in a full version Microsoft SQL data base for future retrieval by others. The future site Meter Data Management System (MDMS) Gateway will retrieve and re-transmit the meter data to an Enterprise Army Meter Data Management System. The contractor supplied Microsoft SQL database may be native to the Host UMCS/Metering Front-End or an entirely separate SQL database dedicated to SQL data storage. The Contractor must follow the applicable Security Configuration Guide for SQL partitioning and hardening procedures.

a. Existing UMCS systems point names vary by system capabilities and site conventions. The site naming convention must be followed where possible. Approval is required from HNC prior to alternative point name creation. This is to ensure there are no conflicts with the MDMS gateway requirements.

b. Primary equipment names:

- Servers are named EEDRS. However, the local data center server naming convention takes priority.

- Building/Facility Point of Connection (BPOC/FPOC). Name is by site and building. Use no space, period or dash unless system constraints dictate otherwise: SiteBuilding#. Example: FTBRAGG3720

- LON TP/FT10 channel names. Name in this order: Protocol Site Building#. Example: LON Bragg 100. Note that here a space is used to separate.

c. The following point naming conventions are approved for new system installations:

SiteName is the Post name.

Building# - is the building number containing the meter; it is always the number of the building, although that building number may include a letter.

Meter - is the meter type within the building: electric, gas, water, steam; use the word METER for electric meters and the words GAS, WATER, STEAM, BTU for the other types of meters.

Meter # - is the meter number (the nth number) within the building.

Parameter - is the name of the measured variable

For single site systems:
Building#_Meter_Meter#_Parameter
Building#.Meter_Meter#.Parameter

BLDG_2315_METER_2_VOLTS_A_B
BLDG_2315.METER_2.VOLTS_A_B

For multi-site systems, where a regional host exists:
SiteName_Building#_Meter_Meter#_Parameter
Sitename.Building#.Meter_Meter#.Parameter

Example:
HOOD_2315_METER_2_KW
HOOD_2315.METER_2.KW

Where a site area designator is required:
SiteName_Area_Building#_METER_Meter#_Parameter

Example:
Hood_A_2315_METER_2_KW
Hood_A.2315.METER_2.KW

Note: Some UMCS host software may automatically attach the Building/Facility Point of Connection (JACEx or NAE) to the point name.

d. Provide the following meter data:

PWR_TOT	Real Power (Total of Phases)	KW

KWH_TOT	Total KWH (Total Energy)	KWH
PWR_DEMAND	Demand Power	KW
PWR_DEMAND_PEAK	Historical Peak Demand Power	KW
VOLT_A_B	Rms Voltage For Phase A	VOLTS
VOLT_B_C	Rms Voltage For Phase B	VOLTS
VOLT_C_A	Rms Voltage For Phase C	VOLTS
AMP_A	Rms Current For Phase A	AMPS
AMP_B	Rms Current For Phase B	AMPS
AMP_C	Rms Current For Phase C	AMPS
PF_A	Power Factor Phase A	PF
PF_B	Power Factor Phase B	PF
PF_C	Power Factor Phase C	PF
PF_Total	Power Factor Total	PF
VAR or KVAR	Reactive Power	Power
CF	Cubic Feet	
GAL	Gallons	

1.3 Meter Identification and Location Data. Contractor shall populate the sample information document shown in the table below and display and store at Installation Level Front End Computer.

Fort Sample Electric Meter Information							
Bldg No.	**Bldg Name**	**Bldg Sqft**	**Cat Code**	**Meter Name**	**Commodity Type**	**Area served by meter (sqft)**	**Reimburs-able (Y/N)**
71	EXCH MAIN STORE	74,053	74053	BLDG_0071_METER_1_VOLTS_A_B	Electricity	74,053	y
01440 HAAF	HEALTH CLINIC	49,679	55010	BLDG_1440_METER_2_VOLTS_A_B	Electricity	49,679	N
2905	OPEN STR INST	40,264	45210	BLDG_2905_METER_1_VOLTS_A_B	Electricity	40,264	N
4541	VEH MAINT SHOP	32,648	21410	BLDG_4541_METER_3_VOLTS_A_B	Electricity	32,648	N
06007 HAAF	ARMY LODGING	43,732	72010	BLDG_6007_METER_1_VOLTS_A_B	Electricity	43,732	N
7560	DEPENDENT SCH	31,040	73046	BLDG_7560_METER_1_VOLTS_A_B	Electricity	31,040	y
7742	CO HQ BLDG	30,000	14185	BLDG_7742_METER_1_VOLTS_A_B	Electricity	30,000	N
10501	CSMS/MATES	31,093	21419	BLDG_10501_METER_2_VOLTS_A_B	Electricity	31,093	y

10531	CSMS/MATES	34,843	21419	BLDG_10531_METER_1_VOLTS_A_B	Electricity	34,843	Y

1.4 Storage of Metered Data. The Advanced Metering Data Management System Installation Level Front End shall store all required meter data for a minimum of two years. If data exceeds allotted space, storage shall grow automatically through database configuration changes without operator intervention.

1.5 Workstation Display

a. System shall display all mandatory metering data (electricity, water, gas and steam) upon request in an organized and easily readable format. Data shall be displayed in no less than 15 minutes intervals.

b. Final install of front end equipment shall, at minimum, display accurate data readings for each meter in a text format. Display capability shall include multiple graphical formats such as data vs. time (minutes, hours, days, weeks, months, and year) comparison between metered data from two or more meters and other standard meter data. Site specific graphics shall be created that display the required metered value, meter location, meter serial number and building square footage served by that meter. In addition, contractor shall differentiate by an asterisk on the graphic display those meters that were not installed by the Army Metering Program.

c. Contractor shall provide two hardcopies and two copies on electronic media (DVD or CD) of detailed instructions for customization and integration of additional display features that are not prepared at the time of final install.

1.6 Energy Reports. The Installation Level Front End Computer shall be configured to provide monthly energy reports that show:

a. Specific building kWh and max kW use and time and day the max occurred.

b. A building’s monthly kWh and max monthly kW with history over the previous 24 months. Include Heating Degree-Days (HDD) and Cooling Degree-Days (CDD) for each month.

c. Summary of what all buildings are using on an installation relative to their square footage (energy consumption density) as a function of kWh and kW peak; when meters are available include the Natural Gas (NG) and water usage including their maximum rate of use for that month. Include HHD and CDD.

d. A bar chart showing the 24 month history of what the installation is using total (kWh, KW peak, NG, and water) and the energy density based on square footage of metered buildings. Include HDD and CDD for each month.

e. A bar chart showing dollar cost for the commodities from the chart above over a 24 month period. Include HDD and CDD for each month.

f. A dirty dozen list of the buildings using the highest energy based on square footage, occupancy rates, hours of use, and a factor coefficient to decrease the rating for high energy density demand type missions. This mission coefficient shall be the same for the same type of mission and applied the same on every installation.

2.0 COMMUNICATIONS

2.1 Between Meters and Installation Level Front End

a. The communications medium shall be compatible with the Installation Level Front End Computer and the Enterprise Energy Reporting Data System (EERDS) Security Functional Architecture available as separate electronic media: Enterprise Energy Data Reporting System Security Functional Architecture.doc (see POC on last page). The installation of wire, fiber optic cable, wireless network equipment, network switches, and/or media converters is required where existing communications infrastructure is non-existent to support communications between the buildings to be metered and the nearest base network access point. If fiber optic cable is required, coordinate with the site NEC for installation guidance and sizing (minimum requirement: 2 single mode fibers). All IP, Ethernet, or wireless communication design and implementation plans shall be approved by the site NEC. The NETCOM Commander has directed NETCOM G3/4, G5, and G6 to support the use of all available means of communication available at sites to reduce the cost of implementing the Army's metering program across all theaters of operation. The use of DSL, existing copper, wireless 900 Mhz radios, existing wireless 802.11 infrastructure, and dark fiber should all be considered as options before installing new copper or fiber. Coordination with NETCOM is recommended before installing new fiber.

b. Coordinate with the Activity and provide specific requirements "to match existing systems" when necessary. Contractor shall verify that the electricity meter installed on any building site is compatible with the post-wide metering system with respect to the types of meters selected and the method used to program the meters for initial use. Software and meter programming tools are necessary to setup the meters described by this guidance. New software tools different from the meter programming methods currently used by post personnel shall require separate approval for use. Contractor shall verify that the metering system installed on any building site is compatible with the facility-wide or post-wide communication and meter reading protocol system.

2.2 Between Installation Level Front End and Enterprise MDMS System

See Paragraph 1.2. The MDMS Contractor shall execute a retrieval of the data in the Microsoft SQL data base. The MDMS Contractor shall format the meter data to include the site specific information that uniquely identifies the installation (Fort Carson, Fort Hood, etc.). IPSec tunneling may be used to

securely transport data. There will likely be a gateway between the Installation Level Front End Computer and the Enterprise MDMS.

2.3 Cybersecurity Requirements

a. The process and related requirements to attain authorization for metering systems have been revised to Risk Management Framework. DoDI 8500.01, Cybersecurity and DoDI 8510.01, Risk Management Framework (RMF) for DoD Information Technology (IT) were published in March of 2014 and outline the Risk Management Framework processes. Commands should coordinate with their local NEC to ensure compliance with the assess and authorize approach outlined in RMF. Additionally, the MCX offers guidance to shape architectural templates and influence the design process for Army installations. This document is Technical Criteria for the Installation Information Infrastructure Architecture and is available upon request from the POC.

b. The Information Systems Engineering Command's (ISEC) Military Engineering Directorate (MED, formerly IASED) in Fort Huachuca, AZ, has conducted testing and hardening for a limited number of metering host configurations that may assist in the development of documentation towards favorable authorization decisions. As the documentation is created for individual systems there exist opportunities to leverage this knowledge to engineer a metering system that will more easily be approved by the NEC. Currently, the Army Metering Program has five accredited front end systems, various BPOCs, and advanced meter options, to include enterprise system level Certificates of Networthiness.

c. Networthiness: The contractor shall provide and prepare documentation as required by AR 25-1 and submit a request for a Certificate of Networthiness (CoN). Networthiness certification is required before connecting hardware/software to the Army Enterprise Network. The selection of system and network components from the Defense Information Systems Agency (DISA) Approved Products List (APL) is encouraged, when available. There is also a list of preapproved software that identifies those that have CoNs. The Contractor shall coordinate all Networthiness efforts with the appropriate installation NEC as well as higher NETCOM headquarters. When issued and certified, the Contractor shall comply with the applicable IATO (Interim Authority to Operate) Security Configuration Guide.

d. In the eyes of some security engineers, IP meters have been regarded as vulnerable and assumed to create a higher risk to the defense in depth architecture. Take note to properly configure these devices so that they do not face the internet. The IP meter interface offers a more robust transfer of data and the ability to remotely reset counters and offer time stamps. This risk assessment is subject to change as testing is completed.

e. While in the design and planning stage, contact the UMCS-MCX for the most recent update on metering system configurations and their affect on cybersecurity (cybersecurity has replaced 'information assurance' under Risk Management Framework (RMF).

3.0 METERS

Note: Reimbursable facilities/customers that require metering devices which exceed the requirements detailed in this guidance shall be installed per written request as approved and provided in pre-proposal documentation.

3.1 Environmental Tolerances of Metering Devices

a. Power Meters:

(1) Outdoor/exterior devices shall be rated for operation and storage from minus 40 degrees C to plus 70 degrees C or better and 5 to 100% relative humidity (RH) (non-condensing). Exterior meters shall be provided with or installed within a NEMA 4 enclosure. Enclosures shall be NEMA 4X for coastal and corrosive environments. When ambient temperature extremes exceed the rating above, provide enclosures with heat strips to maintain operable temperatures. Enclosures shall be lockable (key lock) for information security issues.

(2) Indoor/interior devices shall be rated for operation and storage from 0 degrees C to plus 50 degrees C or better and 5 to 90% relative humidity (non-condensing). Interior meters or meters located in mechanical rooms shall be provided with or installed within a NEMA 12 lockable enclosure.

b. Water Meter Operating Temperatures: 0 degrees C to plus 50 degrees C or better. Water Meter Humidity Operating Range: 5% to 90% RH (non-condensing).

When above frost line and exterior mounting is required, consider the local ambient temperature extremes and protect from freezing with insulated, moisture proof enclosures and heat tracing as required.

c. Gas Meter Operating Temperatures: minus 40 degrees C to plus 70 degrees C.
Gas Meter Humidity Operating Range: 5% to 90% RH (non-condensing).

d. Steam Meter Ambient Operating Temperatures: minus 40 degrees C to plus 80 degrees C.
Steam Meter Medium Operating Temperatures: minus 40 degrees C to plus 240 degrees C.
Humidity Operating Range: 5% to 90% RH (non-condensing)

e. All interior meters and/or remote interface displays shall be provided with or installed within a NEMA 12 enclosure.

f. Wiring: All wiring shall be UL listed.

g. Manufacturer Recommendations: The Contractor shall adhere to all manufacturer recommendations regarding wire sizing, fuse sizing, and wire types.

3.2 Advanced Meter Capability

a. All meters as installed shall provide advanced meter capabilities, either as a single product, or as installed in conjunction and collocated with another product such that the combined installation provides advanced meter capabilities.

b. Meters that do not provide factory advanced capabilities shall provide a pulse output for interfacing to an advanced meter. The minimum and maximum pulse rate and pulse width of the receiving digital input device and software, i.e., electric meter, digital input card on the UMCS or any other accumulator shall be determined by the contractor. The contractor shall provide pulse rate convertors if required. Depending on the product used, relay isolation may be required when connecting to the Input/Output (I/O) device. In addition, the contractor shall determine and eliminate false triggers caused by distance or routing near other voltage sources. It is strongly advised to adhere to the manufacturers' recommendations and industry practices and install isolation relays as field conditions dictate.

3.2.1 Communication Protocol and Methods. Meters shall communicate via either Modbus RTU, ANSI/CEA-709.1-C (LonTalk), or ASHRAE-135 (BACnet) protocols to the existing or new Advanced Metering Data Management System Installation Level Front End (or UMCS/EMCS System Host). In locations where a legacy UMCS system currently exists utilizing a non-compliant communication protocol, additional protocols may be used if approved by the Government. In that case the designer should consider meters with changeable interface communication cards so that future UMCS upgrades can be accomplished with minor changes.

3.2.2 Pulse Input Data Port Interface

a. Meters shall have a data port connection compatible with the selected protocol which communicates to the existing or new Advanced Metering Data Management System Installation Level front end. The meter's interface must be compatible with the conditions at any given site. Analog current loops shall not be used.

b. Auxiliary data ports. Unless otherwise specified, advanced meters shall have a minimum of two pulse inputs for incorporation of other external meter data.

3.2.3 Data Storage and Trend Logs

a. Unless otherwise specified, the meter must be capable of providing and storing 15 minute interval data for 20 distinct points for minimum of 30 days to non-volatile memory. The measured

energy consumption shall be retained in non-volatile memory. The maximum demand and time of maximum demand shall be stored in non-volatile memory and can be reset.

b. Field Interface Tool: Contractor shall provide a field interface tool with the compatible software to extract stored trend data and logs from meters. This is a separate hand-carried device that directly connects with the meter at the installed site.

3.2.4 Meter display. Meters that are required to display data shall provide face plate configurable menus to select the desired data for display. Display requirements may be met with the installation of a local display panel connected to the meter. All collected data shall be capable of display.

3.3 Electric Meter

3.3.1 Power Systems. Meter shall be designed for multifunction electrical measurement on either single or 3 phase power systems. Meter shall support the power configuration as identified at site specific government facilities: single phase (120 or 240 volt); 3 Phase, 3 Wire Delta; 3 Phase, 4 Wire Delta; 3 Phase, 4 Wire Wye (2.5 Element); 3 Phase, 4 Wire Wye (3.0 Element). For three phase application voltage range is 208 – 600V. All meters shall be UL 508 Listed, CSA approved, have CE marking, and meet safety standards UL 1244 or UL 1010-1.

3.3.2 Measured Values: See Electric Meter points list: Advanced Meter Points List.xls for details and additional requirements. Points list assumes a 4 wire delta power configuration. Modify to match site specific requirements.

a. Mandatory Measured values

PWR-TOT	Real Power KW (Total Phases)
KWH-TOT	Total KWH (Total Energy)
PWR-DEMAND	Demand Power
PWR-DEMAND-PEAK	Historical Peak Demand Power
VOLT A-B	Rms Voltage For Phase A
VOLT B-C	Rms Voltage For Phase B
VOLT C-A	Rms Voltage For Phase C
AMP-A	Rms Current For Phase A
AMP-B	Rms Current For Phase B
AMP-C	Rms Current For Phase C
PF-A	Power Factor For Phase A
PF-B	Power Factor For Phase B
PF-C	Power Factor For Phase C
PF-Total	Power Factor Total

VAR or KVAR	Reactive Power

b. Optional Measured values:

PWR-A	Real Power For Phase A
PWR-B	Real Power For Phase B
PWR-C	Real Power For Phase C
HZ-A	Frequency For Phase A
HZ-B	Frequency For Phase B
HZ-C	Frequency For Phase C
KVA-TOT	Total Kva
KVA-A	Kva For Phase A
KVA-B	Kva For Phase B
KVA-C	Kva For Phase C
KVAR-TOT	Total Reactive Power
KVAR-A	Reactive Power For Phase A
KVAR-B	Reactive Power For Phase B
KVAR-C	Reactive Power For Phase C
KVARH-TOT	Total Kvarh (Total Reactive Energy)
KVARH-A	Kvarh (Total Reactive Energy) For Phase A
KVARH-B	Kvarh (Total Reactive Energy) For Phase B
KVARH-C	Kvarh (Total Reactive Energy) For Phase C

3.3.3 Accuracy

a. System Accuracy: System accuracy for the meter product devices including instrument transformers shall not exceed plus or minus 1.5% as calculated using the Root Sum Square (RSS) method and assuming normal distribution.

b. Meter Accuracy: Meter certification shall be IEEE/ANSI C12.20, Accuracy class 0.5% or the meter shall be calibrated with National Institute of Standards and Technology (NIST) traceable standards to an accuracy of 0.5% or better.

c. For reimbursable tenants meter certification shall be NEMA/ANSI C12.20, Accuracy class 0.2%. These meters shall include a Meter display that can display all recorded values.

3.3.4 Surge Protection: Meters shall comply with IEEE/ANSI C37.90.1, Standard surge withstand capability (SWC) tests for relays and relay systems associated with electric power apparatus and IEEE C62.41.

3.3.5 Instrumentation (CTs and PTs)

a. Current transformers (CTs) sized properly so that the meter secondary of the transformer shall output current to ensure at least a plus or minus 0.6% accuracy of current when measured between 10% and 90% of full amperage range.

b. CTs shall not exceed 5 amps on the secondary side.

c. Burden on CTs shall not exceed rated burden for the accuracy class.

d. CTs shall be provided in solid or split core configurations.

e. CTs shall be provided in the appropriate ranges to meet the service entrance amperage requirements (e.g. building service entrance of 800 Amps requires 800:5 CTs for metering).

f. CTs shall be revenue grade and certified per IEEE/ANSI C57.13 or IEC 185.

g. CTs shall be provided that are rated for the appropriate matching frequency of the power generation (60 Hertz CONUS and 50 Hertz OCONUS as applicable).

h. Current sensors shall be sized properly for the application and provide a voltage (normally 0-2 volts) to the meter that results in at least a plus or minus 0.6% accuracy of current when measured between 10% and 90% of full amperage range.

i. Voltage or Potential Transformers (PTs) sized properly so that the meter secondary of the transformer shall output voltage to ensure at least a plus or minus 0.6% accuracy of voltage when measured from zero to the IEEE/ANSI C57.13 or IEC 185 specified standard burden, at the specified standard burden power factor, and at any value from 90% to 110% of rated voltage.

j. PTs shall be revenue grade and certified per IEEE/ANSI C57.13 or IEC 185.

k. Burden on PTs shall not exceed rated burden for accuracy class.

3.3.6 Disconnects and Shorting Blocks

a. The appropriate metering accessories, terminal blocks, shorting blocks, and fuses shall be built into each enclosure and the enclosure shall have an appropriate grounding termination point per standard industry practices. Disconnect wiring blocks shall be provided between the current transformer and the meter where 5 AMP current transformers are used. A shorting mechanism shall be built into the wiring block to allow the current transformer wiring to be changed between shorting block and meter without removing power to the transformer. The wiring blocks shall be located where they

are accessible without the necessity of disconnecting power to the transformer. For multi-ratio current transformers, provide a shorting block from each tap to the common lead. The shorting mechanism must be capable of carrying the current of each current transformer so that the electric meter can be safely removed from the circuit for testing or repair. Low voltage, 0-5 volt current sensors are exempt from the shorting block requirement.

b. Voltage-monitoring circuits shall be equipped with disconnect switches to isolate the meter base or socket from the voltage source.

c. Short circuit protection for each power supply circuit or measuring voltage circuit entering the enclosure must be included in the enclosure. This shall be appropriately sized to protect equipment and personnel should an accidental short occur during maintenance inside the enclosure. Fuses or breakers with appropriate UL ratings shall be used. Fuse type and rating shall be depicted on the As-Built drawings.

d. Switching mechanisms adequate to de-energize all power supply and voltage circuits entering the enclosure must be included in the enclosure. If a breaker is utilized for the short circuit protection that can fulfill this function, no additional hardware will be required.

3.4 Gas Meter

3.4.1 Requirements

a. In addition to the requirements listed below, Natural Gas Distribution and Monitoring Equipment shall be in accordance with UFGS SECTION 33 51 13.00 30. Gas meters measure a defined volume, regardless of the pressurized quantity or quality of the gas flowing through the meter. Temperature, pressure and heating value compensation must be made to measure actual amount and value of gas moving through a meter.

b. Gas distribution equipment shall be installed in accordance with all applicable federal, state and local codes and regulations. Gas distribution equipment shall be installed in conformance with the manufacturer's recommendations and applicable sections of American Society of Mechanical Engineers (ASME) B31.8, American Gas Association (AGA) XR0104 and 49 CFR 192. Gas distribution equipment installed in areas where they will be subject to damage shall be protected by appropriate physical barriers (i.e. bollards).

c. Natural Gas Meters shall be the Diaphragm, Rotary, or for high volume applications Turbine type with pulse output chosen to meet the specific application.

Quantity Measured: Cubic Feet of Natural Gas

Accuracy: plus or minus 1% of scale.

Resolution: minimum of 100 cubic feet of gas

Measurement Configuration: Natural Gas service to a building. For buildings that already have a gas meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a natural gas meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output to a data gathering device. If the existing gas meter will not accept a pulse kit or if no meter exists a new natural gas meter shall be installed, also requiring a pulse output to a data gathering device. Ensure the pulse frequency and electronic characteristics are compatible with the existing data gathering device, if any.

3.4.2 Gas Meter Types

a. Provide gas meters for the natural gas service line to the building. Natural gas meters shall be the Diaphragm, Rotary, or for high volume applications Turbine type with pulse output chosen to meet the specific application. Temperature, pressure and heating value compensation must be made to measure actual amount and value of gas moving through a meter.

b. Diaphragm Gas Meters with flow rates less than 500 cubic feet per hour shall conform to AGA B109.1. Diaphragm Gas Meters with flow rates of 500 cubic feet per hour and higher shall conform to AGA B109.2. Rotary Type Gas Meters shall conform to AGA B109.3. Turbine Type Gas Meters shall conform to ASME MFC-4M. Meters shall be pipe or pedestal mounted and be provided with a strainer immediately upstream. Meters shall be provided with over-pressure protection as specified in ASME B31.8. Include tamper-proof protection, frost protection and fungus-proof protection as applicable. Meters shall be suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates present. Meters shall have a pulse switch initiator capable of operating up to speeds of 500 pulses per minute with no false pulses and shall require no field adjustments or calibration. Initiators shall provide the maximum number of pulses up to 500 per minute that is obtainable from the manufacturer. The minimum pulse rate shall not be less than one pulse per 100 cubic feet of gas.

3.4.3 Valves and Regulators

a. Valves shall be suitable for shutoff or isolation service and shall conform to the following: Steel valves 1-1/2 inches and smaller installed above ground shall conform to ASME B16.34, carbon steel, socket weld or threaded ends with handwheel or wrench operator. Steel valves 2 inches and larger installed above ground shall conform to American Petroleum Institute (API) Spec 6D, carbon steel, butt-weld or flanged ends, with handwheel or wrench operator.

b. Valves and pressure regulators are necessary at all points where pressure reduction or regulation is required by the user. Install a shut-off valve upstream of the regulator and both upstream

and downstream of the meter. Provide a gas meter bypass line with a lockable valve for buildings with critical service.

c. Service Line Regulators. Pressure regulators for individual service lines shall have ferrous bodies. Regulator shall be capable of reducing distribution line pressure to pressures required for users. Regulators shall be provided where gas will be distributed at pressures in excess of 10 inches of water column. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self-contained service regulator. Regulator pipe connections shall not exceed 2 inch size.

3.4.4 Gas Meter Installation

a. A shutoff valve, meter set assembly, and service regulator shall be installed on the service line outside the building, 18 inches above the ground on the riser. An insulating joint (dielectric connection) shall be installed on the inlet side of the meter set assembly and service regulator and shall be constructed to prevent flow of electrical current. A 3/8 inch tapped fitting equipped with a plug shall be provided on both sides of the service regulator for installation of pressure gauges for adjusting the regulator. All service regulator vents and relief vents shall terminate in the outside air in rain and insect resistant fittings. The open end of the vent shall be located where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

b. Meters shall be installed in accordance with ASME B31.8. Permanent gas meters shall be installed with provisions for isolation and removal for calibration and maintenance, and shall be suitable for operation in conjunction with an energy monitoring and control system.

3.4.5 Connections

a. Connections to Publicly or Privately Operated Gas Utility Lines: The contractor shall include all materials for the connections to the existing gas lines. Final connections and the turning on of gas shall be made by the utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of gas lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new gas lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish to the Contracting Officer a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

b. Connection to Government Owned/Operated Gas Lines: Provide the name and location of the utility or operating agency of the existing gas lines. Show on the drawings, the location of valves to

be operated for existing system deactivation. The Contractor shall provide connections to the existing gas lines in accordance with approved procedures. Reactivation of any existing gas lines will only be done by the Government. The Contractor's Connection Plan shall be submitted to the Contracting Officer and approved prior to making any connections to existing gas lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made.

3.4.6 Pressure and Leak Tests

a. Prior to returning the gas line back to service it shall be tested in accordance with ASME B31.8. Test pressures should recognize the weakest component of each system tested for the actual pressure, the maximum allowable operating pressure, and the gas supplier's maximum operating pressure. The test pressure will be 150 percent of the maximum operating pressure or 50 pounds per square inch gauge (psig), whichever is greater. However, the maximum test pressure must not be more than three times the design pressure of the pipe. The service lines shall be tested after modifications and before being placed in service using air as the test medium. Prior to testing the system, the interior shall be blown out, cleaned and cleared of all foreign materials. All meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of all foreign materials.

b. Testing of gas service lines shall be done with due regard for the safety of employees and the public during the test. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. The test shall continue for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship T(1)P(2)=T(2)P(1), in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. The testing instruments shall be approved by the Contracting Officer. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain safety precautions for air pressure testing at all times during the tests.

3.5 Water Meter

3.5.1 Requirements:

a. The water meters must comply with the applicable requirements of ASHRAE 189.1. Where conflicts occur between this guidance and the ASHRAE standard, ASHRAE 189.1 shall prevail.

b. In addition to the requirements listed below Water Meters shall be in accordance with UFGS SECTION 33 12 33.00 30. Water Meters shall be the turbine, propeller, or displacement type with pulse output chosen to meet the specific application (pipe size, flow, pressure, etc.). Water Meters shall be manufactured by Neptune, SeaMetrics, Badger Meter Inc., DLJ, or approved equal. The location of meters and meter boxes shall be shown on the as built drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

Quantities Measured: Gallons of Water (pulse for every 10 gallons)

Accuracy: 1.5% of scale.

Resolution: 1 Gallons per Minute (GPM)

Measurement Configuration: Water Supply to a building. For buildings that already have a water meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a water meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output into a data gathering device. If the existing meter will not accept a pulse kit or if no meter exists, a new water meter shall be installed, also requiring a pulse output to a data gathering device.

3.5.2 Water Meter Types

a. Turbine Type Meters: Turbine type meters shall conform to American Water Works Association (AWWA) C701 Class I or Class II depending on the application. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local UMCS. Meters shall comply with the accuracy and capacity requirements of AWWA C701.

b. Propeller Type Meters: Propeller type meters shall conform to AWWA C704. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register or an encoder-type remote register designed in accordance with AWWA C707 but must be compatible with the local UMCS. Meters shall comply with the accuracy and capacity requirements of AWWA C704.

c. Displacement Type Meters: Displacement type meters shall conform to AWWA C700. Registers shall be straight-reading and shall read in U.S. gallons. Meters in sizes 1/2 through 1 inches shall be frost-protection design as required by the local environmental conditions. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local UMCS. Meters shall comply with the accuracy and capacity requirements of AWWA C700.

d. Compound Type Meters: Compound type meters shall conform to AWWA C702 and shall be furnished with strainers. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. The main casing shall be tapped for field testing purposes. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local UMCS. Meters shall comply with the accuracy and capacity requirements of AWWA C702.

e. Fire Service Type Meters: Provide Fire Service Type Meters as required by the Installation. Fire service type meters shall be proportional type or turbine type conforming to AWWA C703 and shall be furnished with strainers. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local UMCS. Meters shall comply with the accuracy and capacity requirements of AWWA C703. When turbine type main line meters are used, the meter shall be supplied with a separate check valve, as a unit.

[NOTE: There is no published UFGS for the ultrasonic flow meter.]

f. Ultrasonic Flow Meter: The Ultrasonic Flow Meter must be furnished complete with matched transducers, self-aligning installation hardware and transducer cables. Ultrasonic transducers must be optimized for the specific pipe and process conditions for the application. The flow meter accuracy must +/- 1% of rate from 0 to 40 ft/sec (0.3 to 12 meters/sec). The flowmeter, must include either dry contact pulse outputs, 4-20mA, 0-10Vdc or 0-5Vdc output.

3.5.3 Water Meter Installation

a. Meter Boxes: Meter boxes shall be of cast iron, concrete, or plastic. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid and cast iron meter reader lid suitable for vehicle wheel loads. Boxes set in sidewalks, not subject to vehicular traffic,

shall be concrete with cast iron lid and cast iron meter reader lid. Plastic boxes and lids can be used in unpaved areas or grass areas not subject to vehicular traffic. Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

b. Dielectric Fittings: Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

3.5.4 Valves

a. Gate Valves Smaller than 3 Inch in Size: Gate valves that are smaller than 3 inch in size shall meet Manufacturers Standardization Society (MSS) SP-80, Class 150 and have a solid wedge, non-rising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide hand wheel operators. Valves shall open by counterclockwise rotation of the valve stem.

b. Gate Valves 3 Inch Size and Larger: Gate valves 3 inch size and larger shall meet AWWA C500 or UL 262 and be of one manufacturer. Valves shall be AWWA C500, non-rising stem type with double-disc gates or UL 262, inside-screw type with operating nut, split wedge or double disc type gate, and designed for a hydraulic working pressure of 175 psi. Valves shall open by counterclockwise rotation of the valve stem.

3.5.5 Connections

a. Connections to Publicly or Privately Operated Water Utility Lines: Contractor shall provide materials for the connections to the existing water lines. Final connections and the turning on of water shall be made by the Utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of water lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new water lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

b. Connection to Government Owned/Operated Water Lines: Provide the name and location of the utility or operating agency of the existing water lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing water lines in accordance with approved procedures. The Contractor's Connection Plan shall be submitted to the Contracting Officer and approved prior to making any connections to existing water lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made. Reactivation of any existing water lines will only be done by the Government.

3.5.6 Disinfection: Prior to disinfection, obtain Contracting Officer approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying non-potable water is not required. Chlorinating materials shall conform to the following: Chlorine, Liquid: AWWA B301, Hypochlorite, Calcium and Sodium: AWWA B300.

3.5.7 Tests and Inspections

a. Prior to hydrostatic testing, obtain Contracting Officer approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer or Contracting Officer’s Representative will conduct field inspections and witness field tests. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished by the Government. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the approved Performance Work Statement.

b. Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage shall be allowed at copper pipe joints, copper tubing joints (soldered, compression type, brazed), plastic pipe joints, flanged joints and screwed joints.

c. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system. Hold this pressure for not less than 2 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.6 Steam Meter

3.6.1 Requirements:

a. In addition to the requirements listed below Steam Meters shall be in accordance with UFGS SECTION 33 63 23. The vortex type or orifice plate type are recommended. Ensure that the flow meter selected meets the requirements for the specific application based on steam type (wet, saturated or superheated), flow rate, and operating conditions. Steam Meters shall be manufactured by Onicon Incorporated, Sierra Instruments, NICE Instrumentation, Inc., or approved equal.

Quantities Measured: Pounds of Steam

Accuracy: 2.0% of scale.

Resolution: 1 pound of steam

Measurement Configuration: Steam Supply to a building. For buildings that already have a steam meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a steam meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output into a data gathering device. If the existing meter will not accept a pulse kit or if no meter exists, a new steam meter shall be installed, also requiring a pulse output to a data gathering device.

b. Steam Flow Meters: Per SECTION 33 63 23, paragraph 2.4.8. Provide pressure and temperature compensated devices to automatically and continuously correct steam flow meter readings for steam pressure and temperature variations.

3.6.2 Steam Meter Types: Steam flow is measured with several types of flow meters: Differential pressure-based (orifice plates, flow nozzles, venturi tubes, and averaging pitot tubes), vortex, Coriolis, and ultrasonic.

a. Vortex Meter: Vortex flow meters are flow sensors that detect the frequency of vortices shed by a bluff body placed in a flow stream. The frequency of the vortices is proportional to the flow velocity.

b. Orifice Plate: Orifice Plate flow meters are differential producing type orifice plate with a circular hole for insertion into the steam piping between two ASME B16.5 Class 300 welding neck orifice flanges. Orifice plate shall be Type 304 stainless steel. Furnish to the Contracting Officer a dimensional report and flow versus differential curve with accuracy of plus or minus one percent over a 5 to 1 flow range. Orifice flanges shall have at least two radially-drilled and tapped holes for metering and two jack screws.

c. Turbine Flowmeter: As a substance moves through a pipe, it acts on the vanes on a turbine to get it to spin. The rate of spin is measured to find out the speed of the flow.

d. Pitot Tube Flowmeter: The Pitot Static tube measures the total pressure (or impact pressure) at the nose of the Pitot tube and the static pressure of the gas stream at side ports. The difference of these pressures, i.e. the dynamic or velocity pressure varies with the square of the gas velocity.

3.6.3 Steam Meter Installation

a. Connections to Publicly or Privately Operated Steam Utility Lines: Contractor shall provide materials for the connections to the existing steam lines. Final connections and the turning on of steam supply shall be made by the Utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of steam supply lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new steam lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish to the Contracting Officer a certification by the Operating Agency/Utility Company that all utility work has been satisfactorily completed.

b. Connection to Government Owned/Operated Steam Lines: Provide the name and location of the utility or operating agency of the existing steam lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing steam lines in accordance with approved procedures. The Contractor's Connection Plan shall be submitted and approved prior to making any connections to existing steam lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made. Reactivation of any existing steam supply lines will only be done by the Government.

c. Demolition: Remove materials so as not to damage materials which are to remain. Replace existing work damaged by the Contractor's operations with new work of the same construction.

d. Cleaning of Piping: Keep the interior and ends of new piping and existing piping affected by the Contractor's operations, cleaned of water and foreign matter during installation by using plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.

e. Adjustments: Upon completion of the work, furnish the services of a competent technician regularly employed by the manufacturer of the flow meter to make the necessary adjustments to place the steam flow meter in operation and to conduct performance tests which demonstrate that the flow measuring equipment is functioning. Install the steam flow meter in accordance with manufacturer's recommendations.

3.6.4 Piping Tests

a. Provide piping modifications that facilitates acceptance testing such as piping which includes flanges at appropriate locations for flanged blanks to be installed for testing. Include requirements for how the modified piping shall be pressure tested and also specify which pipe sections or equipment that will be pressure tested in the shop if absolutely necessary.

b. Before final acceptance of the work, test each system as in service to demonstrate compliance with contract requirements. Before insulation is applied, hydrostatically test each piping system at not less than 225 psig in accordance with ASME B31.1, with no leakage or reduction in gage

pressure for 2 hours. The Contractor shall flush and clean piping before placing into operation. Flush piping at a minimum velocity of 8 feet per second. Correct defects in work provided by Contractor and repeat tests until work is in compliance with contract requirements. Furnish potable water, electricity, instruments, connecting devices, and personnel required for the tests.

4.0 EXECUTION

4.1 Installation: Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise. Specific installation instructions are located in each meter section above.

a. All current, power, and voltage circuit wiring entering the meter or enclosure must be clearly marked, to avoid installation error and simplify future identification of wires for maintenance purposes. Unless prewired by manufacturer, use the following color code to mark the conductors:

(1) Red - Phase A CT - C1
(2) Orange - Phase B CT - C2
(3) Brown - Phase C CT - C3
(4) Gray with white stripe - neutral current return - C0
(5) Black - Phase A voltage - V1
(6) Yellow - Phase B voltage - V2
(7) Blue - Phase C voltage - V3
(8) White - Neutral voltage

b. Labels: The contractor shall install permanent labels identifying the installed components. Labels shall be lamacoid or similar, and shall be white on black. Approximate size: 1.5” x 3.5”. Information contained should include: Building #, Volts/#Phases/CT Ratio, Meter Type # of #. Example: Line 1 – Building 2415; Line 2 – 208/3/800; Line 3 – EM 1 of 2. Additional information may be required at the behest of the garrison’s Directorate of Public Works.

4.2 Drawings: These identifying markings shown above shall be reflected on the As-Built drawings. Documentation shall contain detailed design data, drawings, cut sheets on selected equipment, design documents, and building list as applicable. In addition to the requirements above, Contractor shall provide the following drawings:

a. plan view of building showing the outline and the approximate location of the meter with designation (i.e. room number), the voltage/# of phases/CT Ratio (i.e. 120/3/600) of the meter, BPOC, approximate conduit and cable routing, wire sizes, and number of conductors;

b. schematics displaying 3 phase 4 wire wye, 3 phase 3 wire delta, and 1 phase configurations, CT orientation/polarity markings;

c. connection drawings that show all wires, color codes of wires, wire sizes, and connection points;

d. general site overview drawing depicting locations of buildings being metered;

e. communications riser diagram containing as much information as is known at the time of the design.

4.3 Scheduling of Work and Outages

a. Installation of current transformers and potential transformers shall require that power be disconnected from the transformer and/or building. No "hot work" allowed unless prior Government approval is granted.

b. The Contract Clauses shall govern regarding permission for power outages, scheduling of work, coordination with Government personnel, and special working conditions.

c. Building Schedule Concurrence Agreement: The contractor shall submit to the Contracting Officer’s Representative (COR) a list of buildings with approved, scheduled utility outages prior to beginning any meter installation. The approval authority for outages is the local Public Works engineering office.

d. Monthly Status Report: The contractor shall report the number of installed meters and the associated building number by the tenth of each month to the Government Project Manager. Major equipment installation, servers, network installation, and software installation shall be included in the report.

4.4 Field Applied Painting

Where field painting of enclosures is required to correct damage to the manufacturer's factory-applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

4.5 Cleanup

Upon completion of the installation all debris and surplus materials resulting from the work shall be removed. Daily housekeeping site clean-up is required.

5.0 TESTING AND CHECKOUT

[Note: This section is not all inclusive of specific testing requirements. Additional testing requirements for proper installation of water, gas, and steam meters are above (piping test, pressure tests, etc.]

5.1 Performance Verification Test (PVT)

a. Perform all Testing, Adjusting, and Commissioning in accordance with UFGS 25 08 10, manufacturer's recommendations, and referenced contract specifications and requirements. Provide certification of compliance. Prepare testing procedures as defined by product manufacturer's standard published written testing procedures and in accordance with UFGS 25 08 10. All electrical meter product certifications shall be performed in accordance with the certification tests described in ANSI C12.20 for 0.5% accuracy class meters, unless noted otherwise below.

b. The Contractor shall complete a Performance Verification Test (PVT). The PVT shall demonstrate to the Government that the actual power utilized by the electrical service being metered is calculated and displayed on the meter display and/or software accurately. The services being verified will be a random sample selected by the Government. The PVT shall utilize suitable test equipment connected to the electrical service being metered that is capable of displaying instantaneous 3-Phase values of Voltage, Current, Phase Power Factor / Phase Angle, Volt Amperes, Watts, and Vars.

c. All safety measures for connectivity to an energized source shall be followed as outlined in Safety Manual EM 385-1-1, Section 11B (latest version). Connectivity to an energized source is contingent on approval from the Government Safety Officer and Government approval of PVT plan. Additionally, a compliance validation assessment will be completed by the Government at its discretion as part of the test and checkout process. Any deviations from the required configurations will require resolution or correction by the Contractor at no additional cost to the Government.

d. The PVT procedures shall encompass testing of the entire system: meter installation, operation, conduit and wiring, data collection at front end, etc. All meters (100%) may not be completely tested in the PVT; however, procedures should take into account the entire system for the meters that are tested.

e. Pre-determined electric meters will be chosen (based on the CFT data) to be fully tested during the PVT. The Contractor will dress out in protective clothing (as appropriate), connect power analyzer with rope or clamp on CTs to the feeds and compare the meter readings between the frontend and the power analyzer.

5.2 Contractor's Field Tests (CFT):

a. As part of the installation and prior to the PVT, the contractor shall perform a Contractor Field Test (CFT) on all meters installed by this work effort. The CFT shall be composed of various screen captures from the metering software which demonstrate proper installation and operation of the newly

installed meters and front-end. The CFT documentation shall be provided to the Government for review and approval 30 days before the PVT is scheduled. The meters selected by the Government for inclusion in the PVT will be developed from the CFT. There is no set number limit of meters for PVT.

b. The Contactor shall provide all test equipment. Test equipment shall be calibrated, stickered and show last calibration date, next calibration date and prove capable of the required accuracy, linearity, and repeatability, and shall be traceable to a nationally recognized testing standard (i.e. NIST, ANSI, etc.). No testing shall be accomplished with un-calibrated test or measurement equipment.

c. Contractor shall test 100% of the meters, verify the accuracy, correct any problems, and submit a report to the Government for review. Testing shall include the front-end server and associated workstation. The CFT report shall only be submitted for approval after all issues have been addressed and corrected.

d. The Contractor shall review the CFT report before submission and correct any apparent and known issues. A CFT Report which indicates obvious installation errors will be rejected. The PVT will not be scheduled until an acceptable CFT report has been approved. The CFT shall serve as the Contractor's opportunity to identify any installation or wiring errors and solve any issues prior to the Government coming to the site to perform the PVT.

e. Provide the screen shots to display the following parameters, as applicable:

Front-End:

- Screen shot showing all connected meters along with data values listed below

Electric Meters: (all values shall be per phase where applicable)

- Line to Line voltages (volts)
- Line-to-neutral voltages (volts)
- Voltage phasor angles (degrees)
- Currents magnitudes (amps)
- Current phase angles (degrees)
- Power: Apparent (kVA), Reactive (kVAr), Real (kW)
- Phase Power Factors (pf)
- CT ratio (i.e. 400:5)
- Electrical Service rating and type (i.e. 277/480-volt, 3Ph, 4-wire, 3CTs, 3PTs,Wye Connected)
- Phasor Diagrams

Pulse Meters (Gas/Water):

- Initial reading of actual physical meter dial to obtain baseline data
- Initial screen shots of front end values for the meter for the same date/time the dials were read.

- Second reading of actual physical meter dial to obtain baseline data
- Second screen shot of front end values for the meter for the same date/time the dials were read.
- Pulse multiplier values (1 pulse = 100 cubic ft)
- Pulses per revolution
- Accumulator baseline or offset values (if applicable)
- BPOC (Building Point of Connection) information or BLC (Building Level Controller)
- The initial (or baseline readings) shall be compared against the second reading for verification of the pulse meter. The difference between the gas meter dial readings will be compared against the difference between the front end readings. The differences shall be within the resolution of 1 pulse count.

f. The data which is accumulated (pulses) should have baseline data to compare for the CFT and during the PVT. The values at the meter dial (e.g. gas, water, steam) and the front end shall be recorded and compared to the values at another point in time. The delta between the meter readings shall be compared to the delta between the front end values to insure the proper multiplier, Lon address mapping, and programming are all correct.

g. CFT Submittals will be rejected if they do not contain enough information to properly verify meter installation and operation. If there is sufficient data in the CFT that supports a properly installed and functioning meter, only a visual inspection of the meter may be necessary during the PVT instead of requiring the Contractor to suit up and connect a power analyzer; however, the Government reserves the right to test any and all meters during the PVT as deemed necessary.

6.0 TRAINING

The Contractor shall conduct a training course for meter configuration, operation, and maintenance of the system as specified. The training shall be oriented for all components and systems installed under this contract. Training manuals shall be delivered for [_x_] trainees with two additional copies delivered for archiving at the project site. The Contractor shall furnish all audiovisual equipment and all other training materials and supplies. A training day is defined as eight hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the project site. For guidance in planning the required instruction, the Contractor shall assume that attendees have a high school education or equivalent, and are familiar with utility systems. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

Training: The course shall be taught at the project site within thirty days after completion of the installation for a period of one [_x_] day(s). A maximum of [_x_] personnel will attend the course. The training shall include:

a. Physical layout of each piece of hardware.
b. Meter configuration, troubleshooting and diagnostics procedures.
c. Repair instructions.
d. Preventive maintenance procedures and schedules.
e. Testing and calibration procedures.

For more information, please contact:

U.S. Army Engineering and Support Center, Huntsville
P.O. Box 1600
CEHNC-EDM-U (UMCS-MCX)
Huntsville, Alabama 35807-4301

Utility Monitoring and Control System
Mandatory Center of Expertise (UMCS-MCX)
Will.White@usace.army.mil
256 895-1739

END OF SECTION

23 23 00 REFRIGERANT PIPING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.03 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.

1. Refrigerant piping indicated is schematic only. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

D. Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals specified in Division 01.

1.04 QUALITY ASSURANCE

A. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

B. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."

C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

1.05 COORDINATION

A. Coordinate layout and installation of refrigerant piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

D. Coordinate pipe sleeve installations for penetrations in exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 07 for materials and methods for sealing pipe penetrations through fire and smoke barriers.

E. Coordinate pipe fitting pressure classes with products specified in related Sections.

1.06 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Refrigeration Oil Test Kits: Two each, containing everything required to conduct one test.

2. Refrigerant: Two containers each, with 20 lb. (9 kg) of refrigerant.

3. Filter-Dryer Cartridges: Three of each type.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Refrigerants:

a. Allied Signal, Inc./Fluorine Products; Genetron Refrigerants.

b. DuPont Company; Fluorochemicals Div.

c. Elf Atochem North America, Inc.; Fluorocarbon Div.

d. ICI Americas Inc./ICI KLEA; Fluorochemicals Bus.

2. Refrigerant Valves and Specialties:

a. Climate & Industrial Controls Group; Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.

b. Danfoss Electronics, Inc.

c. Emerson Electric Company; Alco Controls Div.

d. Henry Valve Company.

e. Sporlan Valve Company.

2.02 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B280, Type ACR.

B. Annealed-Temper Copper Tube: Type K (ASTM B88M, Type A).

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

E. Bronze Filler Metals: AWS A5.8, Classification BAg-1 (silver).

2.03 VALVES

A. Diaphragm Packless Valves: 500-psig (3450-kPa) working pressure and 275 F (135 C) working temperature; globe design with straight-through or angle pattern; forged-brass or bronze body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless-steel spring, nylon seat disc, and with solder-end connections.

B. Packed-Angle Valves: 500-psig (3450-kPa) working pressure and 275 F (135 C) working temperature; forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, and with solder-end connections.

C. Check Valves Smaller than NPS 1 (DN 25): 400-psig (2760-kPa) operating pressure and 285 F (141 C) operating temperature; cast-brass body, with removable piston, polytetrafluoroethylene seat, and stainless-steel spring; globe design. Valve shall be straight-through pattern, with solder-end connections.

D. Check Valves, NPS 1 (DN 25) and Larger: 400-psig (2760-kPa) operating pressure and 285 F (141 C) operating temperature; cast-bronze body, with cast-bronze or forged-brass bolted bonnet; floating piston with mechanically retained polytetrafluoroethylene seat disc. Valve shall be straight-through or angle pattern, with solder-end connections.

E. Service Valves: 500-psig (3450-kPa) pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.

F. Solenoid Valves: Comply with ARI 760; 250 F (121 C) temperature rating and 400-psig (2760-kPa) working pressure; forged brass, with polytetrafluoroethylene valve seat, two-way, straight-through pattern, and solder-end connections; manual operator; fitted with suitable NEMA 250 enclosure of type required by location, with 1/2-inch (16 GRC) conduit adapter and 24- or 12- V, normally closed or normally open holding coil as application requires.

G. Pressure-Regulating Valves: Comply with ARI 770; pilot operated, forged brass or cast bronze, stainless-steel bottom spring, pressure-gage tappings, 24-VDC standard coil, and wrought-copper fittings for solder-end connections; suitable for refrigerant specified.

H. Pressure-Regulating Valves: Comply with ARI 770; direct acting, brass; with pilot operator, stainless-steel diaphragm, standard coil, and solder-end connection; suitable for refrigerant specified.

I. Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.

J. Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

K. Hot-Gas Bypass Valve: Pulsating-dampening design, stainless-steel bellows and polytetrafluoroethylene valve seat; adjustable; sized for capacity equal to last step of compressor unloading; with solder-end connections.

2.04 REFRIGERANT PIPING SPECIALITIES

A. Straight- or Angle-Type Strainers: 500-psig (3450-kPa) working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen of 80 to 100 mesh in liquid lines up to 1-1/8 inches (30 mm), 60 mesh in larger liquid lines, and 40 mesh in suction lines; with screwed cleanout plug and solder-end connections.

B. Moisture/Liquid Indicators: 500-psig (3450-kPa) maximum working pressure and 200 F (93 C) operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.

C. Replaceable-Core Filter-Dryers: 500-psig (3450-kPa) maximum working pressure; heavy gage protected with corrosion-resistant-painted steel shell, flanged ring and spring, ductile-iron cover plate with steel cap screws; wrought-copper fittings for solder-end connections; with replaceable-core kit, including gaskets and the following:

1. Filter-Dryer Cartridge: Pleated media with solid-core sieve with activated alumina, ARI 730 rated for capacity.

D. Permanent Filter-Dryer: 350-psig (2410-kPa) maximum operating pressure and 225 F (107 C) maximum operating temperature; steel shell and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

E. Mufflers: 500-psig (3450-kPa) operating pressure, welded-steel construction with fusible plug; sized for refrigeration capacity.

2.05 RECEIVERS

A. Receivers, 6-Inch (150-mm) Diameter and Smaller: ARI 495, UL listed, steel, brazed, 400-psig (2760-kPa) pressure rating, with tappings for inlet, outlet, and pressure relief valve.

B. Receivers Larger Than 6-Inch (150-mm) Diameter: ARI 495, welded steel, tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII; 400-psig (2760-kPa) pressure rating, with tappings for liquid inlet and outlet valves, pressure relief valve, and liquid-level indicator.

2.06 REFRIGERANTS

A. ASHRAE 34, R-123: Dichlorotrifluoroethane.

B. ASHRAE 34, R-134a: Tetrafluoroethane.

C. ASHRAE 34, R-22: Monochlorodifluoromethane.

D. ASHRAE 34, R-500: Azeotrope.

3.00 EXECUTION

3.01 PIPING APPLICATIONS

A. Aboveground, within Building: Type ACR drawn-copper tubing.

B. Belowground for NPS 2 (DN 50) and Smaller: Type K (Type A) annealed-copper tubing.

3.02 VALVE APPLICATIONS

A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor, for gage taps at hot-gas bypass regulators, on each side of strainers.

B. Install check valves in compressor discharge lines and in condenser liquid lines on multiple condenser systems.

C. Install packed-angle valve in liquid line between receiver shutoff valve and thermostatic expansion valve for system charging.

D. Install diaphragm packless or packed-angle valves on each side of strainers and dryers, in liquid and suction lines at evaporators, and elsewhere as indicated.

E. Install a full-sized, three-valve bypass around each dryer.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve.

1. Install solenoid valves in horizontal lines with coil at top.

2. Electrical wiring for solenoid valves is specified in Division 26 Sections. Coordinate electrical requirements and connections.

G. Install thermostatic expansion valves as close as possible to evaporator.

1. If refrigerant distributors are used, install them directly on expansion-valve outlet.

2. Install valve so diaphragm case is warmer than bulb.

3. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line. Verify proper location for bulb with valve manufacturer.

4. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install pressure-regulating and pressure relief valves as required by ASHRAE 15. Pipe pressure relief valve discharge to outside.

3.03 SPECIALTY APPLICATIONS

A. Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.

B. Install strainers immediately upstream from each automatic valve, including expansion valves, solenoid valves, hot-gas bypass valves, and compressor suction valves.

C. Install strainers in main liquid line where multiple expansion valves with integral strainers are used.

D. Install strainers in suction line of steel pipe.

E. Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.

F. Install pressure relief valves on ASME receivers; pipe discharge to outdoors.

G. Install replaceable-core filter-dryers in vertical liquid line adjacent to receivers and before each solenoid valve.

H. Install permanent filter-dryers in low-temperature systems, in systems using hermetic compressors, and before each solenoid valve.

I. Install solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

J. Install receivers, sized to accommodate pump-down charge, on systems 5 tons (17.5 kW) and larger and on systems with long piping runs.

K. Install flexible connectors at or near compressors where piping configuration does not absorb vibration.

3.04 PIPING INSTALLATION

A. Install refrigerant piping according to ASHRAE 15.

B. Basic piping installation requirements are specified in Division 23 Section “Basic Mechanical Materials and Methods.”

C. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

D. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

E. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

F. Belowground, install copper tubing in protective conduit. Vent conduit outdoors.

G. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

H. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.

3. Install traps and double risers to entrain oil in vertical runs.

4. Liquid lines may be installed level.

I. Install bypass around moisture-liquid indicators in lines larger than NPS 2 (DN 50).

J. Install unions to allow removal of solenoid valves, pressure-regulating valves, and expansion valves and at connections to compressors and evaporators.

K. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.

L. Hanger, support, and anchor products are specified in Section 23 05 29 “Hangers and Supports for HVAC Piping and Equipment.”

M. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6.0 m) long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6.0 m) or longer.
3. Pipe rollers for multiple horizontal runs 20 feet (6.0 m) or longer, supported by a trapeze.
4. Spring hangers to support vertical runs.

N. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
6. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
7. NPS 2-1/2 (DN 65): Maximum span, 108 inches (2700 mm); minimum rod size, 3/8 inch (9.5 mm).
8. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (9.5 mm).
9. NPS 4 (DN 100): Maximum span, 12 feet (3.7 m); minimum rod size, 1/2 inch (13 mm).

O. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1/2 (DN 15): Maximum span, 84 inches (2100 mm); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 3/4 (DN 20): Maximum span, 84 inches (2100 mm); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 84 inches (2100 mm); minimum rod size, 1/4 inch (6.4 mm).
4. NPS 1-1/2 (DN 40): Maximum span, 108 inches (2700 mm); minimum rod size, 3/8 inch (9.5 mm).
5. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (9.5 mm).
6. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9.5 mm).

7. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (9.5 mm).
8. NPS 4 (DN 100): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).

P. Support vertical runs at each floor.

3.05 PIPE JOINT CONSTRUCTION

A. Braze joints according to Division 23 Section “Basic Mechanical Materials and Methods.”

B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

3.06 FIELD QUALITY CONTROL

A. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.

1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
    a. System shall maintain test pressure at the manifold gage throughout duration of test.
    b. Test joints and fittings by brushing a small amount of soap and glycerine solution over joint.
    c. Fill system with nitrogen to raise a test pressure of 150 psig (1035 kPa) or higher as required by authorities having jurisdiction.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.07 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of the conditioned air or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer’s written instructions:

1. Open shutoff valves in condenser water circuit.
2. Check compressor oil level above center of sight glass.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves, except bypass valves that are used for other purposes.
5. Check compressor-motor alignment, and lubricate motors and bearings.

3.08 CLEANING

A. Before installing copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.

B. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.

3.09 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter-dryer after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.

3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).

4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION

23 31 13 METAL DUCTS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500- to plus 2500-Pa). Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round spiral-seam ducts and formed fittings.
3. Duct liner.

1.03 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. NUSIG: National Uniform Seismic Installation Guidelines.

1.04 SUBMITTALS

A. Welding certificates.

B. Field Quality-Control Test Reports.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code--Steel,” for hangers and supports, AWS D1.2, “Structural Welding Code--Aluminum,” for aluminum supporting members and AWS D9.1, “Sheet Metal Welding Code,” for duct joint and seam welding.

B. NFPA Compliance:

1. NFPA 90A, “Installation of Air Conditioning and Ventilating Systems.”
2. NFPA 90B, “Installation of Warm Air Heating and Air Conditioning Systems.”

C. Comply with NFPA 96, “Ventilation Control and Fire Protection of Commercial Cooking Operations,” Ch. 3, “Duct System,” for range hood ducts, unless otherwise indicated.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A653/A653M and having G60 (Z180) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Aluminum Sheets: ASTM B209 (ASTM B209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.03 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber-reinforced fabric.

C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

E. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.

G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.04 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.

2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.

3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A36/A36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.

3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

2.05 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.

2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

a. Ductmate Industries, Inc.

b. Nexus Inc.

c. Ward Industries, Inc.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.

b. Lockformer.

2. Duct Size: Maximum 30 inches (750 mm) wide and up to 2-inch wg (500-Pa) pressure class.
3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of nonbraced panel area unless ducts are lined.

3.00 EXECUTION

3.01 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
1. Supply Ducts: 1-inch wg (250-Pa)
2. Return Ducts (Negative Pressure): 1-inch wg (250-Pa).
3. Exhaust Ducts (Negative Pressure): 2-inch wg (500-Pa).

B. All ducts shall be galvanized steel except as follows:
1. **Insert, in separate subparagraphs, services or service locations**: **[PVC-coated galvanized steel] [Aluminum] [Stainless steel]**.
2. Range Hood Exhaust Ducts: Comply with NFPA 96.
a. Concealed: Carbon-steel sheet.
b. Exposed: Type 304, stainless steel with finish to match kitchen equipment and range hood.
c. Weld and flange seams and joints.
3. Dishwasher Hood Exhaust Ducts:
a. Type 304, stainless steel with finish to match kitchen equipment and range hood. Weld and flange seams and joints.
b. Aluminum, with seams and laps arranged on top of duct.

3.02 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet (3.7 m) unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches (300 mm), with a minimum of three screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Section 23 33 00 “Air Duct Accessories.” Firestopping materials and installation methods are specified in Division 07 Section.

O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA’s “Duct Cleanliness for New Construction.”

P. Paint interiors of metal ducts, that do not have duct liner, for 24 inches (600 mm) upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.03 PVC-COATED DUCT, SPECIAL INSTALLATION REQUIREMENTS

A. Repair damage to PVC coating with manufacturer’s recommended materials.

3.04 RANGE HOOD EXHAUST DUCTS, SPECIAL INSTALLATION REQUIREMENTS

A. Install ducts to allow for thermal expansion through 2000 F (1110 C) temperature range.

B. Install ducts without dips or traps that may collect residues unless traps have continuous or automatic residue removal.

C. Install access openings at each change in direction and at intervals defined by NFPA 96; locate on sides of duct a minimum of 1-1/2 inches (38 mm) from bottom; and fit with grease-tight covers of same material as duct.

D. Do not penetrate fire-rated assemblies except as permitted by applicable building codes.

3.05 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.

3.06 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet (5 m) and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

3.07 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Section 23 33 00 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.08 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give 7 days' advance notice for testing.

3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (500-Pa) (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (500- to 2500-Pa).

4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.09 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Create other openings to comply with duct standards.

2. Disconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

3.10 CLEANING EXISTING SYSTEMS

A. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Use existing service openings where possible.
2. Create other openings to comply with duct standards.
3. Disconnect flexible ducts as needed for cleaning and inspection.
4. Reseal rigid fiberglass duct systems according to NAIMA recommended practices.

5. Remove and reinstall ceiling sections to gain access during the cleaning process.

B. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or larger) particles.

2. When venting vacuuming system to the outside, use filtration to contain debris removed from HVAC system, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.

5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.

7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Provide operative drainage system for washdown procedures.

7. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present. Apply biocidal agents according to manufacturer's written instructions after removal of surface deposits and debris.

F. Cleanliness Verification:

1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
2. Visually inspect metal ducts for contaminants.
3. Where contaminants are discovered, re-clean and reinspect ducts.

G. Gravimetric Analysis: At discretion and expense of Owner, sections of metal duct system, chosen randomly by Owner, may be tested for cleanliness according to NADCA vacuum test gravimetric analysis.

1. If analysis determines that levels of debris are equal to or lower than suitable levels, system shall have passed cleanliness verification.
2. If analysis determines that levels of debris exceed suitable levels, system cleanliness verification will have failed and metal duct system shall be re-cleaned and re-verified.

H. Verification of Coil Cleaning: Cleaning must restore coil pressure drop to within 10 percent of pressure drop measured when coil was first installed. If original pressure drop is not known, coil will be considered clean only if it is free of foreign matter and chemical residue, based on thorough visual inspection.

END OF SECTION

23 33 00 AIR DUCT ACCESSORIES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Manual-volume dampers.
3. Fire and smoke dampers.
4. Turning vanes.
5. Remote damper operators.
6. Duct-mounted access doors and panels.
7. Flexible ducts.
8. Flexible connectors.
9. Duct accessory hardware.

1.03 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Manual-volume dampers.
3. Fire and smoke dampers.
4. Duct-mounted access doors and panels.
5. Flexible ducts.

B. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.04 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:

1. NFPA 90A, “Standard for the Installation of Air-Conditioning and Ventilating Systems.”
2. NFPA 90B, “Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.”

1.05 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

2.00 PRODUCTS

2.01 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A653/A653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-Steel Sheets: ASTM A366/A366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

C. Aluminum Sheets: ASTM B209 (ASTM B209M), Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish for ducts exposed to view and mill finish for concealed ducts.

D. Extruded Aluminum: ASTM B221 (ASTM B221M), Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.02 BACKDRAFT DAMPERS

A. Description: Suitable for horizontal or vertical installations.

B. Frame: 0.052-inch (1.3-mm) thick, galvanized, sheet steel, with welded corners and mounting flange.

C. Frame: 0.090-inch (2.3-mm) thick extruded aluminum, with mounting flange.

D. Blades: 0.050-inch (1.2-mm) thick extended aluminum sheet.

E. Blade Seals: Vinyl.

F. Blade Axles: Nonferrous (for aluminum dampers).

G. Blade Axles: Galvanized steel (for steel dampers).

H. Tie Bars and Brackets: Aluminum (for aluminum dampers).

I. Tie Bars and Brackets: Galvanized steel (for steel dampers).

J. Return Spring: Adjustable tension.

2.03 MANUAL-VOLUME DAMPERS

A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classifications of 3-inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

B. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, and suitable for horizontal or vertical applications.

1. Comply with AMCA 500-D testing for damper rating.

2. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

3. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.

4. Aluminum Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts

5. Roll-Formed Steel Blades: 0.064-inch (1.62-mm) thick, galvanized, sheet steel.

6. Roll-Formed Aluminum Blades: 0.10-inch (2.5-mm) thick aluminum sheet.

7. Blade Seals: Vinyl.

8. Blade Axles: Nonferrous (for aluminum dampers).

9. Blade Axles: Galvanized steel (for steel dampers).

10. Tie Bars and Brackets: Aluminum (for aluminum dampers).

11. Tie Bars and Brackets: Galvanized steel (for steel dampers).

C. Jackshaft: 1-inch (25-mm) diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.

D. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch (2.4-mm) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.04 FIRE DAMPERS

A. General: Labeled to UL 555.

B. Fire Rating:

1. One and one-half hours for 2-hour walls.
2. Three hours for 4-hour walls.

C. Frame: SMACNA Type A with blades in airstream; fabricated with roll-formed, 0.034-inch (0.85-mm) thick galvanized steel; with mitered and interlocking corners.

D. Frame: SMACNA Type B with blades out of airstream; fabricated with roll-formed, 0.034-inch (0.85-mm) thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.

1. Minimum Thickness: 0.052 inch (1.3 mm) or 0.138 inch (3.5 mm) thick as indicated, and length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch (0.85-mm) thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch (0.85-mm) thick, galvanized steel blade connectors.

H. Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.

I. Fusible Link: Replaceable, 165 or 212 F (74 or 100 C) rated as indicated.

2.05 CEILING FIRE DAMPERS

A. General: Labeled to UL 555C; comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

B. Frame: 0.040-inch (1.0-mm) thick, galvanized, sheet steel; round or rectangular; style to suit ceiling construction.

C. Blades: 0.034-inch (0.85-mm) thick, galvanized, sheet steel with nonasbestos refractory insulation.

D. Fusible Link: Replaceable.

1. 165 F (74 C), as applicable.
2. 212 F (100 C).
3. 285 F (141 C).

2.06 SMOKE DAMPERS

A. General: Labeled to UL 555S. Combination fire and smoke dampers shall be labeled for 1-1/2 -hour rating to UL 555.

B. Fusible Link: Replaceable, 165 or 212 F (74 or 100 C) rated as indicated.

C. Damper Motors: Provide for modulating or two-position action.

1. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.

2. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
3. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 F (minus 40 C).
4. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
5. Two-Position Motor: 115 V, 1 phase, 60 Hz.

2.07 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch (38-mm) wide, curved blades set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into side strips suitable for mounting in ducts.

C. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.08 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct.

B. General: Fabricate doors and panels airtight and suitable for duct pressure class.

C. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.

D. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.

E. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

F. Insulation: 1-inch (25-mm) thick, fibrous-glass or polystyrene-foam board.

2.09 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch (70-mm) wide, 0.028-inch (0.7-mm) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

C. Extra-Wide Metal-Edged Connectors: Factory fabricated with a strip of fabric 5-3/4 inches (146 mm) wide attached to two strips of 2-3/4-inch (70-mm) wide, 0.028-inch (0.7-mm) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

D. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 4-3/8-inch (111-mm) wide, 0.028-inch (0.7-mm) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

E. Conventional, Indoor System (minus 10 to plus 250 F) Flexible Connector Fabric: Glass fabric double coated with polychloroprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).

2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp, and 360 lbf/inch (63 N/mm) in the filling.

F. Conventional, Outdoor System (minus 10 to plus 250 F) Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).

2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp, and 440 lbf/inch (77 N/mm) in the filling.

G. High-Temperature System (minus 25 to plus 500 F) Flexible Connectors: Glass fabric coated with silicone rubber and having a minimum weight of 16 oz./sq. yd. (542 g/sq. m) and tensile strength of 285 lbf/inch (50 N/mm) in the warp, and 185 lbf/inch (32 N/mm) in the filling.

H. High-Corrosive-Environment System (minus 20 to plus 500 F) Flexible Connectors: Glass fabric coated with a chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd. (474 g/sq. m).

2. Tensile Strength: 450 lbf/inch (79 N/mm) in the warp, and 340 lbf/inch (60 N/mm) in the filling.

2.10 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1.

B. Flexible Ducts, Uninsulated: Spiral-wound steel spring with flameproof vinyl sheathing.

C. Flexible Ducts, Uninsulated: Corrugated aluminum.

D. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch (38-mm) thick, glass-fiber insulation around a continuous inner liner.

1. Reinforcement: Steel-wire helix encapsulated in inner liner.

2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.

3. Inner Liner: Polyethylene film.

E. Pressure Rating: 6-inch wg (1500-Pa) positive, 1/2-inch wg (125-Pa) negative.

2.11 ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch (6-mm), zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

3.00 EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

D. Provide test holes at fan inlet and outlet and elsewhere as indicated.

E. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.

1. Install fusible links in fire dampers.

F. Install duct security bars. Construct duct security bars from 0.164-inch (4.18-mm) steel sleeve, continuously welded at all joints and 1/2-inch- (13-mm-) diameter steel bars, 6 inches (150 mm) o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch (63-by-63-by-6-mm) steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch (300-by-300-mm) hinged access panel with cam lock in duct in each side of sleeve.

G. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.

1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.

2. Install access panels on side of duct where adequate clearance is available.

H. Label access doors according to Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Adjust duct accessories for proper settings.
2. Operate dampers to verify full range of movement.
3. Inspect locations of access doors and verify that purpose of access door can be performed.
4. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
5. Inspect turning vanes for proper and secure installation.
6. Operate remote damper operators to verify full range of movement of operator and damper.

B. Final positioning of manual-volume dampers is specified in Section 23 05 93 “Testing, Adjusting, and Balancing for HVAC.”

END OF SECTION

23 34 23 HVAC POWER VENTILATORS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

B. Adjust list below to suit Project.

1. Centrifugal roof ventilators.
2. Ceiling-mounting ventilators.

1.03 PERFORMANCE REQUIREMENTS

A. Operating Limits: Classify according to AMCA 99.

1.04 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gages and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Show roof penetration requirements and reflected ceiling plans drawn to scale and coordinating roof penetrations and units mounted above ceiling. Show the following:

1. Roof framing and support members relative to duct penetrations.

2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.07 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 08 Sections.

1.08 EXTRA MATERIALS

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Centrifugal Roof Ventilators:
    a. Aerovent; a Twin City Fan Company.
    b. Breidert Air Products, Inc.
    c. Broan Mfg. Co., Inc.
    d. Carnes Company HVAC.
    e. Cook, Loren Company.

f. Greenheck Fan Corp.

g. Hartzell Fan, Inc.

h. ILG Industries, Inc./American Coolair Corp.

i. JennFan; Div. of Breidert Air Products, Inc.

j. PennBarry.

2. Ceiling-Mounting Ventilators:

a. Breidert Air Products, Inc.

b. Broan Mfg. Co., Inc.

c. Carnes Company HVAC.

d. Cook, Loren Company.

e. Greenheck Fan Corp.

f. ILG Industries, Inc./American Coolair Corp.

g. JennFan; Div. of Breidert Air Products, Inc.

h. PennBarry.

2.02 CENTRIFUGAL ROOF VENTILATORS

A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Removable extruded-aluminum, rectangular top; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

3. Pulleys: Cast-iron, adjustable-pitch motor pulley.

4. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.

2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

3. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.

4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch (40-mm) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 12 inches (300 mm)
3. Pitch Mounting: Manufacture curb for roof slope.
4. Metal Liner: Galvanized steel.
5. Hinged Subbase: Galvanized steel hinged arrangement permitting service and maintenance.
6. Mounting Pedestal: Galvanized steel with removable access panel.

2.03 CEILING-MOUNTING VENTILATORS

A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Motion Sensor: Motion detector with adjustable shutoff timer.
2. Filter: Washable aluminum to fit between fan and grille.
3. Manufacturer’s standard roof jack or wall cap, and transition fittings.

2.04 MOTORS

A. Refer to Division 23 Section “Motors” for general requirements for factory-installed motors.

B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.

C. Enclosure Type: Guarded dripproof.

2.05 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, “Methods for Calculating Fan Sound Ratings from Laboratory Test Data.” Factory test fans according to AMCA 300, “Reverberant Room Method for Sound Testing of Fans.” Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, “Laboratory Methods of Testing Fans for Rating.”

3.00 EXECUTION

3.01 INSTALLATION

A. Install power ventilators level and plumb.

B. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Sections.

C. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Sections.

D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

1. In seismic zones, restrain support units.

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Section 23 05 53 “Identification for HVAC Piping and Equipment.”

3.02 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 “Air Duct Accessories.”

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment.

D. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

A. Equipment Startup Checks:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Verify lubrication for bearings and other moving parts.

6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
7. Disable automatic temperature-control operators.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Section 23 05 93 “Testing, Adjusting, and Balancing for HVAC” for testing, adjusting, and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.05 CLEANING

A. On completion of installation, internally clean fans according to manufacturer’s written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

END OF SECTION

23 37 13 DIFFUSERS, REGISTERS, AND GRILLES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes duct-mounted diffusers, registers, and grilles.

1.03 DEFINITIONS

A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C. Register: A combination grille and damper assembly over an air opening.

1.04 SUBMITTALS

A. Product Data: For each model indicated, include the following:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.

2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.

1.05 QUALITY ASSURANCE

A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 01.

B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A “Standard for the Installation of Air-Conditioning and Ventilating Systems.”

2.00 PRODUCTS

2.01 MANUFACTURED UNITS

A. Diffusers, registers, and grilles are scheduled on the Drawings.

2.02 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70 “Method of Testing for Rating the Performance of Air Outlets and Inlets.”

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Duct-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable.

C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.04 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

32 37 16 FABRIC DUCTS

1.00 GENERAL

1.1 DESCRIPTION OF WORK:
- A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.
- B. Types of non-metal ductwork required for this project include the following:
    1. Textile Air Dispersion Products.

1.2 QUALITY ASSURANCE:
- A. Building Codes and Standards:
    1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and UL 2518. Also Classified by UL-C (Canada) S102.2, BS 5867 Part 2, 1980; GB8624-2006.
    2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.
- B. Design & Quality Control
    1. Manufacturer must have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure and textile permeability, shall be considered and documented.

1.3 SUBMITTALS:
- A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.
- B. Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories for both NFPA 90-A and UL 2518.
- C. Provide detailed drawings confirming configuration of Textile Dispersion System (diameter, lengths, airflow, pressure, and textile permeability).
- D. Provide detailed installation instructions for components to be installed.
- E. Provide warranty and maintenance documentation.

1.4 WARRANTY:
- A. Manufacturer must provide a 10 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.5 DELIVERY, STORAGE AND HANDLING:
- A. Protect textile air dispersion system and suspension components from damage during shipping, storage, and handling.
- B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

2.00 PRODUCTS

2.1 MANUFACTURER:
- A. Available manufacturers: Subject to compliance with requirements, choose one of the following:

1. DuctSox® Corporation
2. FabricAir
3. Q-SOX

2.2 TEXTILE AIR DISPERSION SYSTEM:

A. 2 Row Suspension: Air diffusers shall be constructed two row suspension system.
   1. Two Row Cable
      a. Systems shall be installed 1-1/2" above the 10 and 2 o'clock locations. Textile system attachment to cable shall be made using Gliders spaced every 24 inches. Required for systems of 32" – 59" diameter. Available for systems less than 32" diameter. Cable suspension hardware to include cable, eye bolts, thimbles, cable clamps, and turnbuckle(s) as required.
         1. Cable suspension options (must specify if multiple on same project)
            a. Galvanized steel cable
         2. Support lengths available in 5'(standard), 10', 15', & 30'.

B. TEXTILE
   1. Verona
      a. Textile Construction: Filament/filament twill polyester, fire retardant in accordance with UL 2518.
      b. Air Permeability: 2 (+2/-1) CFM/ft^2 per ASTM D737, Frazier
      c. Weight: 6.8 oz. /yd^2 per ASTM D3776
      d. Warranty: 10 years
   2. Textile Color
      a. Standard: white

C. TEXTILE SYSTEM FABRICATION REQUIREMENTS:
   1. Textile system to be constructed in modular lengths (zippered).
   2. Integrated air dispersion shall be specified and approved by manufacturer. (select only those that apply)
      a. Linear Vents
         1. Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting a 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
         2. Size of vent openings and location of linear vents to be specified and approved by manufacturer.
   3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via. zip screw fastener – supplied by contractor.
   4. Inlet connection includes zipper for easy removal / maintenance.
   5. Lengths to include required intermediate zippers as specified by manufacturer.
   6. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
   7. End cap includes zipper for easy maintenance.
   8. Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

D. DESIGN PARAMETERS:
   1. Textile air diffusers shall be designed from 0.25” water gage minimum to 3.1” maximum, with 0.5” as the standard.
   2. Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
   3. System overall design; diameter, length, airflow, operating static pressure and dispersion shall be designed or approved by the manufacturer.
   4. Do not use textile diffusers in concealed locations.
   5. Use textile air dispersion systems only for positive pressure air distribution components of the mechanical ventilation system.

3.00 EXECUTION

3.1 INSTALLATION OF TEXTILE AIR DISPERSION SYSTEM:
   A. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

3.2 CLEANING AND PROTECTION:
   A. Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.
   B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.
   C. If DuctSox systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION

23 74 09 ROOFTOP AIR CONDITIONERS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following rooftop air conditioners:

1. Cooling-only and Cooling and heating units 6 tons (21 kW) and smaller.
2. Cooling and heating units 7-1/2 to 20 tons (26 to 70 kW).

1.03 DEFINITIONS

A. DDC: Direct-digital controls.

1.04 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following by or under the supervision of a qualified professional engineer:

1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
5. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field Quality-Control Test Reports.

D. Operation and Maintenance Data: Include emergency, operation, and maintenance manuals.

E. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of rooftop air conditioners and are based on the specific system indicated. Refer to Section 01 60 00 “Product Requirements.”

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Fabricate and label refrigeration system to comply with ASHRAE 15, “Safety Standard for Refrigeration Systems.”

D. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, “Energy Efficient Design of New Buildings except Low-Rise Residential Buildings” and International Energy Conservation Code, whichever is greater.”

E. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, “Energy Efficient Design of New Buildings except Low-Rise Residential Buildings” and International Energy Conservation Code, whichever is greater.”

F. Comply with NFPA 54 for gas-fired furnace section.

G. ARI Certification: Units shall be ARI certified and listed.

H. ARI Compliance for Units with Capacities Less Than 135,000 BTUH (39.6 kW): Rate rooftop air-conditioner capacity according to ARI 210/240, “Unitary Air-Conditioning and Air-Source Heat Pump Equipment.”

1. Sound Power Level Ratings: Comply with ARI 270, “Sound Rating of Outdoor Unitary Equipment.”

I. ARI Compliance for Units with Capacities 135,000 BTUH (39.6 kW) and More: Rate rooftop air-conditioner capacity according to ARI 340/360, “Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.”

1. Sound Power Level Ratings: Comply with ARI 270, “Sound Rating of Outdoor Unitary Equipment.”

1.06 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00 “Roof Accessories.”

1.07 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer’s standard, but not less than 5 years from date of Substantial Completion.

2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 15 years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than 3 years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.
5. Warranty Period for Variable-Speed Fan Motors: Manufacturer's standard, but not less than 3 years from date of Substantial Completion.
6. Warranty Period for Electronic Thermostats: Manufacturer's standard, but not less than 3 years from date of Substantial Completion.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 ROOFTOP AIR CONDITIONERS 6 TONS (21 KW) AND SMALLER

A. Manufacturers:

1. Addison Products Company.
2. Carrier Corp.
3. Lennox Industries Inc.
4. McQuay International.
5. Skymark International, Inc.
6. Trane Company (The); North American Commercial Group.
7. YORK International Corporation.

B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.

C. Casing: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch (13-mm) thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.

D. Indoor Fan: Forward curved, centrifugal, directly driven by multispeed motor.

E. Outside Coil Fan: Propeller type, directly driven by motor.

F. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor. Provide phenolic epoxy corrosion-protection coating to both coils.

G. Compressor: Hermetic reciprocating compressor with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater.

H. Refrigeration System:

1. Compressor.
2. Outside coil and fan.
3. Indoor coil and fan.
4. Four-way reversing valve and suction line accumulator.
5. Expansion valve with replaceable thermostatic element.
6. Refrigerant dryer.
7. High-pressure switch.
8. Low-pressure switch.
9. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.
10. Low-ambient switch.
11. Brass service valves installed in discharge and liquid lines.
12. Charge of refrigerant.

I. Filters: 2-inch (50-mm) thick, throwaway filters in filter rack.

J. Heat Exchanger: Aluminized-steel construction for natural gas-fired burners with the following controls:

1. Redundant single or dual gas valve with manual shutoff.
2. Direct-spark pilot ignition.
3. Electronic flame sensor.
4. Induced-draft blower.
5. Flame rollout switch.

K. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood.

1. Damper Motor: Fully modulating spring return with adjustable minimum position.
2. Control: Electronic-control system uses outside-air enthalpy to adjust mixing dampers.
3. Relief Damper: Gravity actuated with bird screen and hood.

L. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.

M. Unit Controls: Solid-state control board and components contain at least the following features:

1. Indoor fan on/off delay.
2. Default control to ensure proper operation after power interruption.
3. Service relay output.
4. Unit diagnostics and diagnostic code storage.
5. Field-adjustable control parameters.
6. Dehumidification control with dehumidistat.
7. Economizer control.
8. Electric heat staging.
9. Gas valve delay between first- and second-stage firing.
10. Indoor-air quality control with carbon dioxide sensor.
11. Low-ambient control, allowing operation down to 0 F (minus 18 C).
12. Minimum run time.
13. Night setback mode.
14. Return-air temperature limit.
15. Smoke alarm with smoke detector installed in supply and return air.
16. Low-refrigerant pressure control.
17. Digital display of outside temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

N. DDC: Install stand-alone control module providing link between unit controls and DDC system. Control module shall be compatible with temperature-control system specified in Section 23 09 23 “BACNET DIRECT DIGITAL CONTROL SYSTEM FOR HVAC.”

O. Electromechanical Thermostat: Staged heating and cooling on subbase with manual system switch (on-heat-auto-cool) and fan switch (auto-on).

1. Night setback operation with single-stage heating control with 7-day time clock with battery backup.
2. Fan-proving switch to lock out unit if fan fails.
3. Dirty-filter switch.

P. Optional Accessories:

1. Cold-Weather Kit: Electric heater maintains temperature in gas burner compartment.
2. Service Outlets: Two, 115-V, ground-fault, circuit-interrupter type.
3. Condensate drain trap.
4. Dirty-filter switch.
5. Hail guards of steel, painted to match casing.

6. Flush diffuser with aluminum grilles, insulated diffuser box with flanges, and interior transition.
7. Power exhaust fan.

Q. Roof Curb: Steel with corrosion-protection coating, gasketing, and factory-installed wood nailer; complying with NRCA standards; minimum height of 14 inches (350 mm).

2.03 ROOFTOP AIR CONDITIONERS 7-1/2 TO 20 TONS (26 TO 70 KW)

A. Manufacturers:

1. AAON, Inc.
2. Addison Products Company.
3. Carrier Corp.
4. Engineered Air.
5. Governair.
6. Lennox Industries Inc.
7. Mammoth Inc.
8. McQuay International.
9. Skymark International, Inc.
10. Trane Company (The); North American Commercial Group.
11. YORK International Corporation.

B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.

C. Casing: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch (13-mm) thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.

D. Indoor Fan: Forward curved, centrifugal, belt driven with **fixed** motor sheaves, grease-lubricated ball bearings, and motor.

E. Outside Coil Fan: Propeller type, directly driven by permanently lubricated motor.

F. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor. Provide phenolic epoxy corrosion-protection coating to both coils.

G. Compressor(s): Number as scheduled hermetic compressors with integral vibration isolators, internal overcurrent and overtemperature protection, AND internal pressure relief.

H. Refrigeration System:

1. Compressor(s).

2. Outside coil and fan.
3. Indoor coil and fan.
4. Check valves.
5. Expansion valves with replaceable thermostatic elements.
6. Refrigerant dryers.
7. High-pressure switches.
8. Low-pressure switches.
9. Thermostats for coil freeze-up protection during low-ambient temperature operation or loss of air.
10. Independent refrigerant circuits.
11. Brass service valves installed in discharge and liquid lines.
12. Charge of refrigerant.
13. Hot-Gas Bypass: Factory-installed valve.
14. Timed Off Control: Automatic-reset control shuts compressor off after 5 minutes.

I. Filters: 2-inch (50-mm) thick, fiberglass, pleated, throwaway filters in filter rack.

J. Heat Exchanger: Aluminized-steel construction for natural gas-fired burners with the following controls:
   1. Redundant dual gas valve with manual shutoff.
   2. Direct-spark pilot ignition.
   3. Electronic flame sensor.
   4. Induced-draft blower.
   5. Flame rollout switch.

K. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood.
   1. Damper Motor: Fully modulating spring return with adjustable minimum position.
   2. Control: Electronic-control system uses outside-air enthalpy to adjust mixing dampers.
   3. Relief Damper: Gravity actuated with bird screen and hood.

L. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.

M. Unit Controls: Solid-state control board and components contain at least the following features:
   1. Indoor fan on/off delay.
   2. Default control to ensure proper operation after power interruption.
   3. Service relay output.

4. Unit diagnostics and diagnostic code storage.
5. Field-adjustable control parameters.
6. Dehumidification control with dehumidistat.
7. Economizer control.
8. Electric heat staging.
9. Gas valve delay between first- and second-stage firing.
10. Indoor-air quality control with carbon dioxide sensor.
11. Low-ambient control, allowing operation down to 0 F (minus 18 C).
12. Minimum run time.
13. Night setback mode.
14. Return-air temperature limit.
15. Smoke alarm with smoke detector installed in supply and return air.
16. Low-refrigerant pressure control.
17. Digital display of outside temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
18. Variable-Air-Volume Control: **Variable-frequency drive** controls supply-air static pressure. Supply-air, static-pressure limit shuts unit down on high pressure.

N. DDC Temperature Control: Install stand-alone control module providing link between unit controls and DDC temperature-control system. Control module shall be compatible with temperature-control system specified in 23 09 23 “Bacnet Direct Digital Control Systems for HVAC.”

O. Electromechanical Thermostat: Staged heating and cooling on subbase with manual system switch (on-heat-auto-cool) and fan switch (auto-on).

1. Night setback operation with single-stage heating control with 7-day time clock with battery backup.
2. Fan-proving switch to lock out unit if fan fails.
3. Dirty-filter switch.

P. Optional Accessories:

1. Cold-Weather Kit: Electric heater maintains temperature in gas burner compartment.
2. Service Outlets: Two, 115-V, ground-fault, circuit-interrupter type.
3. **Copper** condensate drain trap.
4. Dirty-filter switch.
5. Hail guards of steel, painted to match casing.
6. Flush diffuser with aluminum grilles, insulated diffuser box with flanges, and interior transition.
7. Power exhaust fan centrifugal type.

8. Vertical vent extension.

Q. Roof Curb: Steel with corrosion-protection coating, gasketing, and factory-installed wood nailer; complying with NRCA standards; minimum height of 14 inches (350 mm).

2.04 MOTORS

A. General requirements for motors are specified in Section 23 05 13 “Common Motor Requirements for HVAC.”

B. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

C. Controllers, electrical devices, and wiring are specified in Division 26 Sections.

3.00 EXECUTION

3.01 INSTALLATION

A. Install units level and plumb, maintaining manufacturer’s recommended clearances. Install according to ARI Guideline B.

B. Curb Support: Install roof curb on roof structure, level and secure, according to NRCA’s “Low-Slope Membrane Roofing Construction Details Manual,” Illustration “Raised Curb Detail for Rooftop Air Handling Units and Ducts.” Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.

C. Isolation Curb Support: Install units on isolation curbs and install flexible duct connectors and the following vibration isolation and seismic-control devices. Flexible duct connectors are specified in Section 23 33 00 “Air Duct Accessories.” Vibration isolation and seismic-control devices are specified in Section 23 05 48 “Vibration and Seismic Controls for HVAC.”

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Division 23 Section “Plumbing Systems.” Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination in roof curb.

2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

3. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch (50-mm) thick, acoustic duct liner.

4. Install normal-weight, 3000 psi (20.7 MPa), compressive strength (28-day) concrete mix inside roof curb, **[4 inches (100 mm)]** thick. Concrete, formwork, and reinforcement are specified in Division 03.

D. Electrical System Connections: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.

E. Ground equipment according to Division 26.

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.

2. Inspect for and remove shipping bolts, blocks, and tie-down straps.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

3.04 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.

2. Inspect for visible damage to furnace combustion chamber.

3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.

4. Inspect internal insulation.

5. Verify that labels are clearly visible.

6. Verify that clearances have been provided for servicing.

7. Verify that controls are connected and operable.

8. Verify that filters are installed.

9. Clean outside coil and inspect for construction debris.

10. Clean furnace flue and inspect for construction debris.

11. Connect and purge gas line.
12. Adjust vibration isolators.
13. Inspect operation of barometric dampers.
14. Lubricate bearings on fan.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.
    a. Start refrigeration system in summer only.
    b. Complete startup sheets and attach copy with Contractor's startup report.
18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.
    a. Measure gas pressure on manifold.
    b. Measure combustion-air temperature at inlet to combustion chamber.
    c. Measure flue-gas temperature at furnace discharge.
    d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following:
    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outside-air, dry-bulb temperature.
    d. Outside-air-coil, discharge-air, dry-bulb temperature.
25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
    a. Supply-air volume.
    b. Return-air volume.

c. Relief-air volume.

d. Outside-air intake volume.

27. Simulate maximum cooling demand and inspect the following:

a. Compressor refrigerant suction and hot-gas pressures.

b. Short circuiting of air through outside coil or from outside coil to outside-air intake.

28. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:

a. High-limit heat exchanger.

b. Warm-up for morning cycle.

c. Freezestat operation.

d. Economizer to limited outside-air changeover.

e. Alarms.

29. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

3.05 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain rooftop air conditioners.

END OF SECTION

23 81 26 SPLIT-SYSTEM AIR-CONDITIONERS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set for each air-handling unit.

2. Gaskets: One set for each access door.

3. Fan Belts: One set for each air-handling unit fan.

1.07 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, “Safety Standard for Refrigeration Systems.”

2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - “Outdoor Air Quality,” Section 5 - “Systems and Equipment,” Section 6 - “Procedures,” and Section 7 - “Construction and System Start-up.”

1.08 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.09 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.

b. For Parts: Five year(s) from date of Substantial Completion.

c. For Labor: Five year(s) from date of Substantial Completion.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Trane

B. Carrier

C. Lennox

D. Daikin

2.02 INDOOR UNITS 5 TONS (18 KW) OR LESS

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

2. Insulation: Faced, glass-fiber duct liner.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
5. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
6. Fan Motors:
    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 23 05 13 “Common Motor Requirements for HVAC Equipment.”
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
8. Air Filtration Section:
    a. General Requirements for Air Filtration Section:
        1). Comply with NFPA 90A.
        2). Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
        3). Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
    b. Disposable Panel Filters:
        1). Factory-fabricated, viscous-coated, flat-panel type.
        2). Thickness: 2 inches (50 mm).
        3). Initial Resistance: 0.26 inches wg (64 Pa).
        4). Recommended Final Resistance: 1.00 inches wg (249 Pa).
        5). MERV according to ASHRAE 52.2: 8
        6). Media: Interlaced glass fibers sprayed with nonflammable adhesive.
        7). Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

B. Condensate Drain Pans:
1. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
    a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1

b. Depth: A minimum of 2 inches (50 mm) deep.

2. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

a. Minimum Connection Size: NPS 1 (DN 25).

3. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

C. Floor-Mounted, Evaporator-Fan Components:

1. Cabinet: Galvanized or enameled steel with removable panels on front and ends in color selected by Architect.

2. Insulation: Faced, glass-fiber duct liner.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.

5. Fan: Direct drive, centrifugal.

6. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 23 05 13 “Common Motor Requirements for HVAC Equipment.”

b. Multitapped, multispeed with internal thermal protection and permanent lubrication.

7. Air Filtration Section:

a. General Requirements for Air Filtration Section:

1). Comply with NFPA 90A.

2). Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.

3). Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

b. Disposable Panel Filters:

1). Factory-fabricated, viscous-coated, flat-panel type.

2). Thickness: 2 inches (50 mm).

3). Initial Resistance: 0.26 inches wg (64 Pa).

4). Recommended Final Resistance: 1.00 inches wg (249 Pa).

5). MERV according to ASHRAE 52.2: 8

6). Media: Interlaced glass fibers sprayed with nonflammable adhesive.

7). Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

D. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Galvanized or enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.

4. Fan: Direct drive, centrifugal.

5. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 23 05 13 “Common Motor Requirements for HVAC Equipment.”

b. Multitapped, multispeed with internal thermal protection and permanent lubrication.

c. Enclosure Type: Totally enclosed, fan cooled.

d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.

e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

f. Mount unit-mounted disconnect switches on exterior of unit.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

7. Condensate Drain Pans:

a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

1). Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.

2). Depth: A minimum of 1 inch (25 mm) deep.

b. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

1). Minimum Connection Size: NPS 1 (DN 25)

8. Air Filtration Section:
    a. General Requirements for Air Filtration Section:
        1). Comply with NFPA 90A.
        2). Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
        3). Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
    b. Disposable Panel Filters:
        1). Factory-fabricated, viscous-coated, flat-panel type.
        2). Thickness: 2 inches (50 mm).
        3). Initial Resistance: 0.26 inches wg (64 Pa).
        4). Recommended Final Resistance: 1.00 inch wg (249 Pa).
        5). MERV according to ASHRAE 52.2: 8.
        6). Media: Interlaced glass fibers sprayed with nonflammable adhesive.
        7). Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

2.03 OUTDOOR UNITS (5 TONS (18 KW) OR LESS)

A. Air-Cooled, Compressor-Condenser Components:
    1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
    2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
        a. Compressor Type: Scroll.
        b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
        c. Refrigerant Charge: R-410A.
        d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
    3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
    4. Fan: Aluminum-propeller type, directly connected to motor.
    5. Motor: Permanently lubricated, with integral thermal-overload protection.
    6. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
    7. Mounting Base: Polyethylene.

2.04 ACCESSORIES

A. Control equipment and sequence of operation are specified in Section 23 09 23 “Direct Digital Control (DDC) System for HVAC.”

B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

E. Drain Hose: For condensate.

3.00 EXECUTION

3.01 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer’s standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 07 72 00 “Roof Accessories.” Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

E. Install and connect precharged refrigerant tubing to component’s quick-connect fittings. Install tubing to allow access to unit.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.03 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.04 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

23 82 39.16 PROPELLER UNIT HEATERS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes propeller unit heaters.

1.03 SUBMITTALS

A. Product Data: Include specialties and accessories for each unit type and configuration.

B. Field Test Reports: Written reports of tests specified in Part 3 of this Section.

C. Maintenance Data: For propeller unit heaters to include in maintenance manuals specified in Division 01. Include the following:

1. Maintenance schedules and repair parts lists for motors, coils, integral controls, and filters.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.05 COORDINATION

A. Coordinate layout and installation of propeller unit heaters and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airtherm Manufacturing Company.
2. Carrier Corp.
3. Dunham-Bush, Inc.
4. Engineered Air.
5. International Environmental Corp.
6. McQuay International.

7. Rosemex Products.
8. Ruffneck Heaters, Starozik Industries Ltd.
9. Trane Company (The); North American Commercial Group.
10. U S A Coil & Air Inc.

2.02 UNIT HEATERS

A. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with horizontal, adjustable louvers in blow-through configuration.

2.03 MATERIALS

A. Casing: Galvanized steel, with removable panels.

B. Cabinet Finish: Bonderize, phosphatize, and flow-coat with baked-on primer and manufacturer's standard paint applied to factory-assembled and -tested propeller unit heater before shipping.

2.04 FAN

A. Propeller with aluminum blades directly connected to motor.

2.05 FAN MOTORS

A. Motors, 1/2 HP and Smaller: shaded-pole or permanent-split capacitor, multispeed motor with integral thermal-overload protection.

B. Motors, 3/4 HP and Larger: Totally enclosed with permanently lubricated ball bearings.

2.06 ACCESSORIES

A. Horizontal Configuration: Louver fin diffuser.

B. Vertical Configuration: Louver cone diffuser.

2.07 CONTROLS

A. Control Devices: Unit-mounted fan-speed switch and wall-mounting thermostat.

2.08 SOURCE QUALITY CONTROL

A. Test propeller unit heater coils according to ASHRAE 33.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before propeller unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install propeller unit heaters level and plumb.

B. Install propeller unit heaters to comply with NFPA 90A.

C. Suspend propeller unit heaters from structure with rubber-in-shear vibration isolators (rubber hangers).

D. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Unless otherwise indicated, install shutoff valve and union or flange on each connection.

C. Install piping adjacent to machine to allow service and maintenance.

D. Ground equipment.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing and report results in writing:

1. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Test and adjust controls and safeties.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.05 CLEANING

A. After installing units, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. After installing units, clean propeller unit heaters internally according to manufacturer's written instructions.

C. Install new filters in each propeller unit heater within 2 weeks after Substantial Completion.

END OF SECTION

DIVISION 26
ELECTRICAL

26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary for complete and operational electrical systems, as specified herein.

B. This Section, as well as Division 1, concerns all other Sections in Division 26, and shall be considered a part of each of those Sections as if written in their entirety.

1.02 QUALITY ASSURANCE

A. ELECTRICAL CONTRACTORS' QUALIFICATIONS

1. Use adequate numbers of skilled workmen, trained and experienced in their crafts, and who are familiar with the specifications and methods of performing the work in this Division. A licensed Journeyman shall be on site at all times when electrical work is being performed. Electrical work shall be performed under the direct supervision of a Master Electrician who holds a valid license in the State of Texas. The Contractor shall provide a monthly report to the Owner/Engineer for review stating that the Master Electrician has been to the job site and thoroughly reviewed the work. The report shall be signed by the Master Electrician and include the data and time the Master Electrician was on site.

B. WORKMANSHIP

1. Work shall be performed in accordance with quality, commercial practices. The appearance of finished work shall be of equal importance with its operation. Materials and equipment shall be installed based upon the actual dimensions and conditions at the project site. Locations for materials or equipment requiring an exact fit shall be field measured. Conduit and motors shall be isolated to avoid unacceptable noise levels from objectionable vibrations from all systems.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00, SUBMITTALS and shall include:

1. Component catalog number and manufacturing data sheet, indicating pertinent data and identifying each component by the item number and nomenclature as specified.

2. Component drawings showing dimensions, mounting, and external connection details in AutoCAD format.

3. Operation and maintenance manuals shall contain the shop drawings, submittals, spare part lists, schematics, final wiring diagrams with any changes made during construction, start-up and maintenance procedures.

4. The Contractor shall provide a monthly report to the Owner/Engineer for review stating that the Master Electrician has been to the job site and thoroughly reviewed the work. The report shall be signed by the Master Electrician and include the data and time the Master Electrician was on site.

5. The Contractor shall:

    a. Prepare, and keep up-to-date, the Record Drawings and detailed construction drawings;

    b. Record the exact locations of each of these differences, sizes and details of the Construction Work as executed, with cross-references to and other requirements on the Record Drawings.

    c. Keep the Record Drawings on the Work Site;

    d. Upon completion of the Work, or at such other time as may be determined by the Engineer, submit the Record Drawings and copies to the Owner's Representative in accordance with the Owner's Requirements.

    e. Provide revised drawings in AutoCAD noting any changes made to equipment during construction and start-up.

6. The Contractor shall provide an 11x17 wall mounted copy of the one-line diagram in the electrical room as follows:

    a. The copy shall be in AutoCAD format, black and white and shall include all changes to the sheet from addenda, field orders and change orders.

    b. The copy shall be framed in a picture frame with glass. The copy of the sheet shall lay flat against the glass without any wrinkles and other material necessary for the copy to lay flat shall be provided within the picture frame.

1.04 STANDARDS

A. Electrical work shall be executed in accordance with local, State and national codes, ordinances and regulations which have jurisdiction or authority over the work. If the standards and codes conflict with each other, the most stringent shall apply. The applicable provisions of the following standard shall apply as if written here in their entirety:

National Electrical Manufacturer Association (NEMA)

American Society for Testing and Materials (ASTM)
National Fire Protection Association (NFPA)
National Electrical Safety Code (NESC)
Institute of Electrical and Electronic Engineers (IEEE)
National Electrical Code (NEC)
Underwriters' Laboratories (UL)
American National Standards Institute (ANSI)
Uniform Building Code (UBC)
Occupational Safety and Health Administration (OSHA)
Local utility companies
Local Electrical Ordinance
Rural Electrification Association (REA)
Insulated Power Cable Engineers Association (IPCEA)
International Electrical Testing Association (NETA)
National Electrical Contractors Association (NECA)
Association Edison Illuminating Companies (AEIC)

B. Electrical work shall be performed under the direct supervision of a Master Electrician who holds a valid license in the State of Texas.

1.05 DELIVERY AND STORAGE

A. Follow the Manufacturer's directions for the delivery, storage and handling of equipment and materials. Tightly cover equipment and materials and protect it from dirt, water, chemical or mechanical injury and theft. Major electrical equipment shall be stored indoors and space heaters energized where applicable. Equipment that will be stored indoors for an extended period of time and that do not have space heaters shall have a 100 watt incandescent light placed in it and energized to eliminate the build-up of condensation in the equipment. Coordinate with equipment manufacturer for storage requirements. Damaged equipment shall not be acceptable. Upon installation, protect the materials until the work is completed and accepted by the Owner.

1.06 JOB CONDITIONS

A. Permits, licenses and inspections shall be secured and paid for as required by law for the completion of the work. Certificates of approval shall be secured, paid for, and delivered to the Owner before receiving the final acceptance of the work.

B. The location of materials, equipment, devices and appliances indicated are approximate and subject to revisions at the time the work is installed. Final location shall be as proposed by the Contractor and approved by the Engineer.

C. Should project conditions require any rearrangement of work, or if equipment or accessories can be installed to a better advantage than the general arrangement of work on the plans, the Contractor shall before proceeding with the work prepare and submit plans of the proposed rearrangement for the Engineer's review and approval.

D. Motor Horsepower ratings identified are anticipated ratings. If the actual equipment is a different size, the contractor shall provide the appropriate wiring, conduit, over current protection, starters and accessories for a complete and working system at no cost to the owner.

E. All enclosures for equipment unless specifically identified otherwise shall be NEMA 1, 14 gauge steel enclosures for indoor air conditioned areas and not exposed to a hazardous locations; NEMA 3R for exterior locations not exposed to a hazardous locations, NEMA 4X stainless steel for Kitchens not exposed to a hazardous locations.

2.00 PRODUCTS (NOT USED)

3.00 EXECUTION

3.01 INSTALLATION

A. Maintain the waterproof integrity of conduit penetrations through the roof, exterior walls and floors.

B. Install stainless steel sleeves for each conduit passing through floors. Extend sleeves 1-1/2" above the floor slab and grout watertight. The sleeve sizes shall permit the subsequent insertion of a properly sized conduit or raceway.

C. Submit location drawings and obtain Engineer approval prior to installing conduit penetrations through slabs, beams, and walls. Install stainless steel pipe sleeves around the conduit and raceway which pass through concrete beams or walls and masonry exterior walls. The inside diameter of the sleeves shall be at least 1/2" greater than the outside of the service pipes. After the pipes are installed into these sleeves, fill the annular space between the pipes and sleeves with mastic. The complete installation shall be watertight and the fire rating of penetrations through walls, floors and ceilings shall be maintained.

D. Install steel reinforced concrete foundations below floor mounted transformers, and other floor mounted electrical equipment. Concrete foundations shall not be less than 4" high. Neatly chamfer top edges. Concrete foundations shall be 6" wider and 6" longer than the base of the equipment being installed. Concrete shall be in accordance with Division 03, and shall be reinforced with a minimum of 6" x 6" #6 welded wire mesh.

E. Route all conduits parallel to building lines, columns, or steel route conduits near to columns and roof beams.

3.02 CUTTING AND PATCHING

A. Provide adequate support during cutting operations to prevent any damage to the affected masonry. Where openings are cut through masonry walls, provide lintels or structural supports to protect the remaining masonry. The cutting of structural members shall not be permitted without the specific written approval of the Engineer.

3.03 PAINTING

A. Painting shall be in accordance with Division 09. Maintain the original factory finish on material and equipment installed, unless specifically indicated on the plans or specifications. If the finish is marred in transit or during installation, re-finish to a neat, workmanlike appearance. Leave equipment and raceway systems clean and free of grease, dirt, rust, and in a suitable condition for painting.

3.04 LOCKING OF ELECTRICAL FACILITIES

A. Install locks immediately upon the installation of the electrical facility. Provide padlocks for exterior electrical facilities subject to unauthorized entry. Furnish the Owner with two (2) keys per lock up to a quantity of 10 keys. Furnish locks to match the Owner's locking system.

3.05 ACCESS DOORS

A. Wherever access is required in walls, ceilings, or soffits to concealed junction boxes, pull boxes or other electrical equipment, provide and install access doors. Install panels in locations approved by the Engineer. Paint as directed.

3.06 CLEAN AND ADJUST

A. Remove shipping labels, dirt, paint, grease, and stains from equipment. Remove debris as it accumulates. Upon completion of work, clean electrical equipment and the entire electrical installation.

END OF SECTION

26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to install and test 600 volt wires and cables. Electrical work shall be in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Work shall include building wire, cable, wiring connections and terminations, and modular wiring systems.

1.02 QUALITY ASSURANCE: TESTING

A. Megger test circuits for continuity and ground. Verify phasing at connection points. Torque test conductor connections and terminations to the Manufacturer's recommended values. Megger tests shall be performed by a testing company with a minimum of 10 years experience.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00, SUBMITTALS and shall include:

1. Low voltage wire
2. Ground wire
3. Terminations and Connections
4. Infrared Scan Results

1.04 STANDARDS

A. The applicable provisions of the following standards shall apply as if written here in their entirety:

ICEA S-19-81/NEMA WC-3	Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
ICEA S-61-402/NEMA WC-5	Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NFPA 70	National Electrical Code
ANSI/TIA/EIA 606A	Standard for Telecommunications Infrastructure

UL 83	Thermoplastic Insulated Wires and Cables
UL 1063	Machine Tool Wires and Cables
ASTM B3	Soft or Annealed Copper Wires
ASTM B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium, Hard, Soft

1.05 DELIVERY AND STORAGE

A. Deliver cable and wire to the project site in the original packages. Conductors with damaged insulation or exposed nylon jacketing shall not be permitted.

B. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable.

C. Check for reels not completely restrained, reels with interlocking flanges or broken flanges, damaged reel covering or any other indication of damage. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel.

D. Do not drop reels from any height.

E. Unload reels using a sling and spreader bar. Roll reels in the direction of the arrows shown on the reel and on surfaces free of obstructions that could damage the wire and cable.

F. Store cable on a solid, well drained location. Cover cable reels with plastic sheeting or tarpaulin. Do not lay reels flat.

G. Provide moisture protection by using manufacturer's standard procedure or heat shrinkable self-healing end caps applied to both ends of cable. Do not remove end caps until cables are ready to be terminated.

2.00 PRODUCTS

2.01 GENERAL

A. Wires and cables shall be soft-drawn, annealed copper with a conductivity of not less than that of 98% pure copper, UL83 and UL1063 listed, rated 600 volts and certified for continuous operation at maximum conductor temperature of 90 Celsius in dry locations and 75 Celsius in wet locations

B. Conductors #8 or larger shall be stranded and conductors #14 shall be stranded. Utilize single conductors.

C. Except for control circuits and as specifically indicated on the plans the minimum conductor permitted is #12.

D. WIRE MARKING

1. Wire marking shall be in accordance with the National Electrical Code Article 310 and shall be printed on the wire insulation at 2 foot intervals. The printing method used shall be permanent and the color shall sharply contrast with the jacket color.

2. Wire marking shall include the U.L. label and necessary identification, including the Manufacturer, the number of conductors, size, XHHW-2 conductors, sun-resistance, and other pertinent information.

2.02 CONDUCTORS AND CABLES

A. SINGLE CONDUCTOR CABLES: Conductor with thermoplastic insulation rated at 600 volts and insulated with type XHHW-2 insulation. Wire shall be water tank tested and approved as machine tool wire, in accordance with National Machine Tool Builders Association. Wire in light fixture channels and other special locations shall be as specifically noted for temperature in NEC Article 300. Conductors 38 or larger and conductors #14 shall be stranded. Wire shall be manufactured by Southwire, Okonite, General Cable, or Houston Wire & Cable.

B. MULTI-CONDUCTOR CABLES: Type TC; multi-conductor cable specifically approved for the installation of cable trays, in accordance with NEC Article 340. Each cable conductor shall be insulated with XHHW-2 type insulation rated at 600 volts. The individual conductors shall be twisted together and jacketed with a PVC outer covering. Cable shall be as manufactured by Southwire, Okonite Okoseal-N, General Cable or Houston Wire & Cable.

C. GROUND WIRE: Ground wire shall be Class B stranded conductor without insulation in all cases where a single ground wire is indicated to be installed in a conduit with no other conductors in the conduit, or where the ground wire is directly buried in earth or concrete. In all other cases, insulate ground wire with green insulator as specified for low voltage wire.

2.03 WIRE CONNECTIONS AND DEVICES

A. CONNECTORS, COMPRESSION, COPPER, 600 VOLT: As manufactured by Burndy, Thomas & Betts, or Ideal Industries; of the appropriate hole sizes and spacing which are in accordance with NEMA standards; two (2) holes in the tongue for use on conductor sizes 250 kcmil or larger; not required for connections to the circuit breakers in the lighting and/or receptacle panels. All compression connectors shall be long-barrel type, no exceptions.

B. 600 VOLT PLASTIC TAPE: Minnesota Mining & Manufacturing Company, No. 35.

C. WIRENUTS: Silicone-based pre-filled spring wire connecting devices with plastic covering; UL listed for damp and wet locations. Wirenut shall meet requirements of UL 486D for Sealed Wire Connector Systems and shall be manufactured by Ideal Industries, Inc model 63, or as manufactured by ITT or Panduit. Wirenut shall be spring insulated, properly sized and resistant to vibration may be used for No.12 through No.10 solid gauge conductor for lighting and branch circuits only.

D. SPLIT BOLTS: Kearney, Burndy, or Ilsco; shall be usable for connecting conductors which are both copper, both aluminum or one copper and one aluminum. Split bolts shall have a spacer between the two conductors, which it connects.

E. MECHANICAL SET SCREW CONNECTOR: Blackburn HPS, ADR-ALCUL, GP or GT, Burndy or Ilsco; consisting of an aluminum body which has openings on opposite ends for insertion of the conductors. Conductors inserted into these holes shall each be clamped by two set screws. Connectors shall be suitable for use with copper conductors.

F. RUBBER TAPE: Scotch 2210.

G. VINYL TAPE: Scotch 88.

H. INSULATING RESIN: Scotch 3576, 3577, or 3578.

I. POWER DISTRIBUTION BLOCKS: Mersen, Ilsco or Allen-Bradley; rated for 600 VAC and termination of copper conductors. Individual poles shall be constructed of tin plated aluminum and mounted on an insulating base.

3.00 EXECUTION

3.01 PREPARATION

A. Completely swab raceway system before installing conductors. Do not use cleaning agents and lubricants which have a deleterious effect on the conductors or their insulation.

3.02 INSTALLATION

A. GENERAL

1. Install raceway first as a complete system without conductors. Do not install pull wires and conductors until the raceway system is in place in accordance with the NEC and these specifications. Exception: Only flexible connections to motors shall be permitted to be installed after the installation of the remainder of the raceway system. The installation of these conductors shall be limited to exposure to damage for a maximum of one (1) week prior to installing flexible connection and making final terminations. Any conductors exposed to damage (i.e. not installed in raceway) longer than one (1) week shall be subject to rejection by the Owner and/or Engineer. If rejected, the cables

shall be removed, discarded, replaced, reinstalled and re-terminated at the Contractor's expense.

2. Installed unapproved wire shall be removed and replaced at the Contractor's expense.

3. Neatly train wiring inside boxes, equipment and panelboards. Pull conductors into a raceway at the same time and use U.L. listed, wire pulling lubricant for pulling No. 4 AWG and larger wire.

4. Except for hand-pulled conductors into raceways, all wire and cable installation shall be installed with tension-monitoring equipment. Where conductors are found to have been installed without tension-monitoring, the conductors and cables shall be immediately removed from the raceways, permanently identified as rejected material, and removed from the jobsite. New conductors and cables shall be reinstalled, tagged and raceways resealed, all at the Contractor's expense.

5. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii. Where pulling compound is used, use only UL listed compound compatible with the cable outer jacket and with the raceway involved.

6. Properly support cables in accordance with the NEC and manufacturer's recommendations in all raceways. Provide strain relief as required.

7. Arrange wiring in cabinets and panels neatly cut to proper length, remove surplus wire, and bundle and secure in an acceptable manner. Cap spare conductors and conductors not terminated, with the UL listed end caps.

8. Where conductors pass through holes or over edges in sheet metal, remove all burrs, chamfer all edges, and install bushings and protective strips of insulating material to protect the conductors.

9. For conductors that will be connected by others, provide at least 6 feet spare conductors in free standing panels and at least 2 feet spare in other assemblies. Provide additional spare conductor in any particular assembly where it is obvious that more conductor will be needed to reach the termination point.

B. SPLICES

1. Power Conductors: Splice in junction boxes or at outlets only for lighting and receptacle branch circuits. Splices for all other circuits shall be disallowed. Any required splices due to project conditions are subject to the Engineer's approval. Obtain approval from Engineer before installing any splices.

2. Condulet type fittings shall not contain splices. Under no condition shall conductors of a different color be spliced together.

3. For No. 10 and smaller, connect conductors with a twist-on spring wirenut.

C. TERMINATIONS

1. Conductors terminated on a screw termination shall have a crimp on type spade connector applied on the wire end, Panduit PanTerm or approved equal.

2. Tighten all screws and terminal bolts using torque type wrenches and/or drivers to tighten to the inch-pound requirements of the NEC and UL.

3. Use crimp connectors on all stranded conductors.

4. Soldered mechanical joints insulated with tape will not be acceptable.

5. SINGLE CONDUCTORS: Sufficient wire shall be left at outlets to make connections to equipment without straining. Light switches and receptacles shall be connected with pig-tails.

D. GROUNDING

1. Conduits and other raceway shall contain an equipment grounding conductor whether the raceway is metallic or not. Conduits, motors, cabinets, outlets, and other equipment shall be properly grounded in accordance with National Electrical Code requirements. Where ground wire is exposed to mechanical damage, install wire in rigid steel conduit. Make connections to equipment with solderless connections. All connections to ground rods shall be of the fused type utilizing an exothermic welding process.

2. Ground metallic material, including but not limited to metallic raceway, metallic boxes and metallic enclosures. Where metallic material is not connected by raceway to a solid ground, connect the metallic material to the largest equipment grounding conductor, which it houses. Clean the metal surface under the grounding lug to bright metal. Grounding connections to motors shall be to the grounding stud, which shall be threaded into the stationary frame; Use Burndy KC Servit, or approved equal. The ground wire shall not be lugged to a mounting bolt.

3. Ground wire shall be uninsulated copper sized as shown on the plans in all cases where a single ground wire is indicated to be installed in a conduit with no other conductors in the conduit, or where the ground wire is directly buried in earth or concrete. In all other cases, insulate ground wire with green insulation as specified for low voltage wire. Provide and size bonding conductors in accordance with the National Electrical Code.

E. WIRE AND CABLE TAGGING

1. Circuits shall be tagged at terminations (both ends), in pull/junction boxes, cabinets, and terminal strips enclosures as follows:

a. Tags relying on adhesives or taped-on markers are not acceptable.

b. Provide conductor tags for conductors No. 10 AWG and below with legible permanent sleeve of yellow or white PVC with machine printed black marking, Raychem TMS sleeves or approved equal.

c. Provide tags for cables and for conductors No. 8 AWG and larger consisting of permanent nylon marker plates with legible designations hot stamped on the plate. Attach these marker plates to conductors and cables with plastic wire wraps. Tags shall be Raychem TMS-CM cable markers or approved equal.

d. For multi-conductor cables, both the individual conductors and the overall cable shall be tagged. Conductors that are part of a multi-conductor cable shall reference the cable identification number they are a part of, as well as a unique conductor number within the cable.

e. Tags shall be imprinted with panelboard and panelboard position number (e.g. LA3-23) for conductors fed from panelboards.

f. Switchlegs shall have the designation described above on their tags, plus an "S" suffix. Travelers shall have the designation described above on their tags, plus a "T" suffix.

g. Where more than one neutral is present with a group of conductors, a tag shall be applied to each neutral indicating which phase conductors are served by each neutral (e.g. HA-2, 4, 6).

2. Color coding of cables shall comply with the local city codes. In the absence of a local color coding requirement, the following shall be used:

   a. For 480Y/277V, 3-phase wiring:

      1). Phase A - Brown

      2). Phase B - Orange

      3). Phase C - Yellow

      4). Neutral - Gray

      5). Equipment Grounding Conductor - Green

   b. For 208Y/120V or 240/120V, 3-phase wiring:

      1). Phase A - Black

      2). Phase B - Red

3). Phase C - Blue

4). Neutral - White

5). Equipment Grounding Conductor – Green

3. Colored, vinyl marking tape shall be allowed only on conductors greater than 8 AWG. Under no condition shall conductors of a different color be spliced together. Application of tape shall be in accordance with the Manufacturer's recommendations.

F. TESTING

1. Perform tests and inspections and prepare test reports and submit to the Owner/Engineer prior to final inspection.

2. Tests and Inspections:

   a. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

   b. Perform each visual and mechanical inspection and electrical tests stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

   c. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each termination for the cables and conductors No.3 AWG and larger. Remove box and equipment covers so terminations are accessible to portable scanner.

      1). Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each termination 11 months after date of Substantial Completion.

      2). Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

      3). Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

   d. Test Reports: Prepare a written report to record the following:

      1). Test procedures used

      2). Test results that comply with requirements.

      3). Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

   e. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

26 05 23 CONTROL-VOLTAGE ELECTRICAL POWER CABLES

1.00 GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section Includes:

1. Low-voltage control cabling.

2. Control-circuit conductors.

3. Identification products.

1.02 DEFINITIONS

A. EMI: Electromagnetic interference.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

C. Maintenance Data: For wire and cable to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.05 DELIVERY, STORAGE, AND HANDLING

2.00 PRODUCTS

2.01 PATHWAYS

A. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.02 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry."

2.03 LOW-VOLTAGE CONTROL CABLE

A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 18 AWG, stranded (19x29) tinned-copper conductors.

2. PVC insulation.

3. Unshielded.

4. PVC jacket.

5. Flame Resistance: Comply with NFPA 262.

B. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.

2. PVC insulation.

3. Unshielded.

4. PVC jacket.

5. Flame Resistance: Comply with UL 1581.

2.04 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type XHHW-2, in raceway, complying with UL 83.

B. Class 2 Control Circuits: Stranded copper, Type XHHW-2, in raceway, complying with UL 83.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.05 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brady Corporation.

2. HellermannTyton.

3. Kroy LLC.

4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.06 SOURCE QUALITY CONTROL

A. Cable will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports.

3.00 EXECUTION

3.01 INSTALLATION OF PATHWAYS

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows if possible.

C. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.

2. Secure conduits to backboard if entering room from overhead.

3. Extend conduits 3 inches above finished floor.

4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

D. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.02 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, and terminals.

2. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, and terminals.

3. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii.

4. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

5. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

D. Separation from EMI Sources:

a. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

2. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

3. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.03 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables.

3.04 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No 14 AWG.

2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.

3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

3.05 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.06 GROUNDING

A. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.07 IDENTIFICATION

A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

B. End-to-end cabling will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

26 05 26 GROUNDING & BONDING FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (NEC) as shown on the drawings or as specified herein. Electrical work shall be in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

1.02 SUBMITTALS

A. Submittal shall be in accordance with Section 01 33 00, SUBMITTALS and shall include:

1. Grounding materials, equipment and processes including but not limited to:

a. Ground Rods

b. Ground Conductors

c. Connectors

2. Product Data: For each type of product supplied.

3. Field quality-control test reports.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Measure the ground grid resistance with the earth test megger and install additional ground rods and conductors as required until the resistance to the ground conforms to National Electrical Code requirements. Ground resistance measurement shall not exceed 5 ohms. Add ground rods as required to bring resistance to 5 ohms and connect to grounding system.

D. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

2.00 PRODUCTS

2.01 MATERIALS

A. GROUND RODS: Copper-clad, having a diameter of 3/4” and a minimum length of 10'.

B. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

C. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.

2. Stranded Conductors: ASTM B 8.

3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.

4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

D. CONDUIT GROUND FITTINGS: Fittings for bonding ground cable to the conduit shall be FCI Burndy Corp., type NE or Thomas & Betts No. 3951 series.

E. GROUND ROD BOXES: Precast Box with cast iron lid. Lid shall read “ground rod” on lid. Brooks Precast Model. “3-RT” or approved equal.

F. EXOTHERMIC WELDING PROCESS: CADWELD MATERIALS – as manufactured by ERICO products or approved equal.

G. CONNECTORS

1. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

2. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

3. Pipe Connectors: Clamp type, sized for pipe.

4. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.02 PROCESSES

A. All grounding system connections to building steel and ground rods shall be exothermically welded including all cable connections, and cable steel terminations.

B. All materials involved must be from the same sources to insure compatibility. Connections made from this process shall meet the requirements of IEEE Standards 80 and 837 and as listed in MIL 419 and other standards, National Electrical Code, etc.

2.03 GROUNDING SYSTEM

A. Provide a grounding system that includes all connections and the testing of ground rods, ground cables, ground buses, conduits, fittings, anchor supports, thermite process materials and equipment and other materials required for a complete installation. Grounding system shall be installed and sized in accordance with the National Electrical Code.

3.00 EXECUTION

3.01 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.02 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 6 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

2. For grounding electrode system, install at least three rods spaced at least two-rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

3. Ground rod shall be installed such that the top of the ground rod is 6” below grade and enclosed by a ground rod box.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated tinned copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted/clamp type connectors.

2. Underground Connections: Exothermically welded connectors, except as otherwise indicated.

3. Connections to Structural Steel: Exothermically welded connectors.

G. Ground electrical work in accordance with the National Electrical Code Article 250 and local codes.

H. Install ground cables in conduits above grade or directly buried in earth to a depth of not less than 30" below grade. Installation to provide sufficient mechanical protection so as not to break ground cables or connections.

I. Install ground cables continuously between connections. Splices shall not be permitted, except where indicated on the plans. Where ground cables pass through floor slabs, buildings, etc., and when not in metallic enclosures, provide a sleeve of approved, non-metallic materials.

J. Install a green-colored, equipment grounding conductor in raceways. Size conductors in accordance with NEC Article 250.

K. Where ground wire is directly buried in earth or concrete, use standard bare tinned copper cable, in all other cases install a green-colored insulation, equipment grounding conductor in accordance with Section 26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES Size conductors in accordance with NEC Article 250. Provide grounding conductors as required per the NEC.

L. Metal conduits stubbed up into switchgear or other electrical equipment shall be terminated with insulated grounding bushings and connected to the equipment ground bus. Size the grounding wire in accordance with applicable sections of the National Electrical Code.

M. Provide exothermic weld connection for extension to existing stub-up ground conductors.

N. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Provide grounding and bonding jumpers as required per the NEC.

2. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

3. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

4. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

O. Liquid tight flexible metal conduit in sizes 1-1/2” or larger shall have bonding jumpers. Bonding jumpers shall be external, run in parallel (not spiraled) and fastened with plastic tie

wraps. Contractor shall provide bonding jumpers sized in accordance with the National Electrical Code.

P. All equipment enclosures, motor and transformer frames, conduit systems, cable armor, exposed structural steel and all other equipment and materials required by the NEC to be grounded, shall be grounded and bonded in accordance with the NEC. Provide grounding and bonding jumpers as required per the NEC.

Q. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with NEC Article 250.

R. Where exothermic bonding is used, molds shall be of the appropriate size for the wire and rod used. All bonds shall remain exposed for inspection of the Owner's Representative.

S. At each convenience outlet, install a grounding clip attached to the outlet box and leave a sufficient length of #12 wire with green-colored insulation to connect to the grounding terminal at the receptacle.

3.03 INSPECTION

A. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.

B. Use Biddle Direct Reading Earth Resistance Tester or equivalent to measure resistance to ground of the system. Perform testing in accordance with the test instrument manufacturer's recommendation using the fall of potential method.

C. All test equipment provided under this section shall be approved by the Engineer.

D. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.

E. Testing shall be performed before energizing the distribution system.

F. A separate test shall be conducted for each building or system.

G. Notify the Engineer immediately if the resistance to ground for any building or system is greater than five ohms. Provide additional ground rods and conductors as required to bring the resistance to five ohms.

3.04 FIELD QUALITY CONTROL

A. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

B. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

   1. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

   2. Perform tests by fall-of-potential method according to IEEE 81.

C. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION

26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

2. Construction requirements for concrete bases.

1.02 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit.

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

2. Nonmetallic slotted support systems.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

2.00 PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.; a division of Cooper Industries.

c. ERICO International Corporation.

d. GS Metals Corp.

e. Thomas & Betts Corporation.

f. Unistrut; Tyco International, Ltd.

g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

5. Channel Dimensions: Selected for applicable load criteria.

6. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.

7. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.

8. Rated Strength: Selected to suit applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1). Hilti Inc.

2). ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

3). MKT Fastening, LLC.

4). Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1). Cooper B-Line, Inc.; a division of Cooper Industries.

2). Empire Tool and Manufacturing Co., Inc.

3). Hilti Inc.

4). ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5). MKT Fastening, LLC.

6). <Insert manufacturer's name>.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

3.00 EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick

or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.

7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 4000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section “Cast-in-Place Concrete.”

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to install a complete conduit system for each type of electrical system. Electrical work shall be in accordance with Division 26.

1.02 DEFINITIONS

A. Retain abbreviations that remain after this Section has been edited.

1. EMT: Electrical metallic tubing.

2. FMC: Flexible metal conduit.

3. LFMC: Liquidtight flexible metal conduit.

4. RNC: Rigid nonmetallic conduit.

5. RMC: Rigid metallic conduit

1.03 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

2.00 PRODUCTS

2.01 METAL CONDUIT AND TUBING

1. AFC Cable Systems, Inc.

2. Alflex Inc.

3. Allied Tube & Conduit; a Tyco International Ltd. Co.

4. Anamet Electrical, Inc.; Anaconda Metal Hose.

5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. RMC: Rigid Metal Conduit

1. Rigid Steel Conduit: Heavy wall, mild steel tube with metallic, corrosion-resistant coating on interior and exterior, hot-dipped, galvanized steel, free from defects; manufactured in accordance with Fed. Spec. WW-C-581, ANSI C80.1 standards, and U.L. listed.
2. Aluminum Rigid Conduit: Heavy wall, aluminum alloy 6063; low temper number, tube, free from defects and manufactured in accordance with ANSI C80.5 standards and U.L. listed.

C. PVC-Coated Metal Conduit: PVC-coated rigid steel conduit

1. PVC COATED RIGID STEEL: Meeting the requirements of rigid steel conduit; 40 mil PVC exterior coating and 2 mil urethane interior coating. PVC coated rigid steel conduit must bear the ETL Verified PVC-001 label to signify compliance to the adhesion performance standard. Acceptable Manufacturers shall be Rob Roy Plastibond Red, O'kote, Perma-Cote and Ocal.

D. EMT: Electrical Metallic Conduit

1. E.M.T. shall be in accordance with the National Electrical Code. Electric Metallic Tubing shall be steel, electrically welded, hot zinc galvanized and produced to ANSI Specifications C-80.3 and Federal Specification WW-C-563A latest revisions, and shall carry the Underwriters Laboratories label.
2. E.M.T. shall be made from strip steel, high frequency welded. A continuous hot galvanized process shall be employed to coat exterior surfaces evenly and smoothly; a transparent secondary coating shall be applied to provide further protection against corrosion. EMT shall be manufactured in accordance with Under-writers Laboratories UL-797, American National Standards Specifications C-80.3, Federal Specifications WW-C-563A.

E. FMC: Zinc-coated steel. For use with galvanized conduit. Single strip, helically wound, interlocking, heavy wall galvanized steel, in accordance with Fed. Spec. WW-C-566 and U.L. listed.

1. Penetration of fire rated walls, floors or ceilings shall use classified Through-Penetration Firestop Systems described in the current Underwriters Laboratories Fire Resistance Directory

F. LFMC: Liquid tight conduit shall have an extruded, polyvinyl jacket over the helically wound flexible metal and U.L. listed for use.

G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Fittings for EMT: compression type (no set screw allowed).

2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

2.02 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. RNC: Rigid Non-Metallic Conduit

1. Schedule 40 high impact, polyvinylchloride, in accordance with Fed. Spec. W-C-1094 and U.L. listed.
2. Conduit shall be rated for use with 90° C conductors, UL Listed. Material shall comply to NEMA Specification TC-2 (Conduit), TC-3 (Fittings) and UL 651 (Conduit) and 514b (Fittings).
3. Conduit and fittings shall carry a UL label on each 10 foot length; Fittings - stamped or molded on each fitting.
4. The conduit and fittings shall be homogeneous plastic free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections which could mar conductors or cables.
5. Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity

C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

D. Fittings for LFNC: UL 514B.

2.03 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Legrand

2. Approved equal

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, for interior air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 3R, galvanized-steel box with removable interior panel and removable lockable front for exterior locations; Type 4X Stainless steel for Kitchen areas.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: As indicated.

E. Finish: As indicated.

F. Wireways shall not contain more than 30 current-carrying conductors at any cross section. Conductors for signaling circuits or controller conductors between a motor and its starter and used only for starting duty shall not be considered as current carrying conductors. The sum of cross-sectional areas of all contained conductors at any cross section of the wireway shall not exceed 20 percent of the interior cross-sectional area of the wireway.

2.04 SURFACE RACEWAYS

A. Surface Metal Raceways: NEMA 1 steel for interior air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 3R, galvanized-steel box with removable interior panel and removable lockable front for exterior locations; Type 4X Stainless steel for Kitchen areas**.** Manufacturer's standard enamel finish in color as indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Wiremold/Legrand

2.05 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, for interior air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 12, with continuous-hinge cover with flush latch, for interior non-air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 3R, galvanized-steel box with removable interior panel and removable lockable front for exterior locations; Type 4X Stainless steel for Kitchen areas.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

G. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front for interior air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 12, with continuous-hinge cover with flush latch, for interior non-air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 3R, galvanized-steel box with removable interior panel and removable lockable front for exterior locations; Type 4X Stainless steel for Kitchen areas.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.06 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

C. Coordinate sleeve selection and application with selection and application of firestopping.

2.07 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.

2. Calpico, Inc.

3. Metraflex Co.

4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

2. Pressure Plates: Stainless Steel. Include two for each sealing element.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

3.00 EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit

2. Concealed Conduit, Aboveground: Rigid steel conduit

3. Underground Conduit: RNC, Type EPC-40PVC, direct buried.

4. Transition from underground to above ground or where conduit penetrates walls/slabs: PVC Coated Rigid Steel Conduit to 6” each direction.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC. Connections shall be limited to 6’ maximum.

6. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R steel.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT

2. Exposed and Subject to Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

   a. Mechanical rooms.

   b. Drill Hall.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT

4. Transition from underground to above ground or where conduit penetrates walls/slabs: PVC Coated Rigid Steel Conduit to 6” each direction.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC. Connections shall be limited to 6’ maximum.

6. Damp or Wet Locations: Rigid Steel Conduit

7. Raceways for Concealed General Purpose Distribution of Communications Cable: Steel

8. Boxes and Enclosures: NEMA 250, Type 1 for interior air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 12, with continuous-hinge cover with flush latch, for interior non-air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 3R, galvanized-steel box with removable interior panel and removable lockable front for exterior locations; Type 4X Stainless steel for Kitchen areas

C. Minimum Raceway Size: 3/4-inch trade size above grade and 1-inch trade size conduit below grade.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Do not install aluminum conduits in contact with concrete.

3.02 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

K. Raceways for Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

    1. 3/4-Inch Trade Size: Install raceways in maximum lengths of 100 feet.

    2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 100 feet.

    3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

    1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC: Install in each run of belowground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.

3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

2. Use LFMC in damp or wet locations not subject to severe physical damage.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

3.03 SIZING AND INSTALLATION OF WIREWAYS, PULL BOXES AND JUNCTION BOXES

A. The CONTRACTOR shall be responsible for providing and sizing all wireways, pull boxes and junction boxes per the National Electrical Code (NEC) Article 314 and all other relevant sections of the NEC.

B. Install Products in accordance with manufacturer's instructions.

C. Use screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.

D. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

E. Wireway Supports: Per manufacturer's recommendations. The Contractor shall support the wireway rigidly to the building structures using hardware bolted or screwed to the structure. Supporting wireways from corrugated metal structures shall not be allowed.

F. Close ends of wireway and unused conduit openings.

3.04 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials.

K. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1 inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.05 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.06 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.07 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.08 ROUTING AND SUPPORT

A. Use the conduit route where shown on the plans. Route conduits that do not have a specified route in the most direct path between the two points, i.e. home runs shown with an arrow symbol. Route conduits parallel to building lines. Concealed conduits on the plans shall be below grade, within walls, or above ceilings.

B. Route conduit through roof openings for piping and ductwork where possible. Otherwise, route conduit through the roof with pitch pocket. Conduit shall not penetrate ductwork. Exposed conduit shall not be installed on the roof without the Engineer's prior approval.

C. Install conduit at elevations which maintain headroom, and at locations which avoid interference with other work requiring grading of pipe, the structure, finished walls, etc. Avoid crossing other work. Conduits shall not be placed in close proximity to equipment, systems, and service lines. Maintain a minimum of 3" separation, except in crossing which shall be a minimum of 1".

D. Conduits in buildings shall be exposed on unfinished ceilings, or as shown on the plans. Rigidly support conduits to the building structures using hardware bolted or screwed to the structure. The mounting hardware shall not mount the conduit directly on concrete walls and ceilings, but shall space the conduit away from the surfaces using mineralac-type hardware, strut channel clamps.

E. Provide expansion fittings at expansion, construction and seismic joints. Provide combination expansion/deflection fittings where conduits are concealed at these joints.

F. Group conduit in parallel runs where practical. Use a conduit rack constructed of channels with conduit straps or clamps. Provide space for an additional 25% conduit.

3.09 TERMINATIONS

A. Use threaded hubs for termination of conduits. Locknut termination of conduits shall not be used on this project.

END OF SECTION

26 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Conduit and accessories.

2. Handholes and boxes.

1.03 DEFINITION

A. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.

2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.

3. Accessories for manholes, handholes, and boxes.

4. Warning tape.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

1. Duct entry provisions, including locations and duct sizes.

2. Reinforcement details.

3. Frame and cover design and manhole frame support rings.

4. Grounding details.

5. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.

6. Joint details.

C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.

2. Cover design.

D. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

2. Drawings shall be signed and sealed by a qualified professional engineer.

E. Product Certificates: For concrete and steel used in precast concrete manholes, as required by ASTM C 858.

F. Qualification Data: For professional engineer and testing agency.

G. Source quality-control test reports.

H. Field quality-control test reports.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.07 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Owner's written permission.

1.08 COORDINATION

A. Coordinate layout and installation of ducts, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to handholes, and as approved by Architect.

2.00 PRODUCTS

2.01 CONDUIT

A. PVC COATED RIGID STEEL: Meeting the requirements of rigid steel conduit; 40 mil PVC exterior coating and 2 mil urethane interior coating, U.L. 6A listed manufactured in accordance with Fed. Spec. WW-C-581, ANSI C80.5 standards, ETL Verified PVC-001 and U.L. listed. Acceptable Manufacturers shall be Rob Roy Plastibond Red, Ocal and Perma-Cote.

B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.02 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corp.; Pipe & Plastics Group.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

B. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.

2. Warning Tape: Underground-line warning tape specified in 26 05 53 “Identification For Electrical Systems."

2.03 PRECAST CONCRETE HANDHOLES AND BOXES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carder Concrete Products.
2. Christy Concrete Products.
3. Elmhurst-Chicago Stone Co.
4. Oldcastle Precast Group.
5. Riverton Concrete Products; a division of Cretex Companies, Inc.
6. Utility Concrete Products, LLC.
7. Utility Vault Co.
8. Wausau Tile, Inc.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.
2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
3. Cover Legend: Molded lettering, "ELECTRIC” or "TELECOMM” as required for each service.
4. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
5. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
    a. Extension shall provide increased depth of 12 inches.
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

6. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 6 inches vertically and horizontally to accommodate alignment variations.

    a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.

    b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.

    c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

7. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

    a. Type and size shall match fittings to duct or conduit to be terminated.

    b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

3.00 EXECUTION

3.01 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

D. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, installed in direct-buried duct bank, unless otherwise indicated.

3.02 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.

2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20, Polymer concrete, SCTE 77, Tier 15 structural load rating.

3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10, Polymer concrete units, SCTE 77, Tier 8 structural load rating.

3.03 EARTHWORK

A. Excavation and Backfill: Comply with 31 23 33.16 “Trenching and Backfill for Utilities” but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to 01 73 29 “Cutting and Patching"

3.04 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward handholes and away from buildings and equipment.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 8 inches o.c. for 4-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.

2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to handhole.

3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Common Work Results for Electrical."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

G. Pulling Cord: Install 200-lbf- test nylon cord in ducts, including spares.

H. Concrete-encased Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to pre-vent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches be-tween tiers.

3. Excavate trench bottom to provide firm and uniform support for duct bank.

4. Install backfill. Select backfill to be class 4 earth fill. Fill shall consist of materials which are classified as SP, SM, SC, CL or dual classifications thereof, which have a liquid limit less than or equal to 35 and a plasticity index of a minimum of 4 and a maxi-mum of 15, which are free of organic materials. Compact to 95% standard proctor.

5. Pouring Concrete: Spade concrete carefully during pours to prevent voids at exterior surface of envelope. Do not use power-driven agitating equipment unless specifically designed for duct-bank application

6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and telecomm ducts.

7. Depth: Install top of duct bank at least 36 inches below finished grade, unless other-wise indicated.

8. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.

b. Transition from underground to above ground or where conduit penetrates walls/slabs: PVC Coated Rigid Steel Conduit to 6” each direction.

9. Warning Tape: Bury warning tape approximately 12 inches above all concrete and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.05 INSTALLATION OF CONCRETE HANDHOLES, AND BOXES

A. The CONTRACTOR shall be responsible for providing and sizing all wireways, pull boxes and junction boxes per the National Electrical Code (NEC) Article 314 and all other relevant sections of the NEC.

B. Precast Concrete Handhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.

2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:

1. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.

2. Where indicated, cast handhole cover frame integrally with handhole structure.

3.06 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. The CONTRACTOR shall be responsible for providing and sizing all wireways, pull boxes and junction boxes per the National Electrical Code (NEC) Article 314 and all other relevant sections of the NEC.

B. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

C. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

D. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.

E. Install handholes and boxes with bottom below the frost line, below grade.

F. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

G. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.07 INSTALLATION

A. Conduits shall enter handholes a minimum of 12” above the finished floor of the handhole.

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.09 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION

26 05 48 VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Isolation pads.

2. Spring isolators.

3. Channel support systems.

B. Related Sections include the following:

1. Division 26 Section "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.

1.03 DEFINITIONS

A. The IBC: International Building Code.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

B. Comply with NFPA 70.

2.00 PRODUCTS

2.01 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ace Mountings Co., Inc.

2. Amber/Booth Company, Inc.

3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arrange in single layer of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene rubber.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Finish: Manufacturer's standard prime-coat finish ready for field painting.

E. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.

4. Color-code or otherwise mark vibration isolation devices to indicate capacity range.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

D. Perform tests and inspections.

1. Measure isolator deflection.

2. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

3.03 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.02 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.03 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.00 PRODUCTS

2.01 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. All markings to labels, schedules, tags or nameplates shall be machine printed only. Hand printing is prohibited. Circuits shall be tagged at terminations (both ends), in pull boxes, cabinets, and enclosures as follows:

1. Tags relying on adhesives or tapes-on markers are not acceptable.

2. Provide conductor tags for conductors No. 10 AWG and below with legible permanent sleeve of yellow or white PVC with machine printed black marking, Raychem TMS sleeves or approved equal.

3. Provide tags for cables and for conductors No. 8 AWG and larger consisting of permanent nylon marker plates with legible designations hot stamped on the plate. Attach these marker plates to conductors and cables with plastic wire wraps. Tags shall be Raychem TMS-CM cable markers or approved equal.

4. Tags shall be imprinted with panelboard and panelboard position number (e.g. LA3-23) for conductors fed from panelboards. Other conductors shall have tags imprinted with the MCC which feeds the conductors (e.g. MCC 1).

5. Switchlegs shall have the designation described above on their tags, plus an “S” suffix. Travelers shall have the designation described above on their tags, plus a “T” suffix.

6. Where more than one neutral is present with a group of conductors, a tag shall be applied to each neutral indicating which phase conductors are served by each neutral (e.g. HA-2, 4, 6).

2.02 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches wide.

2.03 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

2. Printing on tape shall be permanent and shall not be damaged by burial operations.

3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.

2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.04 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal size, 7 by 10 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.05 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Attach plates to equipment with stainless steel screws. Provide an O-ring for screws on NEMA 4X enclosures, O-rings shall maintain the integrity and NEMA 4X rating for enclosures. Minimum letter height shall be 3/8 inch.

3.00 EXECUTION

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with stainless steel mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.

2. Wall surfaces directly external to raceways concealed within wall.

3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl labels. Install labels at 30-foot (10-m) maximum intervals.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot (10-m) maximum intervals.

D. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.

2. Power.

3. UPS.

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

b. Colors for 208Y/120-V Circuits:

1). Phase A: Black.

2). Phase B: Red.

3). Phase C: Blue.

4). Neutral: White

c. Colors for 480Y/277-V Circuits:

1). Phase A: Brown.

2). Phase B: Orange.

3). Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or

taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.

2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equip-ment in finished spaces.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.

3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equip-ment including, but not limited to, the following:

a. Power transfer switches.

b. Controls with external control power connections.

K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high.

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label Stenciled legend 4 inches high.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.

b. Enclosures and electrical cabinets.

c. Access doors and panels for concealed electrical items.

d. Switchgear.

e. Switchboards.

f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

g. Substations.

h. Emergency system boxes and enclosures.

i. Motor-control centers.

j. Enclosed switches.

k. Enclosed circuit breakers.

l. Enclosed controllers.

m. Variable-speed controllers.

n. Push-button stations.

o. Power transfer equipment.

p. Contactors.

q. Remote-controlled switches, dimmer modules, and control devices.

r. Battery-inverter units.

s. Battery racks.

t. Power-generating units.

u. Monitoring and control equipment.

v. UPS equipment.

END OF SECTION

26 05 73.01 ELECTRICAL POWER SYSTEM STUDIES

1.00 GENERAL

1.01 DESCRIPTION

General: This section specifies that the CONTRACTOR prepare a short circuit and relay coordination study and an arc flash hazard analysis for the electrical power system as shown on the plans.

Short Circuit and Relay Coordination Study and Arc Flash Analysis

The studies shall provide an evaluation of the electrical power system and the model numbers and settings of the protective relays or devices and metering or motor monitoring devices for setting by the CONTRACTOR. The Studies shall include settings for all motor protective relays and electric system monitoring.

A. Scope:

1. The Contractor is responsible for providing all pertinent information necessary for the successful completion of the Short Circuit and Relay Coordination Study and Arc Flash Analysis. All cable and raceway data, data for existing equipment, data from all new switchboards, pad-mounted switches, switchgear, motor control centers, transformers, panelboards, and separately mounted fuses, starters or circuit breakers shall be obtained by the Contractor. Obtain all existing or new protective device information to include all present settings. The Contractor shall obtain any needed data or information from Contract Documents, various suppliers, the Electric Utility, the Owner and from conducting his own field investigations. The data obtained shall be organized and submitted to the Engineer to show that all the necessary data gathering work has been done.

2. Calculations shall utilize actual X/R and three phase short circuit values obtained by the contractor from the Electric Utility. The use of infinite bus fault current calculation is not acceptable.

3. Provide a complete short circuit study. Include three phase and phase-to-ground calculations. Provide an equipment interrupting or withstand evaluation based on the actual equipment and model numbers provided on this project. Generic devices are not acceptable. Normal system operating method, alternate operation, and operations that could result in maximum fault conditions shall be thoroughly addressed in the study. The study shall assume all motors operating at rated voltage with the exception that motors identified as "standby" shall not be included. Electrical equipment bus impedance shall be assumed zero. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at the electrical equipment busses. The Study shall be performed using actual available short circuit currents available and system impedances as obtained from the Electric Utility/Owner. An assumption of infinite bus for the purposes of the Study is not

acceptable. Study shall use actual motor X/R and subtransient reactance data obtained from equipment suppliers.

4. A relay coordination study shall be performed to determine appropriate relay settings. The study shall include all electrical equipment provided under this contract and any up-stream equipment that has an impact on the coordination study. The study shall show transformer damage curves, generator damage curves, cable short circuit withstand curves and motor curves. Include all medium and low voltage switchgear, distribution switchboards, motor control centers, starters, and panelboards main circuit breakers. Complete the short circuit study down to the main breaker or main lugs on all panelboards. Panelboard branch circuit devices need not be considered. The phase over current and ground-fault protection shall be included as well as settings for all other adjustable protective devices. All motor monitoring relays and protective or monitoring devices that are a part of a supplier's equipment (such as switchboards) shall be in included. Include the last protective device in the Electric Utility's system feeding each facility being considered.

5. Provide Time-Current Curves on 11X17 log-log paper. Do not put more than one branch of protective devices on any one coordination curve. Include a one-line diagram and the names of each protective device in the branch. Use the names designated in the Contract Documents. Include motor and transformer damage curves, and cable short circuit withstand curves. Coordination study time-current curves (11x17 log-log type) including the instrument transformer ratios, model numbers of the protective relays, and the relay settings associated with each breaker. Organize the curves as specified here in. Ground fault time current curves shall be on a separate sheet.

6. An equipment evaluation study shall be performed to determine the adequacy of the fault bracing of all bus from the panelboard level up to the pad-mounted switches and fuse cutouts on the overhead electric lines or protective device. Include circuit breakers, controllers, surge arresters, busway, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents.

7. Provide arc flash hazard analysis in accordance with the applicable NFPA, ANSI, and IEEE standards.

8. The studies shall be performed, sealed and signed by a Registered Professional Engineer licensed in the state of Texas.

9. Any problem areas or inadequacies in the equipment shall be promptly brought to the Engineer's attention.

10. Use industry standard short circuit software, SKM CAPTOR and DAPPER or an equal approved by the Engineer.

11. The report shall include a comparison of short circuit duties of each bus to the interrupting capacity of the equipment that is protecting that bus.

12. The report shall include all data that was used as input to the report. This data shall include cable impedance, conduit type, source impedance, equipment ratings, motor X/R and subtransient reactance data, etc.

13. The Contractor shall coordinate with the Owner and/or Electric Utility for electrical data required for the studies. The use of infinite bus for arc-flash calculations shall not be allowed. Arc-flash calculations shall use actual utility data.

1.02 REFERENCES

A. This Section contains references to the following documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Reference	Title
IEEE 141	Recommended Practice for Electric Power Distribution for Industrial Plants
IEEE 242	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
NFPA 70E	Handbook for Electrical Safety in the Workplace
IEEE 1584	IEEE Guide for Performing Arc-Flash Hazard Calculations
NEC	National Electrical Code

1.03 SCHEDULE

A. The report shall be provided to the Engineer NO LATER THAN 60 days before the equipment is shipped to the Work site. SHIPMENT AND DELIVERY OF EQUIPMENT WILL NOT BE ACCEPTED AT THE JOBSITE UNTIL THE STUDY HAS BEEN COMPLETED, SUBMITTED AND APPROVED BY THE ENGINEER.

1.04 SUBMITTALS

Submittals shall be in accordance with Section 01 33 00, SUBMITTALS and shall include:

A. Short Circuit and Relay Coordination Study. Time current curves shall be on 11x17 log-log type paper. The Contractor can provide time current curves on 8 ½ x 11 log-log type paper as a supplement but not as a replacement.

B. Arc Flash Hazard Analysis

1. Provide a copy of project specific Arc Flash labels for each panelboard, switchboard, pad-mounted switch, switchgear, disconnect, Motor Control Center, including all existing electrical equipment – switchgear, starters, motor control center, panelboards, starters, etc.

2. Provide a color copy of project specific Arc Flash labels for each panelboard, switchgear, switchboard, pad-mounted switch, disconnect, motor control centers, transfer switches, including all existing electrical equipment – VFDs, switchgear, soft starters, panelboards, starters, etc.

3. Provide a 11x17 copy of the one-line diagram color-coded to show the incident ranges & clothing classifications at each bus. Provide a table indicating the color coding used for each incident range & clothing classification. The following is a recommended color coding for the following Hazard/Risk Category numbers:

    a. Blue to indicate up to ≤4 cal/cm^2
    b. Brown to indicate >4 cal/cm^2 to ≤8 cal/cm^2
    c. Yellow to indicate >8 cal/cm^2 to ≤25 cal/cm^2
    d. Orange to indicate >25 cal/cm^2 to ≤40 cal/cm^2
    e. Red to indicate Above 40 cal/cm^2

C. Provide six (6) bound color copies of the completed short circuit and relay coordination study, the arc flash analysis shall be submitted to the Engineer for approval. Each hard copy of studies shall be bound in a 3-ring binder.

D. Two Software copies of actual power systems computer program project data files burned in on a CD. The Contractor shall provide an electronic copy on a CD-ROM of all files used to develop the electrical system model in the power system analysis program and all files for the written study analysis and summary data tables. For instance if SKM software is used for the power system studies, then the SKM files shall be burned in on a CD-ROM and provided to the Owner/Engineer. This shall include any library files used for circuit breakers, fuses, etc. for the power system analysis.

2.00 EXECUTION

2.01 GENERAL

A. Provide a short-circuit and relay coordination study and arc flash hazard analysis on the electrical power distribution system, as specified. The studies shall be performed in accordance with IEEE Standards 141 and 242, IEEE 1584, ANSI, and the NEC and shall utilize the ANSI method of short circuit analysis in accordance with ANSI C37.010. The studies shall be performed using actual equipment data for all equipment. The coordination studies shall use the data from the manufacturer of protective devices.

2.02 QUALIFICATIONS

A. The studies shall be performed by the by an electrical manufacturer/consultant service/electrical testing agency who is regularly engaged in power system studies. A Licensed Professional Engineer with proficiency in electrical power engineering shall conduct the studies and shall seal and sign the studies. The Professional Engineer shall be licensed to practice engineering in the State of Texas. A study submitted without a Professional Engineer's seal will not be reviewed and returned Not Approved, Revise & Resubmit.

2.03 SHORT CIRCUIT STUDY

A. The CONTRACTOR shall be responsible for obtaining and verifying all data needed to perform the study.

B. As a minimum, each short circuit study shall include the following:

1. One-Line Diagram:

a. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.

b. Type designation, current rating, range or adjustment, manufacturer's style and catalog number for all protective devices.

c. Power and voltage ratings, impedance, primary and secondary connections of all transformers. Use the ratings (ie. Impedence, X/R, etc.) of the actual transformers being provided where available.

d. Type, manufacturer, and ratio of all instrument transformers energizing each relay.

e. Nameplate ratings of all motors and generators with their subtransient reactances. Transient reactances of synchronous motors and generators and synchronous reactances of all generators. Obtain data on the actual equipment being provided. Generic or average data numbers are not acceptable.

f. Sources of short circuit currents such as utility ties, generators, synchronous motors, and induction motors. Provide short circuit studies using each source of power separately. The study shall determine if there is sufficient short circuit current to adequately cause interruption of a protective device using the weaker power source (typically local generation), and shall determine if the equipment can safely interrupt the fault if the greater power source is connected. Additional short circuit calculations shall include emergency as well as normal switching conditions as well as normal and emergency power sources described here in.

1). Show short circuit calculations listing short circuit levels at each bus. Provide the same data in tabular from.

g. All significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc shall be included.

h. The time-current setting of existing adjustable relays and direct-acting trips, if applicable.

2. Impedance Diagram:

a. Available MVA or impedance from the utility company.

b. Local generated capacity impedance.

c. Bus impedance.

d. Transformer and/or reactor impedances.

e. Cable impedances.

f. Equipment impedances.

g. System voltages.

h. Grounding scheme (resistance grounding, solidly grounding, or no grounding).

i. Motor contribution assuming the new and existing motors as shown on the plans all running at the same time.

3. Calculations:

a. Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.

b. Calculate the maximum and minimum fault currents.

c. A discussion section evaluating the adequacy or inadequacy of the equipment method of calculation and formulas used such that all calculations can be verified manually by the Engineer, with recommendations as required for improvements to the system.

d. Any inadequacies shall be called to the attention of the Engineer and recommendation made for improvements.

e. Six (6) bound copies of the completed short circuit study shall be submitted to the Engineer.

2.04 RELAY COORDINATION STUDY

A. As a minimum, the coordination study for the power distribution system shall include the following on 5-cycle, log-log graph paper:

1. The time-current coordination analysis shall be performed with aid of a digital computer.

a. Time-current curves for each device shall be positioned to provide for maximum selectivity to minimize system disturbances during fault clearing, but still maintain a low incident energy level. Where selectivity cannot be achieved, the Engineer shall be notified as to the cause.

2. Time-current curves for each device shall be positioned to provide for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, the Engineer shall be notified as to the cause.

3. Time-current curves and points for cable and equipment damage.

4. Circuit interrupting device operating and interrupting times.

5. Indicate maximum fault values on the graph.

6. Sketch of bus and breaker arrangement.

7. Six (6) bound copies of the completed relay coordination study shall be submitted to the Engineer.

2.05 ARC FLASH HAZARD ANALYSIS

A. The study shall be performed in accordance with the NEC and all applicable OSHA, ANSI, and IEEE standards.

B. The contractor shall adjust all adjustable time-current devices such that the trip settings lower the arc flash exposure and minimizing the clearing time. However, the contractor shall adjust the time-current devices to avoid nuisance tripping.

C. The contractor shall utilize fault current values from the short circuit analysis to determine the Incident energy, limited approach boundary, restricted approach boundary, and appropriate PPE required.

D. The contractor shall provide project specific arc-flash labeling. The arc-flash labeling shall be placed on the outside of the cover of the switchgear, motor control centers, combination motor starters, panelboard, switchboard, distribution panel, and all electrical panels, etc. such that it can be read without opening the electrical equipment. Mount arc-flash labels a maximum of 6'-6" AFF, include the housekeeping pad in the mounting height. The contractor shall provide arc-flash labeling on all existing panelboards, switchboards, distribution panel, etc. where breakers are added or work is performed in or on the electrical equipment.

E. Arc Flash Labels shall be chemical resistant, UV resistant, water resistant, scratch resistant, and made of 3.0 mil vinyl tape as manufactured by DuraLabel, Brady or approved equal. The lettering shall be performed by thermal transfer print.

1. Arc Flash labels and label lettering shall be sized large enough to be legible at a distance outside the hazard area.

2. Arc Flash Labels shall be placed on the door(s) of the room if the hazard area reaches or extends beyond the electrical room door(s).

3. The arc flash label shall include a DANGER header when the incident energy is above 40cal/cm2, and a WARNING header for all other incident energy levels.

F. To ensure a safe workplace, and that the labeling meets NEC, OSHA, IEEE, and NFPA requirements, use specialized arc flash software to calculate protection boundaries. These protection boundaries shall include the Flash Protection Boundary, Limited Approach Boundary, and Restricted Approach Boundary.

G. The arc-flash analysis shall be based on calculated fault from the Short Circuit Study at each respective bus. The arc-flash software program shall be used to calculate the available arcing fault at each bus in the system, the resultant flash protection boundary based on the applicable protective device operating times and the associated incident energy that workers may be exposed to at the specified working distances.

H. The report shall include the following information: Arc-flash evaluation table, arc-flash and shock hazard label definitions, arc-flash evaluation information, arc-flash and shock hazard labels and definitions of terms used in the arc-flash hazard analysis.

I. Six (6) bound copies of the completed arc-flash hazard analysis shall be submitted to the Engineer's Representative.

J. Arc Flash labels shall be similar to the following example:

WARNING	
Arc Flash and Shock Hazard	
Appropriate PPE Required	
13 inch	Flash Hazard Boundary
0.67	cal/cm^2 Flash Hazard at 18 inches
3	PPE Category
480 VAC	Shock Hazard when cover is removed
0	Glove Class
42 inch	Limited Approach
12 inch	Restricted Approach
10.692 kA	Calculated Available Fault Current
Equip. ID:	**Panel LP1**
Protected By: 125A CB: TX1 (480V MCC1)	
Study Date: September 15, 2015	
Upstream Protective Device: Panel HP1 Circuit 1,3,5	

END OF SECTION

26 09 23 LIGHTING CONTROL DEVICES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to install contactors. Electrical work shall be in accordance with Section 26 05 00 “Common Work Results for Electrical.”

1.03 SUMMARY

A. This Section includes the following lighting control devices:

1. Outdoor photoelectric switches.

2. Indoor occupancy sensors.

3. Lighting contactors.

4. Emergency shunt relays.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for manual light switches.

1.04 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

C. BAS: Building Automation System

D. DDC: Direct Digital Control

1.05 SUBMITTALS

A. Product Data: General device descriptions, dimensions, wiring details, nomenclature

B. Riser Diagrams-typical per room type (detailed drawings showing device interconnectivity of devices)

C. Example Contractor Startup/Commissioning Worksheet-must be completed prior to factory start-up

D. Shop Drawings:

1. Show installation details for occupancy and light-level sensors.

2. Interconnection diagrams showing field-installed wiring.

3. Lighting Contactors: Shop drawings shall include dimensioned drawing showing layout of enclosure in plan view and elevations, Control Schematic in ladder logic showing operation of the contactor and data sheets for each component provided

E. Field quality-control test reports.

F. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. All steps in sensor manufacturing process shall occur in the USA, including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.

1.07 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

2.00 PRODUCTS

2.01 INDOOR OCCUPANCY (VACANCY) SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sensor Switch, an Acuity Brands Company

2. Hubbell Lighting.

3. Leviton Mfg. Company Inc.

4. Lithonia Lighting; Acuity Lighting Group, Inc.

5. Novitas, Inc.
6. RAB Lighting, Inc.
7. TORK.
8. Watt Stopper (The).
9. Lutron

B. General Description:

1. This specification is based on the nLight Network Control System from Sensor Switch, an Acuity Brands Company.
2. The lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control.
3. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)
4. All system devices shall be networked together enabling digital communication and shall be individually addressable.
5. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.
6. The system architecture shall facilitate remote operation via a computer connection.
7. The system shall not require any centrally hardwired switching equipment.
8. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.

2.02 SYTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts: intelligent lighting control devices, standalone lighting control zones, network backbone for remote or time based operation.

B. System architecture SHALL NOT use WiFi or any wireless method to communicate between devices, and WiFi or wireless communication shall not be required for system operation.

C. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.

D. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches (see *Networked LED Luminaire* section)

E. Intelligent lighting control devices shall communicate digitally, require <4 mA of current to function (Graphic wall stations excluded), and possess RJ-45 style connectors.

F. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.

G. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.

H. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

I. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

J. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.

K. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

L. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.

M. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.

N. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.

O. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

P. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information via the wired backbone.

Q. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.

1. Auto-On / Auto-Off (via occupancy sensors)

    a. Zones with occupancy sensors automatically turn lights on when occupant is detected.

    b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

    c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.

2. Manual-On / Auto-Off (also called Semi-Automatic)

    a. Pushing a switch will turn lights on.

    b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

3. Manual-On to Auto-On/Auto-Off

    a. Pushing a switch will turn lights on.

    b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.

    c. Sequence can be reset via scheduled (ex. daily each morning) events

4. Auto-to-Override On

    a. Zones with occupancy sensors automatically turn lights on when occupant is detected.

    b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.

    c. Sequence can be reset via scheduled (ex. daily each morning) events

5. Manual-to-Override On

a. Pushing a switch will turn lights on.

b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.

c. Sequence can be reset via scheduled (ex. daily each morning) events

6. Auto On / Predictive Off

a. Zones with occupancy sensors automatically turn lights on when occupant is detected.

b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

c. If switch is pressed, lights turn off and a short “exit timer” begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.

7. Multi-Level Operation (multiple lighting levels per manual button press)

a. Operating mode designed specifically for bi-level applications

b. Enables the user to cycle through the up to four potential on/off lighting states using only a single button.

c. Eliminates user confusion as to which of two buttons controls which load

d. Three different transition sequences are available in order to comply with energy codes or user preference)

e. Mode available as a setting on all nLight devices that have single manual on/off switch (ex. nWSX, nPODM, nPODM-DX).

f. Depending on the sequence selected, every button push steps through relays states according to below table

g. In addition to achieving bi-level lighting control by switching loads with relays, the ability to command dimming outputs to “step” in a sequence that achieves bi-level operation is present.

R. A taskbar style desktop application shall be available for personal lighting control.

S. An application that runs on “smart” handheld devices (such as an Apple® IPhone®) shall be available for personal lighting control.

T. Control software shall enable logging of system performance data and presenting useful information in a web-based graphical format and downloadable to .CSV files.

U. Control/management software shall enable integration with a Building Automation System via BACnet MS/TP.

V. System shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

2.03 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

2.04 CONTROL MODULE (GATEWAY)

A. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet.

B. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.

C. Control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.

D. Device shall automatically detect all devices downstream of it.

E. Device shall have a standard and astronomical internal time clock.

F. Device shall have one RJ-45 10/100 BaseT Ethernet connection.

G. Device shall have a USB port

H. Each control gateway device shall be capable of linking 1500 devices to the management software.

I. Device shall be capable of using a dedicated or DHCP assigned IP address.

J. Network Control Gateway device shall be the following Sensor Switch model Series: **nGWY2**

2.05 NETWORKED SYSTEM OCCUPANCY SENSORS

A. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

B. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions.

C. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.

D. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

E. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

F. Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.

G. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.

H. Sensors shall be available in multiple lens options which are customized for specific applications.

I. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

J. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.

K. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue

L. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.

M. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.

N. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.

O. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.

P. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.

Q. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.

R. Wall switch sensors shall be available with optional raise/lower dimming adjustment controls

S. Network system shall have sensors that can be embedded into luminaire such that only the lens shows on luminaire face.

T. Embedded sensors shall be capable of both PIR and Dual Technology occupancy detection

U. Embedded sensors shall have an optional photocell

V. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.

W. Fixture mount sensors shall be capable of powering themselves via a line power feed.

X. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.

Y. Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).

Z. All dimmers shall communicate with the central lighting control panel. The occupancy status shall be available to integrate to the Building Automation System.

2.06 NETWORKED SYSTEM DAYLIGHT (PHOTOCELL AND/OR DIMMING) SENSORS

A. Photocell shall provide for an on/off set point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

B. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.

C. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

D. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).

E. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)

F. Combination units that have all features of on/off photocell and dimming sensors shall also be available.

G. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.

H. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.

I. Network system shall have dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.

2.07 NETWORKED SYSTEM POWER (RELAY) PACKS

A. Power pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.

B. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.

C. All devices shall have two RJ-45 ports.

D. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.

E. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

F. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

G. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.

H. Power (Secondary) Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming or fluorescent ballasts/LED drivers.

I. Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of fluorescent ballasts/LED drivers.

J. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).

K. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.

L. Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.

M. Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.

N. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.

O. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.

P. Specific Secondary Packs shall be available that control louver/damper motors for skylights.

Q. Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.

2.08 NETWORKED SYSTEM RELAY AND DIMMING PANELS

A. Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.

B. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.

C. Panel shall provide one 0-10VDC dimming output paired with each relay.

D. Panel shall power itself from an integrated 120/277 VAC supply.

E. Panel shall be capable of operating as either two networked devices or as one.

F. Panel shall supply current limited low voltage power to other networked devices connected via CAT-5.

G. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection

2.09 NETWORKED AUXILIARY INPUT/OUTPUT (I/O) DEVICES

A. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.

B. Devices shall have two RJ-45 ports

C. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

D. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current (typically 40 or more ballasts).

E. Specific I/O devices shall have an input that read a 0-10 VDC signal from an external device.

F. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event, run a local/remote control profile, or raise/lower a dimming output

G. Specific I/O devices shall sense state of low voltage outdoor photocells

H. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.

2.10 NETWORKED LED LUMINAIRES

A. Networked LED luminaire shall have a mechanically integrated control device

B. Networked LED luminaire shall have two RJ-45 ports

C. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)

D. Networked LED luminaire shall provide low voltage power to other networked control devices

E. System shall be able to turn on/off LED luminaire without using a relay

F. System shall be able to maintain constant lumen output over the specified life of the LED luminarie (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage).

G. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).

2.11 NETWORKED SYSTEM WALL SWITCHES AND DIMMERS

A. Devices shall recess into single-gang switch box and fit a standard GFI opening.

B. Devices shall be available with zero or one integrated Class 1 switching relay.

C. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

D. All sensors shall have two RJ-45 ports.

E. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.

F. Devices with dimming control outputs can control 0-10 VDC dimmable ballasts by sinking up to 20 mA of current (typically 40 or more ballasts).

G. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.

H. Devices with mechanical push-buttons shall provide tactile and LED user feedback.

I. Devices with mechanical push-buttons shall be made available with custom button labeling

J. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.

2.12 NETWORKED SYSTEM GRAPHIC WALL STATION

A. Device shall have a 3.5” full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.

B. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.

C. Device shall enable user supplied .jpg screen saver image to be uploaded.

D. Device shall surface mount to single-gang switch box

E. Device shall have a micro-USB style connector for local computer connectivity.

F. Device shall have two RJ-45 ports for communication

2.13 NETWORKED SYSTEM SCENE CONTROLLERS

A. Device shall have two to four buttons for selecting programmable lighting control profiles or acting as on/off switches.

B. Device shall recess into single-gang switch box and fit a standard GFI opening.

C. Devices shall provide LED user feedback.

D. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

E. All sensors shall have two RJ-45 ports.

F. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.

G. Device shall be capable of selecting a lighting profile be run by the system’s upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).

H. Device shall have LEDs indicating current selection.

2.14 COMMUNICATION BRIDGES

A. Device shall surface mount to a standard 4” x 4” square junction box.

B. Device shall have 8 RJ-45 ports.

C. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.

D. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.

E. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.

2.15 LIGHTING CONTROL PROFILES

A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.

B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.

C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.

D. Every device parameter (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.

E. All lighting control profiles shall be stored on the network control gateway device and on the software's host server.

F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.

G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.

H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.

I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.

J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

2.16 LIGHTING CONTACTORS

A. Lighting contactors shall comply with the specifications and the following Manufacturers will be acceptable:

1. Square D.

2. Eaton Cutler-Hammer.

3. ASCO.

4. General Electric.

B. Lighting Contactors: Electrically held two-wire control conforming to NEMA ICS 2. Mount contactors in an ANSI/NEMA ICS 6, enclosure. Provide solderless pressure wire terminals. Lighting contactors shall have the following characteristics:

1. Coil Operating Voltage: 120 volts, 60 Hertz.

2. Contacts: 30, 60, 100 amperes as required, number of pole, 600 volts, 60 Hertz as required for application.

C. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, for interior air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 12, with continuous-hinge cover with flush latch, for interior non-air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 3R, galvanized-steel box with removable interior panel and removable lockable front for exterior locations.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

3.00 EXECUTION

3.01 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.03 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.

2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

3.04 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.05 COMMISSIONING

A. General Requirements

1. Three site visits shall be required for proper commissioning. The first site shall ensure that the contractor is trained to install the system correctly. The second, the factory engineer will start up the system, ensure that it is operating according to specification, and perform initial programming. The third visit shall be for the purposes of refining the programming, and training the owner/end user on the system.

B. Provide factory-certified field service engineer to ensure proper system installation and operation under following parameters.

1. Certified by the equipment manufacturer on the system installed.

2. At least three site visits to accomplish the following tasks:

a. Prior to wiring

1). Review and provide installer with instructions to correct any errors in the following areas:

a). Low voltage wiring requirements

b). Separation of high and low voltage wiring runs

c). Wire labeling

d). Load schedule information

e). Switching panel locations and installation

f). Physical locations and network addresses of controls

g). Analog phone line requirement

h). Computer-to-network connections

i). Load circuit wiring

j). Connections to other systems and equipment

2). After system installation

3). Check and approve or provide correction instructions on the following:

a). Connections of power feeds and load circuits

b). Connections and locations of controls

c). Connections of low voltage inputs

d). Connections of the data network

4). Turn on system control processor and download any pre-programmed system configuration

5). Verify panel address(es)

6). Download pre-programmed system configuration and information to switching and/or dimming panels

7). Check load currents and remove bypass jumpers

8). Verify that each system control is operating to specification

9). Verify that each system circuit is operational according to specification

10). Verify that manufacturers' interfacing equipment is operating to specification

11). Verify that any computers and software supplied by the manufacturer are performing to specifications

12). Verify that any remote WAN (Wide Area Network) connections such as dial-up or broadband access points are operating properly

13). Have an owner's representative sign off on the above-listed system functions

b. Before project completion and hand-off

c. Demonstrate system capabilities and functions to owner's representative

d. Train owner's representative on the proper operation and maintenance of the system

C. Documentation requirements

1. A third-party commissioning authority, who is not involved in the design or construction, is required to verify that the lighting controls are adjusted, programmed, and functioning in accordance with the design and the manufacturer's installation instructions. The commissioning authority also must submit documentation certifying that the lighting systems are in compliance with or exceed the performance requirements. The certification needs to be specific enough to verify conformance to the authority having jurisdiction.

2. Functional testing for automatic lighting controls will be performed. The building owner will be given, within 90 days from the date of receipt of certificate of occupancy, written certification that the lighting controls meet documented performance criteria.

a. *Occupancy sensors:* At least 10% will be tested for each unique combination of sensor type and space geometry. If 30% or more fail the acceptance criteria, all remaining identical combinations must be tested. The below information need to be verified:

1). Proper location and aiming.

2). Correction operation where the sensors include status indicators.

3). The lights turn ON to the permitted level when the space becomes occupied (if auto-ON).

4). The lights turn ON only when manually activated (if manual-ON).

5). False-ON triggering does not occur by movement in adjacent areas or from HVAC operation.

b. *Time-switch controls:* The below information need to be verified:

1). The time-switch control is programmed with accurate weekday, weekend and holiday schedules.

2). The time switch includes the correct time and date.

3). Any battery backup is installed and energized.

4). The override is set to no longer than two hours.

5). Simulating an occupied condition, that all lights can be turned ON/OFF by their local manual switch, and that the switch only operates the local lighting.

6). Simulating an unoccupied condition, that the controlled lighting turns OFF, and that the manual override allows only local lighting to turn ON and remain ON until the next time sweep occurs within two hours.

7). The owner must be given documentation indicating the programming (including weekday, weekend and holiday schedules) and all other settings.

c. *Daylight-responsive lighting controls:* The below information need to be verified:

1). Proper location of all control devices.

2). Calibration of devices (with calibration adjustment being readily accessible only to authorized personnel) with accurate set-points and threshold light levels.

3). Lighting adjusts to light level set-points in response to daylight.

3.06 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.07 START-UP & SUPPORT FEATURES

A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.

D. All system devices shall be capable of being given user defined names.

E. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

F. All sensor devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

26 22 00 LOW-VOLTAGE TRANSFORMERS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.03 ENERGY STAR / NEMA TP1 COMPLIANCE NOT SUFFICIENT DUE TO ELECTRONIC LOAD PROFILE

A. ENERGY STAR / NEMA TP1 is a linear load standard and as such is not sufficient to establish compliance with this specification.

1. It sets efficiency benchmarks for transformers feeding linear loads at 35% of their nameplate load.

2. The linear load test profile, while standard at manufacturer's facilities, neglects the substantial extra losses created by nonlinear loads, producing unrealistically high efficiency expectations compared to what will be measured when feeding nonlinear loads.

1.04 MANDATORY TESTING UNDER ELECTRONIC EQUIPMENT LOAD

A. A. It is mandatory that the manufacturer test the transformers under nonlinear load representative of real world electronic equipment. Transformers that have not been subject to testing under nonlinear load will not be considered for this project due to the uncertainty related to their real world performance.

B. Manufacturer must have a nonlinear (Electronic) Load Test Program operating in the production environment and documented per quality standard ISO9001.

1. As a minimum, the nonlinear load bank shall consist of three phases of 120V switch-mode power supplies typical of commercially supplied models capable of producing current total harmonic distortion up to at least 100% current THD, with the capability of blending in other load profiles such as 3-phase rectifiers and resistive load.

2. Acceptable Alternate Nonlinear Load Bank Configurations:

a. Crest factor 3 load used in the UPS industry.

3. Metering shall be revenue class. Dual meters shall gather simultaneous primary and secondary energy and harmonic data. Meter and CT combination must have revenue class accuracy.

4. Efficiency: Measurements shall be taken at multiple load levels and plotted to show compliance with specification and correlation to the designed efficiency curve.

5. Harmonic data including current and Voltage THD at the different load levels shall be included with the test report.

6. At time of shipment, the manufacturer shall supply for each individual transformer shipped, its nonlinear load performance data by product serial number.

1.05 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Technical data per NEMA ST20 for each distinct configuration on the project

D. Nonlinear Electronic Load efficiency at 40% of nameplate rating

E. Manufacturer's Nonlinear Electronic Load Test Program description. This shall include as a minimum metering system details, load waveform and harmonic spectrum.

F. Copy of Factory test of a representative 75kVA transformer.

G. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.06 REFERENCE DOCUMENTS

A. ANSI/NEMA ST 20 - Dry Type Transformers for General Applications.

B. ANSI/NEMA TP-1 – Guide for Determining Energy Efficiency for Distribution Transformers

C. IEEE-519 – Recommended Practices and Requirements for Harmonic Control in Electric Power Systems

D. IEEE-1100 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment

1.07 MANUFACTURING ENVIRONMENTAL MANAGEMENT SYSTEM: ISO14001 STANDARD

A. Transformer manufacturing can produce significant emissions of volatile compounds and significant other waste. To minimize environmental impact, the transformer must the product of a manufacturing process that has been independently audited to comply with the ISO 14001 Environmental Management System Standard, where strict quality control of raw material sourcing and construction techniques maximize product efficiency and minimize emissions and waste byproducts.

B. Ecologo mark is insufficient due to lack of standard testing, efficiency and manufacturing benchmarks.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.09 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.10 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Concrete, reinforcement, and formwork requirements are specified in Division 03.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Cutler-Hammer
2. General Electric
3. Square D
4. No other manufacturers will be accepted.

2.02 TRANSFORMER REQUIREMENTS

A. Transformers shall be built and tested in accordance with ISO 14001, ISO 9001, NEMA ST20 and NEMA TP1, and then tested under nonlinear load in the factory prior to shipment.

B. Product must be a standard item in the manufacturer's catalog.

C. Transformers shall be copper-wound, two winding type, rated for 60Hz operation, Insulation Class: 220 degree C, Epoxy Polyester impregnation for core and coil assembly. Transformers 750 kVA and less, 600 volt primary and less, shall be U.L. Listed and bear the label. All terminals, including those for changing taps, must be readily accessible by removing a front coverplate.

D. Operating Temperature Rise: 130 degree C. rise over a 24-hour average ambient temperature of 40 degree C

E. K-Rating: 7

F. Linear Load Losses: 25% less than NEMA TP-1 to meet proposed federal efficiency legislation

G. Exceed NEMA TP-1 efficiency levels under K-7 load profile

H. Nonlinear Load Efficiency at 40% of nameplate rating per mandatory testing procedure:

1. 15kVA: 97.3%, 30kVA: 97.7%, 45kVA: 98.0%, 75kVA: 98.6%, 112.5kVA: 98.7%, 150kVA: 98.8%, 225kVA: 98.8%, 300kVA: 98.8%, 500kVA: 98.8%, 750kVA: 98.8%

I. Voltage Distortion across the transformer under electronic equipment load shall be less than 2% at 40% load to facilitate system compatibility with IEEE-519 section 6.6.

2.03 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.04 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine floors and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements in Division 26 Section "Vibration Controls for Electrical Systems."

3.03 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Remove and replace units that do not pass tests or inspections and retest as specified above.

3.05 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.06 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.07 WARRANTY

A. 25 years prorated, with standard limited liability.

END OF SECTION

26 24 16 PANELBOARDS

1.00 GENERAL

1.01 WORK INCLUDED

A. Section Includes:

1. Distribution panelboards.

2. Lighting and appliance branch-circuit panelboards.

3. Load centers.

1.02 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protection Device.

1.03 REFERENCES

A. ANSI/NEMA: American National Standards Institute/National Electrical Manufacturers Association

1. NEMA AB 1: Molded Case Circuit Breakers.

2. NEMA PB 1: Panelboards.

3. NEMA PB 1.1: Instruction for Safe Installation, Operation, and Maintenance of Panelboards rated 600 volts or less.

4. NEMA PB 1.2: Application Guide for Ground-fault Protective Devices for Equipment.

B. Federal Specifications, FS-W-C-375A: Circuit Breakers, Molded Case, Branch circuit and Service.

C. American National Standards Institute/National Fire Protection Association (ANSI/NFPA),No. 70 – National Electrical Code (NEC), Article 384 – Switchboards and Panelboards.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00, SUBMITTALS and shall include:

1. Product Data: For each type of panelboard, switching and overcurrent protective device, SPD, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Instructions for handling and storage.

2. Installation instructions.

3. Dimensions and weight.

4. Detail enclosure type and NEMA rating.

5. Detail bus configuration, current, and voltage ratings.

6. Detail breaker arrangement.

7. Short-circuit current rating of panelboards and overcurrent protective devices.

8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

9. Include wiring diagrams for power, signal, and control wiring.

C. Qualification Data: for qualified testing agency.

D. Field Quality-Control Reports:

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Use panelboards manufactured and tested in accordance with NEMA PB 1.

D. Provide circuit breakers that are manufactured and tested in accordance with NEMA AB 1 and Federal Specification FS-W-C-375.

E. Comply with NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; if required, install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.07 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.

b. Altitude: Not exceeding 6600 feet.

1.08 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

2.00 PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface -mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Air Conditioned Locations: NEMA 250, Type 1.

b. Other Wet or Damp Indoor Locations: NEMA 250, Type 3R.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Finishes:

a. Panels and Trim: Steel or galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.

b. Back Boxes: Same finish as panels and trim.

4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains Location: As required by project conditions.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Circuit breakers shall be equipped with individually insulated, braced and protected connectors to the main bus. The front surface of all circuit breakers shall be flush with each other. Permanent, individual circuit numbers shall be affixed to each breaker in a common position. Tripped indication shall be clearly indicated by the breaker handle between the "ON" and "OFF" position. Space positions indicated on the plans shall be so that the additional connectors or bus will not be required to add breakers.

G. Each panelboard shall have a short circuit current rating equal to or greater than the fault current available at each panel. Series rating of breakers shall not be permitted. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and bear the applicable U.L. label. Each circuit breaker used in 480Y/277 Volt Panelboards shall have an interrupting capacity of not less than 65,000 Amps, RMS symmetrical; Each circuit breaker used in 208Y/120 Volt Panelboards shall have an interrupting capacity of not less than 14,000 Amps, RMS symmetrical.

2.02 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: As indicated on panel schedule.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.03 APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: As indicated on panel schedule.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. For lighting control panelboards, refer to specification 26 24 18 Lighting Control Panelboards.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Square D; a brand of Schneider Electric.

B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

1. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.

3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.

    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

    d. Ground-Fault Protection: Integrally mounted or Remote-mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

    e. Shunt Trip: 120 or 24-V trip coil energized from separate circuit, set to trip at 55 or 75 percent of rated voltage.

    f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional or with field-adjustable 0.1- to 0.6-second time delay.

    g. Auxiliary Contacts: One SPDT switch or Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.

    h. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.

    i. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

    j. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.

    k. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

    l. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.

2.05 PANELBOARD SUPPRESSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Current Technology; a subsidiary of Danahar Corporation.

2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

4. Liebert Corporation.

5. Square D; a brand of Schneider Electric.

B. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:

a. LED indicator lights for power and protection status.

b. Audible alarm, with silencing switch, to indicate when protection has failed.

c. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.

C. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:

a. Fuses rated at 200-kA interrupting capacity.

b. Fabrication using bolted compression lugs for internal wiring.

c. Redundant suppression circuits.

d. Redundant replaceable modules.

e. Arrangement with wire connections to phase buses, neutral bus, and ground bus.

f. LED indicator lights for power and protection status.

g. Audible alarm, with silencing switch, to indicate when protection has failed.

h. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

i. Four-digit, transient-event counter set to totalize transient surges.

2. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.

3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.

a. Line to Neutral: 70,000 A.

b. Line to Ground: 70,000 A.

c. Neutral to Ground: 50,000 A.

4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

5. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277, or 208Y/120-V, three-phase, four-wire circuits shall be as follows:

a. Line to Neutral: 800 V for 480Y/277, 400 V for 208Y/120.

b. Line to Ground: 800 V for 480Y/277, 400 V for 208Y/120.

c. Neutral to Ground: 800 V for 480Y/277, 400 V for 208Y/120.

2.06 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

3.00 EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 84 inches above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box.

D. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

H. Comply with NECA 1.

3.03 IDENTIFICATION

A. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Device Nameplates: Label each branch circuit device in panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

c. Instruments and Equipment:

1). Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panel-boards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Over-current Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

3.06 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

26 27 26 WIRING DEVICES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, receptacles with integral USB ports, and associated device plates.

2. Snap switches.

3. Cord and plug sets.

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.06 COORDINATION

A. Cord and Plug Sets: Match equipment requirements.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc., (Cooper).

2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

3. Leviton Mfg. Company, Inc. (Leviton),

4. Pass & Seymour Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.02 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).

b. Hubbell; HBL5351 (single), CR5352 (duplex).

c. Leviton; 5891 (single), 5352 (duplex).

d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.03 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pass & Seymour; 2094.

2.04 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.

2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.05 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).

b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).

c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).

d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.06 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Smooth, high-impact thermoplastic. Color selected by Architect.

3. Material for Damp Locations and Kitchens: Screw heads shall have color to match plate, 302/304 stainless steel. Damp locations shall include restrooms, exterior locations, kitchens and any other areas where moisture or water is present.

B. Weatherproof device covers shall have a NEMA 3R rating while receptacle is in use rating with die cast aluminum construction as manufactured by Thomas & Betts Model No. CKMUV or approved equal.

C. Mark power/receptacle outlets with voltage, phase, panel name and circuit number.

D. Identify all wall switches, disconnect switches, etc. with nametags, circuit served and panel origin, nametags shall be approved by the ENGINEER/OWNER'S REPRESENTATIVE. Receptacle and light switch cover plates shall be Pass & Seymour, or approved equal, custom laser engraved plates.

E. Identify all push-button stations with their function and equipment served.

2.07 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices and faceplates in gypsum and/or acoustical panel-walls shall be ivory, unless otherwise required by NFPA 70.

3.00 EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Existing outlet boxes and associated raceway may be used for new devices/wiring, provided height of outlet box is in compliance with latest ADA and TAS requirements.

C. In areas that contain plaster or masonry walls, installation of devices and their boxes are intended to be surface mounted.

D. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install wiring devices after all wall preparation, including painting, is complete.

E. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

a. a. Cut back and pigtail, or replace all damaged conductors.

b. b. Straighten conductors that remain and remove corrosion and foreign matter.

c. c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

F. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

G. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

H. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.

3.02 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

26 28 13 FUSES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches and enclosed controllers.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.

b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

3. Current-limitation curves for fuses with current-limiting characteristics.

4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

5. Coordination charts and tables and related data.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.

2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

4. Coordination charts and tables and related data.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

1.05 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.06 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.07 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.

2. Edison Fuse, Inc.

3. Ferraz Shawmut, Inc.

4. Littelfuse, Inc.

2.02 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK1, time delay.

2. Other Branch Circuits: Class J, time delay.

3. Control Circuits: Class CC, time delay.

3.03 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.04 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch.

END OF SECTION

26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1.00 GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.02 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.03 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1, for interior air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 3R, galvanized-steel box with removable interior panel and removable lockable front for exterior locations; Type 4X Stainless steel for Kitchen areas.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of over-current protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

2. Altitude: Not exceeding 6600 feet.

1.06 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.07 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

2. Fuse Pullers: Two for each size and type.

2.00 PRODUCTS

2.01 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Cutler-Hammer

2. General Electric

3. Square D

4. No other manufacturers will be accepted.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.

5. Hookstick Handle: Allows use of a hookstick to operate the handle.

6. Lugs: Mechanical type, suitable for number, size, and conductor material.

7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.02 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Cutler-Hammer

2. General Electric

3. Square D

4. No other manufacturers will be accepted.

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horse-power rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.

4. Hookstick Handle: Allows use of a hookstick to operate the handle.

5. Lugs: Mechanical type, suitable for number, size, and conductor material.

6. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.03 SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Bussmann, Inc.

2. Eaton Cutler-Hammer

3. Ferraz Shawmut, Inc.

4. Littelfuse, Inc.

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

E. Accessories:

1. Oiltight key switch for key-to-test function.

2. Oiltight green ON pilot light.

3. Isolated neutral lug; 100 percent rating.

4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.

5. Form C alarm contacts that change state when switch is tripped.

6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.

7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.04 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: TNEMA 250, Type 1, with continuous-hinge cover with flush latch, for interior air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 12, with continuous-hinge cover with flush latch, for interior non-air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 3R, galvanized-steel box with removable interior panel and removable lockable front for exterior locations; Type 4X Stainless steel for Kitchen areas.

2. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Enclosed switches will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

26 36 00 TRANSFER SWITCHES

1.00 GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.

2. Nonautomatic transfer switches.

3. Remote annunciation systems.

4. Remote annunciation and control systems.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and by-pass/isolation switch.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.

2. List of all factory settings of relays; pro-vide relay-setting and calibration instructions, including software, where applicable.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain automatic transfer switches and nonautomatic transfer switches, remote annunciator and control systems through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for in-tended use.

C. Comply with NEMA ICS 10.

D. Comply with NFPA 70.

E. Comply with NFPA 99.

F. Comply with NFPA 110.

G. Comply with UL 1008 unless requirements of these Specifications are stricter.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactor Transfer Switches:

    a. Emerson; ASCO Power Technologies, LP.

    b. GE Zenith Controls.

    c. Russelectric, Inc.

    d. Onan.

2. Transfer Switches Using Molded-Case Switches or Circuit Breakers:

    a. Eaton Electrical Inc.; Cutler-Hammer.

    b. GE Zenith Controls.

    c. Hubbell Industrial Controls, Inc.

    d. Onan.

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

   1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

   1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.

   2. Switch Action: Double throw; mechanical-ly held in both directions.

   3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

J. Battery Charger: For generator starting batteries.

   1. Float type rated 2 A.

   2. Ammeter to display charging current.

3. Fused ac inputs and dc outputs.

K. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

L. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 26 Section "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suit-able for types and sizes of field wiring indicated.

2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.

3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

M. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.03 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

H. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.

I. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.

J. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

3. Voltage/Frequency Lockout Relay: Pre-vent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

5. Test Switch: Simulate normal-source failure.

6. Switch-Position Pilot Lights: Indicate source to which load is connected.

7. Source-Available Indicating Lights: Super-vise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.

11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.

12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then re-transfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.

    b. Push-button programming control with digital display of settings.

    c. Integral battery operation of time switch when normal control power is not available.

2.04 NONAUTOMATIC TRANSFER SWITCHES

A. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." Switch shall be capable of transferring load in either direction with either or both sources energized.

B. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." In addition, removable manual handle provides quick-make, quick-break manual-switching action. Switch shall be capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.

C. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops (break before make) during switching sequence.

D. Nonautomatic Transfer-Switch Accessories:

1. Pilot Lights: Indicate source to which load is connected.

2. Source-Available Indicating Lights: Super-vise sources via transfer-switch normal- and alternate-source sensing circuits.

a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

b. Emergency Power Supervision: Red light with nameplate engraved "Alternate Source Available."

3. Unassigned Auxiliary Contacts: One set of normally closed contacts for each switch position, rated 10 A at 240-V ac.

4. Switch shall be equipped with a separate interlocked receptacle compartment containing receptacles for quick-connection and disconnection of portable cord-connected equipment.

a. Interlock shall prevent the lower generator switch from being closed while cable compartment door is open, and shall prevent the door from being opened while the switch is closed.

b. Compartment shall be equipped with a spring-assisted door to al-low portable cords to exit the compartment while in use, but shall close when not in use to effectively seal the compartment to prevent insects and small animals from entry.

c. Compartment shall be equipped with receptacles for sufficient cable connection for the ampacity of the switch.

d. Receptacles for switches 200 amps and greater shall be of the single cable per phase design – utilizing quarter turn cam type connections.

e. Receptacles shall be: Cam-Lok type. 600 amp and 800 amp switches shall employ parallel receptacles.

2.05 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.

2. Switch position.

3. Switch in test mode.

4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.

2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.

3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.

4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.06 REMOTE ANNUNCIATOR AND CONTROL SYSTEM

A. Functional Description: Include the following functions for indicated transfer switches:

1. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.

2. Indication of switch position.

3. Indication of switch in test mode.

4. Indication of failure of digital communication link.

5. Key-switch or user-code access to control functions of panel.

6. Control of switch-test initiation.

7. Control of switch operation in either direction.

8. Control of time-delay bypass for transfer to normal source.

B. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.

C. Remote Annunciation and Control Panel: Solid-state components. Include the following features:

1. Controls and indicating lights grouped together for each transfer switch.

2. Label each indicating light control group. Indicate transfer switch it controls, location of switch, and load it serves.

3. Digital Communication Capability: Matched to that of transfer switches supervised.

4. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.

2.07 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

3.00 EXECUTION

3.01 INSTALLATION

A. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

B. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.02 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. In-crease raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.

2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.

3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.

b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.

c. Verify that manual transfer warnings are properly placed.

d. Perform manual transfer operation.

5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.

b. Simulate loss of phase-to-ground voltage for each phase of normal source.

c. Verify time-delay settings.

d. Verify pickup and dropout voltages by data readout or inspection of control settings.

e. Test bypass/isolation unit functional modes and related automat-ic transfer-switch operations.

f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.

g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of nor-mal power, and engine cool-down and shutdown.

6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

C. Testing Agency's Tests and Inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.

b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.

c. Verify that manual transfer warnings are properly placed.

d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.

b. Simulate loss of phase-to-ground voltage for each phase of normal source.

c. Verify time-delay settings.

d. Verify pickup and dropout voltages by data readout or inspection of control settings.

e. Test bypass/isolation unit functional modes and related automat-ic transfer-switch operations.

f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.

g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of nor-mal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

D. Coordinate tests with tests of generator and run them concurrently.

E. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

F. Remove and replace malfunctioning units and retest as specified above.

G. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning de-vice designed to measure temperature or to detect significant deviations from nor-mal values. Provide calibration record for device.

3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.04 3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 01 Section "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION

26 43 13 SURGE PROTECTION DEVICE FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes field-mounted SPD's for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Sections:

1. Division 26 Section "Panelboards" for factory-installed SPD.

1.03 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed voltage rating.

C. SPD: Surge Protection Device(s), both singular and plural.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

B. Qualification Data: For qualified testing agency.

C. Product Certificates: For SPD's, from manufacturer.

D. Field quality-control reports.

E. Operation and Maintenance Data: For SPD's to include in emergency, operation, and maintenance manuals.

F. Warranties: Sample of special warranties.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

C. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

D. Comply with NEMA LS 1.

E. Comply with UL 1449.

F. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

A. Service Conditions: Rate SPD's for continuous operation under the following conditions unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.

2. Operating Temperature: 30 to 120 deg F.

3. Humidity: 0 to 85 percent, noncondensing.

4. Altitude: Less than 20,000 feet above sea level.

1.07 COORDINATION

A. Coordinate location of field-mounted SPD's to allow adequate clearances for maintenance.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Replaceable Protection Modules: Two of each size and type installed.

2.00 PRODUCTS

2.01 SERVICE ENTRANCE SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology Inc.; Danaher Power Solutions.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
4. Leviton Mfg. Company Inc.
5. Square D; a brand of Schneider Electric.

B. Surge Protection Devices:

1. Comply with UL 1449.
2. Modular design with field-replaceable modules.
3. Fuses, rated at 200-kA interrupting capacity.
4. Fabrication using bolted compression lugs for internal wiring.
5. Redundant suppression circuits.
6. Redundant replaceable modules.
7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
8. LED indicator lights for power and protection status.
9. Audible alarm, with silencing switch, to indicate when protection has failed.
10. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
11. Four-digit transient-event counter set to totalize transient surges.

C. Peak Single-Impulse Surge Current Rating: 240 kA per mode/480 kA per phase.

D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2

1. Line to Neutral: 70,000 A.
2. Line to Ground: 70,000 A.
3. Neutral to Ground: 50,000 A.

E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V, 3-phase, 4-wire circuits shall be as follows:

1. Line to Neutral: 800 V for 480Y/277 V.

2. Line to Ground: 800 V for 480Y/277 V.

3. Neutral to Ground: 800 V for 480Y/277 V.

2.02 PANELBOARD SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology Inc.; Danaher Power Solutions.

2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

4. Leviton Mfg. Company Inc.

5. Square D; a brand of Schneider Electric.

B. Surge Protection Devices:

1. Comply with UL 1449.

2. Modular design with field-replaceable modules.

3. Short-circuit current rating complying with UL 1449, and matching or exceeding the panel-board short-circuit rating and redundant suppression circuits; with individually fused met-al-oxide varistors.

4. Fuses, rated at 200-kA interrupting capacity.

5. Fabrication using bolted compression lugs for internal wiring.

6. Redundant suppression circuits.

7. Redundant replaceable modules.

8. Arrangement with wire connections to phase buses, neutral bus, and ground bus.

9. LED indicator lights for power and protection status.

10. Audible alarm, with silencing switch, to indicate when protection has failed.

11. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. .

12. Four-digit transient-event counter set to totalize transient surges.

C. Peak Single-Impulse Surge Current Rating: 150 kA per mode/300 kA per phase.

D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2:

1. Line to Neutral: 70,000 A.

2. Line to Ground: 70,000 A.

3. Neutral to Ground: 50,000 A.

E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V or 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:

1. Line to Neutral: 1200 V for 480Y/277 V and 800 V for 208Y/120 V.

2. Line to Ground: 1200 V for 480Y/277 V and 900 V for 208Y/120 V.

3. Neutral to Ground: 1000 V for 480Y/277 V and 700 V for 208Y/120 V.

2.03 ENCLOSURES

A. Indoor Enclosures: NEMA 250 Type 12.

B. Outdoor Enclosures: NEMA 250 Type 3R.

3.00 EXECUTION

3.01 INSTALLATION

A. Install SPD’s at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install SPD’s for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide multiple, 30-A circuit breaker minimum as a dedicated disconnecting means for SPD’s unless otherwise indicated. Coordinate circuit breaker with the SPD manufacturer.

3.02 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

3.03 STARTUP SERVICE

A. Do not energize or connect service entrance equipment panelboards to their sources until SPD’s are installed and connected.

B. Do not perform insulation resistance tests of the distribution wiring equipment with the SPD’s installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to maintain SPD’s.

END OF SECTION

26 51 00 INTERIOR LIGHTING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures and drivers.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections include the following:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.03 DEFINITIONS

A. CRI: Color-rendering index.

B. CU: Coefficient of utilization.

C. LER: Luminaire efficacy rating.

D. Luminaire: Complete lighting fixture, including ballast housing if provided.

E. RCR: Room cavity ratio.

1.04 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast.

4. Energy-efficiency data.

5. Life, output, and energy-efficiency data for lamps.

6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.

B. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Lighting fixtures.

2. Suspended ceiling components.

3. Other items in finished ceiling including the following:

    a. Air outlets and inlets.

    b. Sprinklers.

    c. Smoke and fire detectors.

    d. Occupancy sensors.

    e. Audio/Visual equipment including projectors and monitors.

C. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.07 WARRANTY

A. Warranty Period for LED fixtures, including LED drivers: Five years from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

2. Battery and Charger Data: One for each emergency lighting unit.

2.00 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified in Lighting Fixture Schedule.

2.02 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position.

F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 90 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

2.03 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.

b. Charger: Fully automatic, solid-state type with sealed transfer relay.

c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.04 DRIVERS FOR LED FIXTURES

A. Electronic Driver for LED Fixtures: Comply with UL 1310 Class 2 requirements for dry and damp locations. Include the following features unless otherwise indicated:

1. Rated for 50,000 hours of life, unless otherwise noted.
2. Sound Rating: Class A.
3. Total Harmonic Distortion Rating: <15 percent.
4. Current Crest Factor: 1.5 or less.
5. 0-10V dimming, standard (no step dimming).

2.05 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, nickel-cadmium type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Integral Time-Delay Relay: Holds unit on for fixed interval of 10 minutes when power is restored after an outage.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.06 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel.

C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

2.07 LED FIXTURES

A. Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on fixture schedules.

B. Include the following features unless otherwise indicated:

1. Each Luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).

2. Each luminaire shall be rated for a minimum operational life of 50,000 hours utilizing a minimum ambient temperature of (25°C).

3. Light Emitting Diodes tested under LM-80 Standards for a minimum of 12,000 hours.

4. Color Rendering Index (CRI) of 82 at a minimum.

5. Color temperature 3500 K, unless otherwise indicated.

6. Rated lumen maintenance at 70% lumen output for 50,000 hours, unless otherwise indicated.

7. Fixture efficacy of 60 Lumens/Watt, minimum.

8. 5 year luminaire warranty, minimum.

9. Photometry must comply with IESNA LM-79.

10. The individual LEDs shall be constructed such that a catastrophic loss of the failure of one LED will not result in the loss of the entire luminaire.

11. Luminaire shall be constructed such that LED modules may be replaced or repaired without the replacement of the whole fixture.

C. Technical Requirements:

1. Luminaire shall have a minimum efficacy of 60 lumens per watt. The luminaire shall not consume power in the off state.

2. Operation Voltage: The luminaire shall operate from a 50 HZ to 60 HZ AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.

3. Power Factor: The luminaire shall have a power factor of 0.9 or greater.

4. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 15 percent.

5. Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.

D. Thermal Management

1. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.

2. The LED manufacturer's maximum thermal pad temperature for the expected life shall not be exceeded.

3. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.

4. The luminaire shall have a minimum heat sink surface such that LED manufacturer's maximum junction temperature is not exceeded at maximum rated ambient temperature.

3.00 EXECUTION

3.01 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.

2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

26 56 00 EXTERIOR LIGHTING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.03 DEFINITIONS

A. CRI: Color-rendering index.

B. HID: High-intensity discharge.

C. Luminaire: Complete lighting fixture, including ballast housing if provided.

D. Pole: Luminaire support structure.

1.04 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
6. Photoelectric relays.
7. Ballasts, including energy-efficiency data.

8. Lamps, including life, output, and energy-efficiency data.

9. Materials, dimensions, and finishes of poles.

10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.

B. Qualification Data: For agencies providing photometric data for lighting fixtures.

C. Field quality-control test reports.

D. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.

2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.

3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

2.00 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified in Lighting Fixture Schedule.

2.02 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or de-form in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to pre-vent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

K. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

L. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

M. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Color: As indicated on Lighting Fixture Schedule.

3.00 EXECUTION

3.01 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated supports.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.02 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems."

3.03 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

END OF SECTION

DIVISION 27
COMMUNICATIONS

27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

1.00 GENERAL

1.01 SUMMARY

A. Structured cabling for voice and data

B. Grounding and Bonding

C. Cable Pathways

D. Cable management

E. Outfitting of communication equipment rooms

1.02 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

A. Foundations and pads required for equipment furnished under this Division

B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.

C. Flashing of conduits into roofing and outside walls.

D. Heating, ventilating, and air conditioning equipment.

E. Electrical service to equipment rooms.

F. Cutting and patching for low voltage systems work, except for errors and omissions under this Division.

1.03 RELATED WORK - OWNER FURNISHED EQUIPMENT AND SYSTEMS

A. Telephone system electronics

B. Data network electronics

C. Computer workstations, servers, printers and other peripherals

1.04 QUALITY ASSURANCE

A. Contractor shall identify all types of quality control mechanisms they employ. Please list.

B. Perform work in accordance with contract documents.

C. All personnel performing the work of this Section shall be thoroughly familiar with the cabling methods set forth in the latest release of the BICSI TDMM (Building Industry Consulting Services International Telecommunications Distribution Methods Manuals).

D. Contractor’s RCDD shall review all required work prior to commencing. The Contractor’s RCDD shall oversee the installation and will have the end responsibility for the quality of the installation work performed. All submitted designs and or changes to the design shall be approved and signed off by the Contractor’s RCDD.

E. The installed cabling systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades cabling systems.

F. Expansion Capability: Unless otherwise indicated, provide spare positions in wall fields, cross connects, and terminal strips, and space in cable pathways to accommodate twenty (20) percent future growth in campus distribution and riser.

G. Backward Compatibility: The provided solution shall be backward compatible with lower category ratings such that if higher category components are used with lower category components, the permanent link and channel measures shall meet or exceed the lower channel's specified parameters.

H. Component Compliance: The provided solution's components shall each meet the minimum transmission specifications listed herein such that no individual component will be less than specifications for permanent and channel, regardless of the fact that tests for permanent and channel ultimately meet required specifications.

I. Pre-installation inspection: Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.

J. Test optical fiber cable while on reels. Use an optical time domain reflectometer (OTDR) to verify the cable length and locate cable defects, splices, and connector, including the loss value of each.

K. Test each pair of UTP cable for open and short circuits. Test results to be submitted to Owner.

L. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.05 STANDARDS

A. The Contractor's performance of the Work shall comply with applicable federal, state and local laws, rules and regulations. The Contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections and shall pay without burden to The Owner, all fees and charges in connection therewith unless specifically provided otherwise. In the event of violation, the Contractor shall pay all fines and penalties, including attorney's fees and other defense costs and expenses in connection therewith.

B. Federal Communications Commission

1. Equipment requiring FCC registration or approval shall have received such approval and shall be appropriately identified.

C. Codes, Standards and Ordinances

1. Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with NFPA-70(National Electrical Code®), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:

a. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015

b. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2015

c. ANSI/TIA/EIA Standards

1) ANSI/TIA-568.0-D – Generic Telecommunications Cabling for Customer Premises, 2015
2) ANSI/TIA-568.0-D – Generic Telecommunications Cabling for Customer Premises – Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling, 2015
3) ANSI/TIA/EIA-568.1-D – Commercial Building Telecommunications Cabling Standard, 2009 - Part 1: General Requirements, 2015
4) ANSI/TIA/EIA-568-C.2 – Commercial Building Telecommunications Cabling Standard, 2014 - Part 2: Balanced Twisted Pair Cabling Components
5) ANSI/TIA/EIA-568.3-D – Optical Fiber Cabling Components Standard, 2016
6) ANSI/TIA/EIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces, 2015
7) ANSI/TIA/EIA-606-C – The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2017
8) ANSI-J-STD-607-C – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2015
9) ANSI/TIA/EIA-526-7 – Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, 2015
10) ANSI/TIA/EIA-526-14A – Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant, 2015
11) ANSI/TIA/EIA-758-B – Customer-Owned Outside Plant Telecommunications Cabling Standard, 2012
12) ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2016
13) TIA/EIA TSB-67 – Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems.
14) NEMA-VE-1 – Metal Cable Tray Systems, 2009
15) NEMA-VE-2 – Metal Cable Tray Installation Guidelines, 2006
16) NFPA-70 – National Electrical Code, 2016
17) UFC 3-580-01 – DoD Unified Facilities Criteria, Telecommunications Interior Infrastructure Planning and Design, June 1, 2016
18) Install cabling in accordance with the most recent edition of BICSI® publications:
19) BICSI – Telecommunications Distribution Methods Manual, 13th Edition
20) BICSI – Cabling Installation Manual
21) Federal, state, and local codes, rules, regulations, and ordinances governing the Work, are as fully part of the specifications as if herein repeated or hereto attached. If the Contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Owner's Representative in writing. Where the requirements of other sections of the specifications are more stringent than

applicable codes, rules, regulations, and ordinances, the specifications shall apply.

22) American Society for Testing and Materials (ASTM): ASTM E. 814 – Standard Test Method for Fire Tests of Penetration Firestop Systems

23) Underwriters Laboratories, Inc. (UL): UL 1479 – Tests of Through-Penetration Firestop Systems

24) Americans with Disabilities Accessibility Guidelines.

25) Code of Federal Regulations, Title 29, Chapter XVII, Part 1910 (OSHA).

26) Uniform Building Code (UBC).

27) International Building Code (IBC).

28) Texas Department of State Health Services (TDSHS).

29) Applicable codes and directives of authorities having jurisdiction

1.06 COMPLETENESS OF WORK

A. The Contract Documents depict low voltage systems which are intended to be complete and functioning systems. All products, materials, labor, and programming necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.

B. Catalog numbers referenced throughout this Division's drawings and specifications are intended to convey a general understanding of the type of quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra charge shall be allowed because a catalog number is found to be incomplete or obsolete.

1.07 PRE-INSTALLATION CONFERENCE

A. Arrange and schedule pre-installation conference prior to beginning any work of this section Communications.

B. Agenda: Clarify questions in writing related to work to be performed, scheduling, coordination, etc. with consultant and/or project manager/Owner representative.

C. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisor and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate, or test communications cables on the project. The Contractor's RCDD that will oversee the installation is required to attend the pre-installation conference.

D. The manufacturer that will be providing the extended warranty is required to have a representative attend the pre-installation conference.

1.08 SEQUENCE AND SCHEDULING

A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed

schedule of work to be performed. This schedule shall be submitted with the bid and if accepted will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

D. Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, Owner acceptance, and demolition completion.

1.09 SUBMITTALS

A. Comply with provisions of Division 01.

B. Produce Shop Drawings for section 27 05 28, 27 11 00, 27 13 00, 27 15 00 and 27 41 30.

1.10 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

A. If a proposed alternate material is equal to or exceeds specified requirements, Contractor shall provide manufacturer's specifications in writing for written approval prior to purchase and installation of proposed materials. The proposed material substitution shall not void or change manufacturer's warranty.

B. Contractor shall provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing. Contractor shall respond to these changes with a complete material list, labor, and taxes in writing presented to the Owner for approval. Contractor shall not proceed with additional scope of work without a signed approval by the Owner.

C. Additional work performed by the Contractor will not be paid by Owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

1.11 USE OF THE SITE

A. Use of the site shall be at the Owner's direction in matters in which the owner deems it necessary to place restriction.

B. Access to building wherein the Work is performed shall be as directed by the Owner.

C. The Owner will occupy the premises during the entire period of construction for conducting his or her normal business operations. Cooperate with the owner to minimize conflict and to facilitate the owner's operations.

D. Schedule necessary shutdowns of plant services with the Owner, and obtain written permission from the owner. Refer to article - CONTINUITY OF SERVICES herein.

E. Proceed with the Work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the owner.

F. All Contractor personnel must check in with the facilities engineering department and/or the General Contractor upon arrival and upon departure.

1.12 DELIVERY AND STORAGE

A. Insofar as possible, deliver items in manufacturers' original unopened packaging. Where this is not practical, cover items with protective materials, to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.

B. Store items in a clean dry place and protect from damage.

C. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

D. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

E. Provide protective covering during construction to prevent damage or entrance of foreign matter.

F. Contractor is responsible for on-site security of tools, test equipment and materials.

G. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.13 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 1 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 1 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.

2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).

3. As-built cable schedules with recorded cable routing and lengths of each designated run.

4. As built documentation of all cabling systems.

5. As built documentation of IDF/TR modifications and associated cabinet elevations.

B. Warranty and Maintenance:

1. Test Report Binder(s)

2. Record Drawings

1.14 RECORD DRAWINGS

A. Keep a hard copy set of project drawings at the job site exclusively for recording deviations from the Construction Drawings.

B. Record locations and depths of buried and concealed conduits from fixed, easily identifiable objects, such as building walls. Where conduits are concealed in walls, indicate distances off of building corners or other building features not likely to be disturbed by future alterations.

C. Mark deviations in a different color so that work of various systems can be easily identified.

D. When Work is completed, record all deviations in an electronic format using AutoCAD 2007 in a format usable to the Owner. Coordinate this format with the Owner.

E. Submit two copies of completed "record drawings" on electronic media such as CD or DVD to Owner's Representative for distribution.

2.00 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. All materials and equipment used in carrying out these specifications are to be new and have UL listing, or listing by other recognized testing laboratory when such listings are available.

B. Model numbers and manufacturers included in this specification are listed to establish as standard of product quality.

C. Other qualified manufacturers may be substituted only with The Owner’s written consent. To request a substitution, the Contractor shall submit complete technical data, samples, and if requested, results of independent testing laboratory tests of proposed equipment.

1. If proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.

2. Material not specifically identified within this document but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified material and equipment.

3. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

3.00 EXECUTION

3.01 COORDINATION

A. Insofar as it is possible to determine in advance, advise the General Contractor to leave proper chases and openings. Place all outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work. Should the Contractor neglect doing this, any cutting and/or patching required is to be done at this Contractor’s expense. Visit site and be informed of conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work involved.

B. Carefully coordinate with other divisions to ensure proper power requirements, grounding, fireproofing and interlocking controls between the fire alarm system, security system, and other owner furnished systems.

C. Notify other tradesmen of any deviations or special conditions necessary for the installation of work. Interferences between work of various Contractors to be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to Owner.

D. The Owner or the Owner's Representative shall be the mediating authority in all deviation and disputes arising on project.

E. Coordinate with local telephone and cable service providers to assure that proper points of service, demarcation location and grounding requirements are in accordance with contract drawings. Duct bank is to be provided by Division 26. This Contractor shall be involved regarding discussions about services to the building.

1. Coordinate with other trades to provide wall and ceiling access panels wherever required for access to communication equipment.

F. Intent:

1. These sections of specifications and drawings form a complete set of documents for communications systems for this project. Neither is complete without the other. Any item mentioned in one shall be as binding as though mentioned in both.

2. The intent of these specifications and drawings is to form a guide for a complete systems installation. Where an item is reasonably necessary for a complete system but not specifically mentioned, such as pull boxes, fittings, expansion fittings, support hangers, etc. provide same without additional cost to Owner.

3. Communication equipment room layouts indicted on drawings are diagrammatical only. Exact location of outlets and equipment to be coordinated and governed by project conditions. The Designer reserves the right to make any reasonable changes (approximately 6 feet) in location of junction boxes, or equipment prior to roughing in of such without additional cost to Owner.

G. Deviations:

1. No deviations from specifications and drawings to be made without full knowledge and consent of Designer.

2. Should the Contractor find during progress of work that existing conditions make desirable a modification of the requirements of any particular item, report such item promptly to Designer for his decision and instructions.

H. Main Horizontal Pathway/Raceway

1. Unless otherwise noted on the drawings, all communications/low voltage systems cabling shall be routed above accessible corridor ceilings parallel to room walls and corridors via cable tray or J-hook supports. Cabling shall be segregated by function as follows:

2. Voice/data cabling.

3. All other systems.

3.02 CONTINUITY OF SERVICES

A. The Contractor shall not take any action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the owner's representative. Arrange the Work to minimize shutdown time.

B. Owner's personnel will perform shutdown of operating systems. The Contractor shall give three (3) days' advance notice for systems shutdown.

C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

3.03 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS

A. Trenching, Excavation, and Backfilling is the responsibility of the General Contractor. This Contractor is to coordinate all requirements with the GC. Failure to properly coordinate this effort resulting in additional trenching, excavation, backfilling, or repairs shall be performed without additional cost to Owner.

3.04 PLYWOOD BACKBOARD AND WALL BACKING

A. Contractor shall provide 4' W x 8' H x 3/4" D fire retardant plywood backboard as indicated in all Communication Rooms. Plywood is to be painted with two coats of flat white fire retardant paint on all six sides and installed 6" above finished floor. The fire rating on the plywood shall be masked prior to painting and the mask removed after installation such that the fire rating is always visible.

B. General Contractor is to provide appropriate backing in walls as required for mounting brackets and other wall mounted equipment per manufacturer requirements.

C. Where work is to be done in an existing Telecommunication Room (TR), the Contractor shall ensure plywood in the TR is flame retardant. If the existing plywood does not comply the Contractor shall replace it with plywood compliant with 3.4.A.

3.05 FIRESTOPPING

A. Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications penetration and base each selection on criteria specified herein.

B. Selected systems shall not be less than the hourly time delay ratings indicated in the Contract Documents for each respective fire-rated floor, wall, or other partition of building construction. Firestop for each type of communications penetration shall conform to requirements of an independent testing laboratory design drawing or manufacturer's approved modification when used in conjunction with details shown on the Drawings.

C. Perform all necessary coordination with trades constructing floors, walls, or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.

D. Coordinate each firestop selection with adjacent Work for dimensional or other interference and for feasibility. In areas accessible to public and other "finished" areas, firestop systems

Work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.

E. Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.

F. Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of Firestopping. Remove combustible installation aids after firestopping material has cured.

G. All firestops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.

H. Existing raceways, cable trays, and cabling that penetrate existing building construction shall be firestopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.

I. If required by inspecting authorities:

1. Expose and remove Firestopping to the extent directed by inspecting authority to permit his or her inspection.

2. Reinstall new firestopping and restore Work where removed for inspection.

3.06 TESTS

A. On completion of Work, installation shall be entirely free of damaged conductors, software errors, incomplete jack termination including labeling and faceplates and dust. Perform a thorough operation test in the presence of the Owner or their representative. Provide documentation of all test results as outlined in each system's specifications. Include labor, materials and instruments for above tests.

B. Furnish owner, as a part of closing documents, a copy of such tests including identification of each cable, also the dedicated communication service ground test as required by each systems individual manufacturer indicating compliance with their requirements.

C. Prior to final observation and acceptance, test and leave in satisfactory operating condition, all systems and equipment including but not limited to the following:

1. Grounding.

2. Firestopping of all sleeves and conduits.

3. Telephone and LAN systems.

4. Turn in test results on cabling.

3.07 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches, and abrasions. This includes touching up paint removed for grounding.

B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.

C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.

D. Contractor shall keep all liquids (drinks, Sodas, etc.) off finished floors, carpets, tiles, racks and equipment. If any liquid damage to above finishes or equipment, Contractor shall provide professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense

3.08 INSPECTION FEES AND PERMITS

A. Obtain and pay for all necessary permits and inspection fees required for communication systems installation. Work shall not start until all permit applications are approved.

3.09 OBSERVATIONS

A. When field observation services are a part of the project scope, the Designer's office will provide periodic observation of the progress of Work specified herein. The purpose of the observation service is to ensure compliance of Contractor's Work with specifications and drawings. The Designer's office may also observe tests required of this Contractor as called for in other sections of the specifications.

B. Specifications and drawings represent Work to be done in view of total project requirements. To eliminate possible conflict with other trades, final location of conduits, jacks, outlets, components, etc., is responsibility of this Contractor. Contractor to provide all supervision required for his personnel to ensure that installation is made in accordance with specifications and drawings and all safety rules and regulations are observed. In event of conflicts of Work on project with other trades, Contractor is to make every reasonable effort to resolve conflict through meetings and discussions with other parties involved, by preparation of drawings, or other appropriate action. Only after this has been done shall the Designer's assistance be requested through the RFI process.

C. When the Designer is requested to visit the project to aid in resolution of conflicts, or for witnessing tests, they shall be given a minimum of 48 hours notice prior to time their presence is requested at job site.

3.10 WARRANTY-GUARANTEE

A. The Designer reserves right to accept or reject any part of the installation which does not successfully meet requirements as set out in these specifications.

B. This Contractor shall, and hereby does, guarantee all Work installed under this division shall be free from defects in workmanship and materials for a period of one year from date of final acceptance. This Contractor further agrees to repair or replace any defective material or workmanship which is or becomes defective within the terms of this warranty-guarantee.

C. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

END OF SECTION

27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS

1.00 GENERAL

1.01 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. This section includes the minimum requirements for the installation of telecommunications grounding systems in Telecommunications Rooms.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Telecommunications Grounding Busbars
2. Ground Blocks
3. Compression Lugs
4. Bonding Conductors

1.02 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. ANSI American National Standards Institute
2. AWG American Wire Gauge
3. BICSI Building Industry Consulting Service International
4. EIA Electronics Industries Alliance
5. NECA National Electrical Contractors Association
6. NEMA National Electric Manufacturers Association
7. NFPA National Fire Protection Association
8. RCDD Registered Communications Distribution Designer
9. RFP Request for Proposal
10. STD Standard
11. TGB Telecommunications Grounding Busbar
12. TIA Telecommunications Industry Association
13. TMGB Telecommunications Main Ground Bus Bar
14. UL Underwriters Laboratories

1.03 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the Owner.

C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing telecommunications grounding systems.

D. Contractor’s Qualifications:

1. Firms regularly engaged in the installation of Electrical Systems or Data Communications cabling and that have installation experience with systems similar to that required for this project.

2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.

3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.

4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician shall be a full-time employee of the contractor.

5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the Owner.

E. Manufacturer’s Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015

2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006

3. ANSI/TIA-568.0-D – Generic Telecommunications Cabling for Customer Premises, 2015

4. ANSI/TIA-568.1-D – Commercial Building Telecommunications Cabling Standard, 2015

5. ANSI/TIA/EIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces, 2015
6. ANSI/TIA/EIA-606-C – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2017
7. ANSI-J-STD-607-C – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2015
8. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2017
9. NFPA 70 – National Electric Code, 2016
10. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
11. NEMA – VE 1 – Metal Cable Tray Systems, 2009
12. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006
13. UFC 3-580-01 – DoD Unified Facilities Criteria, Telecommunications Interior Infrastructure Planning and Design, June 1, 2016
14. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.04 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the Owner in writing prior to commencement of affected work.

1.05 PERMITS

A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.06 SCHEDULING

A. The Contractor shall comply with all scheduling requests established by Owner, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.07 REQUIREMENTS

A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The Owner must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the Owner in writing.

E. The Owner reserves the right to waive these requirements at any time.

1.08 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. Provide all submittal requirements under this section as a single package.

D. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.

2. Proposed format of as-built documentation.

1.09 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.

2. Provide above closeout documentation as an electronic file in PDF format.

B. Warranty and Maintenance:

1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the Owner.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01, or for a period of 1 year from final completion, whichever is longer. Repair or replace defects occurring in labor or product within the Warranty period without charge.

B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

2.00 PRODUCTS

2.01 GENERAL

A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.02 WALL-MOUNT BUSBARS

A. Telecommunications Grounding Busbar (TGB)

1. Telecommunications Grounding Busbar (TGB) shall be constructed of .25 in. (6.4 mm) thick solid copper bar.
2. The busbar shall be 4 in. (101 mm) high and minimum 12 in. (304.8 mm) long and shall have at least 18 attachment points for two-hole grounding lugs.
3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD-607-**C** and shall accept at least 3 lugs with 5/8 in (15.8 mm) hole centers and 3 lugs with 1 in. (25.4) mm) hole centers.
4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 2 in. (50 mm) standoff from the wall.
5. The busbar shall be UL Listed as grounding and bonding equipment.
6. Approved products:
    a. Chatsworth Products 40153-020
    b. Cooper Industries SBTGB
    c. Approved equivalent.

2.03 BONDING CONDUCTORS

A. Telecommunications Bonding Conductor

1. Telecommunications bonding conductor shall be a minimum size #6 AWG stranded, annealed copper conductor, with a PVC jacket.
2. Conductor shall be constructed with a green insulated jacket.
3. Conductor shall be UL-listed Type THHN or THWN-2, suitable for operation at 600V, at conductor temperatures of up to 105° F.

2.04 BONDING ACCESSORIES

A. Lay-In Ground Terminal Block

1. Ground terminal block shall be made of electroplated tin aluminum extrusion.
2. Ground terminal block shall accept conductors ranging from #14 AWG through 1/0.
3. The conductors shall be held in place by two stainless steel set screws.
4. Ground terminal block shall have two 1/4 in. (6.4 mm) holes spaced on 5/8 in. (15.8 mm) centers to allow secure two-bolt attachment to the rack or cabinet.
5. Ground terminal block shall be UL Listed as a wire connector.
6. Acceptable Manufacturers:
    a. Chatsworth Products 40167-001
    b. Cooper Industries SBLL 1
    c. Approved equivalent

B. Compression Lugs

1. Compression lugs shall be manufactured from electroplated tinned copper.
2. Compression lugs shall have two holes spaced on 5/8 in. (15.8 mm) or 1 in. (25.4 mm) centers, as stated below, to allow secure two bolt connections to bus bars.
3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
4. Compression lugs shall be UL Listed as wire connectors.
5. Acceptable Manufacturers:
    a. Chatsworth Products 40162
    b. Cooper Industries SBCL Series
    c. Approved equivalent

3.00 EXECUTION

3.01 INSTALLATION

A. Wall-Mount Busbars

1. Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.
2. Conductor connections to the TMGB or TGB shall be made with 2-Hole Bolt-On Compression Lugs sized to fit the busbar and the conductors.
3. Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
4. The wall-mount busbar shall be bonded to the main building ground, in the nearest electrical room, as part of the overall Telecommunications Bonding and Grounding System.

B. Grounding of Cable Tray

1. Install Green #6 AWG bonding jumper (12 in. max) with grounding bolts at each cable tray joint.
2. Install Green #6 AWG grounding conductor, with grounding bolts, from side of cable tray down to TMGB or TGB. Maintain a horizontal or downward path from the cable tray to the TMGB or TGB. Drill and tap side of cable tray (for appropriate size bolt, 1/4 in. x 20 min.), making sure that bolt does not extend into wire management part of tray.

C. Grounding of Racks and Cabinets

1. Every rack and cabinet shall be bonded to the TMGB or TGB.
2. Install a lay-in terminal block on the rack/cabinet to accept the bonding conductor.

a. Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

3. Install a bonding conductor from the terminal block in the rack/cabinet to the TMGB or TGB. Terminate the conductor at the TMGB/TGB with a two-hole compression lug.

D. Installation of Bonding Conductors

1. Shall be routed so to minimize bends and length.
2. Shall be a minimum of #6 AWG.
3. Bonding Conductors shall maintain a horizontal or downward path to the TMGB or TGB. No bend shall form an included angle of more than 90 degrees or have a radius of less than 6 in.

E. Grounding Voice and Data Systems

1. Provide an approved ground at all newly installed distribution frames and protector locations using proper bonding to any existing facility. Ensure ground continuity by properly bonding to any existing facility. Ensure ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, and framework. All grounds shall consist of minimum #6 AWG copper wire and shall be supplied from the Telecommunications Main grounding Busbar or a Telecommunications Grounding Busbar.
2. Bond metallic conduits at one end to proper ground.
3. Provide maximum 0.5 Ohm resistance at 0.05 volts at each ground bar.
4. Ground electronic components, equipment cabinets and racks, cable trays and cable racks.
5. Provide ground lead for copper cable in multiples of 25 or more.
6. For overall-shielded cable, bond shield to proper grounding sources at one end. Do not loop ground leads or share with conduit ground leads.

END OF SECTION

27 05 28 PATHWAYS FOR COMMUNICATIONS SYSTEMS

1.00 GENERAL

1.01 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. This section includes the minimum requirements for the installation of communications cable pathways outside of Telecommunications Rooms.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Non-Continuous Cable Support Systems
2. Fire-Rated Pathway Devices
3. Multi-Service Poke-Through Devices
4. Conduit Systems
5. Junction Boxes/ Pull Boxes

1.02 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. AFF Above Finished Floor
2. ANSI American National Standards Institute
3. ASTM American Society for Testing and Materials International
4. BICSI Building Industry Consulting Service International
5. BOCA Building Officials and Code Administrators International,
6. CAN Canada/Canadian
7. EIA Electronics Industries Alliance
8. EMT Electrical Metallic Tubing
9. HVAC Heating, Ventilating and Air Conditioning
10. NEC National Electric Code
11. NECA National Electrical Contractors Association
12. NEMA National Electric Manufacturers Association
13. NFPA National Fire Protection Association
14. OAR Owner’s Authorized Representative
15. OD Outer Diameter
16. RCDD Registered Communications Distribution Designer

17. RFP Request for Proposal
18. RMC Rigid Metallic Conduit
19. STD Standard
20. TIA Telecommunications Industry Association
21. UL Underwriters Laboratories
22. ULC Underwriters Laboratories of Canada

1.03 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing cable pathways.

D. Contractor’s Qualifications:

1. Firms regularly engaged in the installation of Electrical Systems or Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.

2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.

3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.

4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician shall be a full time employee of the contractor.

5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.

E. Manufacturer’s Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015
2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
3. ANSI/TIA-568.0-D – Generic Telecommunications Cabling for Customer Premises, 2015
4. ANSI/TIA-568.1-D – Commercial Building Telecommunications Cabling Standard, 2015
5. ANSI/TIA/EIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces, 2015
6. ANSI/TIA/EIA-606-C – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2017
7. ANSI-J-STD-607-C – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2015
8. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2017
9. NFPA 70 – National Electric Code, 2016
10. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
11. NEMA – VE 1 – Metal Cable Tray Systems, 2009
12. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006
13. UFC 3-580-01 – DoD Unified Facilities Criteria, Telecommunications Interior Infrastructure Planning and Design, June 1, 2016
14. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.04 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.05 PERMITS

A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.06 SCHEDULING

A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.07 REQUIREMENTS

A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.

E. The Owner reserves the right to waive these requirements at any time.

1.08 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. Produce Shop Drawings for ALL horizontal and vertical pathways, to include but not limited to, dimensions/size of pathway, routing placement and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements as well as vertical and horizontal offsets and transitions.

D. Provide all submittal requirements under this section as a single package.

E. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
2. Proposed format of as-built documentation.

1.09 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
   1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
   2. Provide above closeout documentation as an electronic file in PDF format.
   3. As built documentation of all pathway systems to include cable tray, conduits (horizontal and vertical), and non-contiguous support.

B. Warranty and Maintenance:
   1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01, or for a period of 1 year from date of final completion, whichever is longer. Repair or replace defects occurring in labor or product within the Warranty period without charge.

B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

2.00 PRODUCTS

2.01 GENERAL

A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.02 NON-CONTINUOUS CABLE SUPPORT SYSTEMS

A. Non-Continuous Cable Supports (J-Hooks)

1. Non-continuous cable supports shall provide a complete horizontal and vertical 1in bend radius control to help prevent degradation of cable performance.
2. Shall be UL 2043 and CAN/ULC S102.2 listed and are suitable for use in air handling spaces.
3. Support shall provide a retainer, or cable tie entry for securing cable bundles within the cable support.
4. Approved Products:
    a. Erico CADDY CAT HP System
    b. Panduit J-PRO Cable Support System
    c. Approved Equivalent

2.03 FIRE-RATED PATHWAY DEVICES

A. Provide through-wall fire-rated pathway devices, as required.

1. Cables penetrating through fire-rated floors or walls shall utilize fire-rated pathway devices capable of providing an F rating equal to the rating of the barrier in which the device is installed.
2. The device shall be tested for smoke leakage (L rating) and shall not require the use of any optional sealing materials to achieve the published rating.
3. The device shall utilize a fire and smoke sealing system that automatically adjusts to the addition or removal of cables.

4. Wiring devices shall be capable of allowing a 0 to 100-percent visual fill of cables.
5. Wire devices shall be of a sufficient size to accommodate the quantity and size of data cables required and shall be suitable for use with new or existing cable installations.
6. The installed device (in normal use) shall require no maintenance and shall accommodate future cable changes without mechanical adjustment and/or removal or replacement of protective materials.
7. Approved Products:
    a. Hilti CP 653 Firestop Speed Sleeve
    b. Hilti CFS-SL RK Firestop Retrofit Sleeve Kit
    c. Hilti CP 657 Firestop Brick
    d. Hilti FS ONE Intumescent Firestop Sealant
    e. Hilti CP 620 Fire Stop Foam
    f. Approved equivalent

2.04 CABLE TRAY SYSTEMS

A. Wire Mesh Cable Tray
1. Provide wire mesh cable tray on the concourse and support spaces, as shown on the drawing set.
2. Wire mesh cable tray shall be manufactured from round steel wire that is a minimum of .196” (5mm) in diameter. Wires shall be welded at intersections to form a 2” x 4” (50.8mm x 101.6mm) grid pattern. The tray shall be U-shaped with equal height sidewalls.
3. Individual tray sections shall be 12" (300mm) wide, unless shown otherwise on plans, with 4” (105mm) high sidewalls.
4. Tray ends will be formed downward at 90° to allow easy drop-in installation with approved supports.
5. Wire mesh cable tray shall be zinc electroplated after fabrication.
6. Wire mesh cable tray shall be UL Classified for grounding purposes.
7. Acceptable systems:
    a. Cablofil CF105/000 EZ
    b. Chatsworth 34821-512
    c. Cooper B-Line FT4X12 EG
    d. Approved equivalent.

B. Wire Mesh Cable Tray Accessories
1. Provide a bend radius to connect the sidewalls of adjoining wire mesh cable tray wherever a splice or an intersection in the cable tray pathway results in a 4" or wider

gap between the sidewalls. The bend radius should be the same height as the sidewalls of the wire mesh cable tray.

2. Provide elevation change hinges to form cable over a smooth curve wherever cable tray changes elevations.
3. Provide conduit adapters for all conduit that transitions into the cable tray.
4. Wire mesh cable tray accessories will be manufactured from steel extrusion and/or sheet.
5. Wire mesh cable tray accessories will be pre-galvanized before fabrication.
6. Acceptable products:
    a. Cablofil
        1) Part Number EZT90KIT Bend Radius Kit
        2) Part Number EAC Elevation Change Kit
        3) Part Number CE40CC & CH Conduit Adapter
    b. Chatsworth 34740-501 Bend Radius Kit
    c. Cooper B-Line
        1) Part Number 90 DEGREE KITEG Bend Radius Kit
        2) Part Number FTAxxxCCGLV Conduit Connector
    d. Approved equivalent

C. Wire Mesh Cable Tray Splices and Fasteners

1. Provide a method of simultaneously splicing, bonding and securing intersecting wire mesh cable tray sections to supports when supports are placed directly under a wire mesh cable tray pathway at a splice point, intersection point, or at the beginning or end of a change in elevation.
2. Provide a method of splicing and bonding wire mesh cable tray sections together at a splice point or an intersection point that is not located directly over a support.
3. Provide a method for bonding and securing wire mesh cable tray to supports when supports are placed mid-span (in between a splice or intersection point) along a wire mesh cable tray pathway.
4. Provide a method for attaching a bonding conductor to the wire mesh cable tray.
5. Acceptable products:
    a. Cablofil
        1) EDRN
        2) PRECLICK
        3) FASLOCK
        4) GNDSB
        5) GNDCL

b. Chatsworth

1) 34738-501

2) 34739-501

3) 34838-001

c. Cooper B-Line

1) FSTLCZN

2) GROUND BOLT

d. Approved equivalent

D. Wire Mesh Cable Tray Supports

1. Supports will be sized at minimum to match the width of the wire mesh cable tray that is supported. The support may be wider than wire mesh cable tray.
2. Support design will allow the support to be placed under a wire mesh cable tray at any point mid-span or directly under a pathway splice or intersection.
3. Each support location will utilize a trapeze mounted support bracket in the cable tray, allowing drop-in of installed cabling.
4. Each support will be punched with an alternating obround and round hole-pattern that accepts wire mesh cable tray ends which are formed downward at 90° and self-threading splice plate attachment hardware.
5. When placed directly under a splice or intersection, the support will allow drop-in attachment of cable tray. Splice hardware will splice cable trays and secure wire mesh cable trays to the support.
6. Supports will be manufactured from steel extrusion and/or sheet.
7. Wire Mesh Cable Tray Supports will be zinc electroplated after fabrication.
8. Acceptable products:
   a. Cablofil FASP 300
   b. Chatsworth 34730-512
   c. Cooper B-Line FTB12CT
   d. Approved equivalent.

E. Wire Mesh Cable Tray Installation Tools

1. Provide cutting and forming tools, as required, for field fabrication of wire mesh cable tray pathways.
2. Provide tools, as required, for pulling cable around turns, bends or intersections in wire mesh cable tray pathway.

F. Wire Mesh Cable Tray Support – Installation Hardware

1. Provide installation hardware to attach wire mesh cable tray supports to building structure.

G. Flexible conduit

1. Provide flexible plastic conduit for wall feeds to modular furniture.
2. Conduit to be 2” diameter and black in color.
3. Conduit to be terminated with liquid tight straight connectors, with NPT threads.
4. Include appropriate wall plates that adapt to the conduit connectors.
5. Approved products:
    a. Heyco 8456 Liquid Tight Tubing, 2”, Black
    b. Heyco 8642 Nylon Straight Connector, 2”, Black

2.05 CONDUIT SYSTEMS

A. General

1. Provide conduit for technology systems as required for installation of communications infrastructure.
2. All conduit system components shall be UL rated.
3. All conduit system components shall comply with the NEC.
4. All conduit fittings, junction and pull boxes shall provide minimum cable bend radius is accordance with ANSI/EIA/TIA-569B.
5. All conduit fittings shall have plastic bushings on all exposed conduit ends.

B. Rigid Metal Conduit (RMC) and Fittings before Coating:

1. RMC shall be UL6 listed and conform to ANSI C80.4 and NEC Article 344.
2. RMC coating shall comply with WW-C-581d.

C. Electrical Metallic Tubing (EMT):

1. EMT shall be UL listed and conform to NEC Article 358.
2. EMT fittings shall be formed steel compression ring type. Die cast fittings are not allowed.
3. Only manufacturer’s fittings, adapters, and terminators shall be used.
4. All transition junction and pull boxes, fittings terminators and adapters shall be a metallic material.
5. Shall be used inside buildings only.

D. Flexible conduit for pathways, other than modular furniture feeds, is not permitted.

E. Plastic conduit is not permitted for above-ground use, other than for modular furniture feeds.

F. Conduit Bodies are not permitted.

G. Conduit Fittings

1. All above ground fittings shall be of metallic material.

2. Conversion fittings are required for non-metallic (below ground) to metallic (above ground) transitions.
3. All fittings shall be compression or threaded.
4. Fittings shall provide a secure connection for pulling communications cables.
5. Setscrew fittings are not permitted.

2.06 JUNCTION BOXES / PULL BOXES

A. All pull boxes shall be constructed with a minimum of 14 gauge Galvanized Steel with an ANSI 61 grey polyester powder finish inside and out over Phosphatized surfaces or Galvanizes Steel unless otherwise specified.

B. All pull boxes shall be minimum NEMA Type 1 rated on concourse level indoor spaces. Pull boxes shall be minimum NEMA Type 3R rated in ramp spaces and outdoor locations. Boxes are to be sized according to the table below unless otherwise specified.

C. All pull boxes shall have flat, removable covers fastened with plated steel screws within unique keyhole screw slots in the cover to permit removal of the cover without extracting screws unless otherwise specified.

Maximum Trade Size of Conduit (inches)	Minimum Box Size (inches)			For Each Additional Conduit Increase Width (inches)
	Width	Length	Depth	
1	4	16	3	2
1.25	6	20	3	3
1.5	8	27	4	4
2	8	36	4	5
2.5	10	42	5	6
3	12	48	5	6
3.5	12	54	6	6
4	15	60	8	8

D. All removable box covers shall be connected to box with a safety strap or chain.

E. All pull boxes shall provide the appropriate provisioning for grounding.

3.00 EXECUTION

3.01 GENERAL

A. Raceways shall be mechanically and electrically connected to all boxes and fittings and shall be properly grounded per NEC.

B. The routing and location of all conduits, cable tray, cable hooks and other raceways shall be coordinated with other trades prior to and during building construction to avoid delays and conflicts.

C. Conduit shall be provided for all security system infrastructure pathway, unless specifically noted otherwise on the drawings.

D. Where raceways pass through walls, partitions and floors, seal penetrations to provide a neat installation that will maintain the integrity of the waterproofing or fireproofing, as applicable, of the structure. Coordinate installation requirements with roofing installer where conduits pass through the roof.

E. All Raceways shall be run at least 6-inches from hot flues, steam pipes, hot water pipes and other hot surfaces.

F. All raceways entering a building from underground shall be sealed to prevent water, moisture, gas, or other foreign matter from entering the building. Service conduits shall be sealed in accordance with NEC 230-8.

G. Contractor’s on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and records drawings.

H. DO NOT route communication pathways under HVAC condensing units.

I. Expansion Fittings:

1. Raceways shall be provided with expansion fitting where necessary to compensate for thermal expansion and contraction.

2. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit funs where necessary. Provide bonding jumpers across fittings in metal raceway systems.

3.02 INSTALLATION

A. Non-Continuous Cable Support Systems (J-hooks)

1. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.

2. Cable hooks may only be used for above ceiling pathway distances of less than 50 feet from the cable tray to the work area outlet.

a. For distances of 50 feet or greater, or for areas with no ceiling, metal conduit must be used between the cable tray and work area outlet.

3. Cable hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.

4. Install cables without damaging conductors, shield, or jacket.

5. Do not exceed load ratings specified by manufacturer.

6. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.

7. Cable Hook spacing maximum 5 feet on center.

8. Maintain maximum cable sag between cable hooks of 12 inches.
9. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

B. Firestopping

1. Comply with manufacturer’s product data, including product technical bulletins, product catalog installation instruction, and product carton instruction for installation.
2. Verify substrate conditions are acceptable for product installation in accordance with manufacturer’s instructions.
3. Install firestopping to comply with performance requirements specified herein.
    a. Install firestopping to comply with listed fire rated assemblies in accordance with ASTM and UL requirements.
    b. Installer shall be trained and approved by the manufacturer.
4. Protect installed products from damage during construction operations until final completions.
5. Inspection: Code official or building inspectors to review proper installation using manufacturer’s guidelines.

3.03 PATHWAY INSTALLATION

A. Raceways shall be mechanically and electrically connected to all boxes and fittings and shall be properly grounded per NEC.

B. The routing and location of all conduits, cable tray, cable hooks and other raceways shall be coordinated with other trades prior to and during building construction to avoid delays and conflicts.

C. Where raceways pass through walls, partitions and floors, seal penetrations to provide a neat installation that will maintain the integrity of the waterproofing or fireproofing, as applicable, of the structure. Coordinate installation requirements with roofing installer where conduits pass through the roof.

D. All Raceways shall be run at least 6-inches from hot flues, steam pipes, hot water pipes and other hot surfaces.

E. All raceways entering a building from underground shall be sealed to prevent water, moisture, gas, or other foreign matter from entering the building. Service conduits shall be sealed in accordance with NEC 230-8.

F. Contractor’s on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and records drawings.

G. DO NOT route communication pathways under HVAC condensing units.

H. Expansion Fittings:

1. Raceways shall be provided with expansion fitting where necessary to compensate for thermal expansion and contraction.

2. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit funs where necessary. Provide bonding jumpers across fittings in metal raceway systems.

3.04 CONDUIT INSTALLATION

A. Conduit shall be installed with threaded fittings and couplings.

B. All metallic couplings, connectors and fittings shall be malleable Iron or Steel and finished with Zinc plating or by Galvanizing.

C. All conduits shall be plugged immediately upon installation to prevent the entrance of construction dirt and debris. All conduits shall be swabbed and cleaned before wires are pulled:

D. Expansion fittings shall be utilized in all cases where conduits pass through building expansion joints. Fittings shall be of an approved weatherproof telescopic type bonding jumpers around or through the fitting.

E. Connection of Conduit to Pull / Junction Boxes and Enclosures:

1. Connection to NEMA 1 type boxes and enclosures:

a. Rigid conduit: Install insulated bushings and double locknuts.

b. EMT: Install compression box connectors with insulated throats.

2. Connection to NEMA 3R, 4, 4X, and 12 type boxes: Install insulated bushings and sealing locknuts or hubs.

3. When conduits enter floor mounted enclosures from below and there is no sheet metal to which to attach; install grounding bushings on the conduit. Bond bushings to ground bus using a conductor the same size as required for an equipment grounding conductor sized for the giver circuit.

4. Install sealing bushing within all conduits which have entered a building from outside, whether from above or below grade.

F. Each Conduit route shall be installed with the least amount of bends as possible. No section of conduit shall be longer than 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend) between pull points, pull boxes or reverse bends.

G. The inside radius of bends in conduit shall be.

1. 6 times the internal diameter for 2-inches or less.

2. 10 times the internal diameter for greater than 2-inches.

H. A measured pull tape shall be placed in all installed conduit.

I. Any single conduit run extending from an IDF/MDF shall not serve more than one outlet.

J. All communication conduits shall be indentified with color coded orange tape marked “Communications” every 50 feet. Tag conduit termination points (to include J-Box locations) with the origination and destination location.

K. Conduit shall be reamed to eliminate sharp edges and terminated with an insulated bushing.

L. Conduit protruding through the floor shall be terminated at a minimum of 3 inches above the floor surface.

M. All stubbed conduit ends shall be provided with a ground bushing.

N. All conduit penetrations shall be provided with the proper conduit sleeves.

1. Sleeves shall extend three inches AFF or four inches below finished ceiling, with a bushing.

2. Sleeves shall be installed in the communications room floor or ceiling a minimum of two to four inches on center from the wall.

3. Conduit floor sleeves shall be spaced to allow space for ground bushing and insulated bushing for cable protection.

4. Shall be installed in a single tier or row from left to right horizontally. If two tiers or rows are required, the conduits shall be staggered minimum of 2 inches between tiers.

5. Cable support anchors shall be installed 18 to 24 inches above the sleeves.

O. All cable (horizontal, riser or backbone) wall or ceiling penetrations shall be provided with the proper conduit sleeves.

1. Sleeves shall extend three inches AFF or four inches below finished ceiling, with a bushing.

2. Sleeves shall be installed in the floor or ceiling a minimum of two to four inches on center from the wall.

3. Sleeves shall be installed in the walls at a minimum of two inches extended on each side of the wall.

4. Cable floor, ceiling and wall sleeves shall be spaced to allow space for ground bushing and insulated bushing for cable protection.

5. Shall be installed in a single tier or row from left to right horizontally.

6. If two tiers or rows are required, the conduits shall be staggered minimum of 2 inches between tiers.

7. Cable support anchors shall be installed 18 to 24 inches above the sleeves.

P. All conduit and cabinet entrances shall be sealed with an approved, re-enter able sealant material to prevent ingress of water, dust or other foreign materials.

Q. Conduit shall not be embedded in the required fire protective covering of a structural member that is to be individually encased in accordance with BOCA.

R. Install all exposed conduit parallel or perpendicular to lines of existing construction and grouped together where possible, without interfering with use of premises or working areas. Prevent safety hazards and interference with operating and maintenance procedures.

S. Conduit Sizing and supports:

1. Horizontal (station) conduit is defined as the conduit run between the communications outlet and the cable tray or communications room as indicated on Drawings.

2. Each horizontal conduit run shall be a one-inch metallic conduit and shall be home run from each communications outlet box to the equipment room, termination equipment or cable tray, as indicated in Drawings.
3. Each route shall be installed with the least amount of conduit bends. Each single horizontal conduit run shall be provided with a junction or pull box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend).
4. Each dual horizontal conduit run shall be provided with a Junction or Pull Box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend). The quantity of conduits entering the Junction or Pull Box shall equal the number of conduits exiting the Junction or Pull Box.
5. Each terminating (outlet end) conduit connection shall be provided with the proper connecting insulated bushing or fitting.
6. Each originating end (communications room end) shall be provided with the proper connecting insulated ground bushing and properly bonded to ground.

T. Horizontal Conduit Routes:

1. Horizontal (station) conduit is defined as the conduit run between the communications outlet and the cable tray or communications room as indicated on Drawings.
2. Each horizontal conduit run shall be a one-inch metallic conduit and shall be home run from each communications outlet box to the equipment room, termination equipment or cable tray, as indicated in Drawings.
3. Each route shall be installed with the least amount of conduit bends. Each single horizontal conduit run shall be provided with a junction or pull box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend).
4. Each dual horizontal conduit run shall be provided with a Junction or Pull Box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend). The quantity of conduits entering the Junction or Pull Box shall equal the number of conduits exiting the Junction or Pull Box.
5. Each terminating (outlet end) conduit connection shall be provided with the proper connecting insulated bushing or fitting.
6. Each originating end (communications room end) shall be provided with the proper connecting insulated ground bushing and properly bonded to ground.

U. Horizontal conduit entrance in communications rooms – wall entry

1. Horizontal conduits shall enter the communications room wall 12 to 18 inches above the top of the cable tray. Maintain cable bend radius with supporting device as required.
2. Conduit wall stubs shall be spaced in increments equal to the conduit outside diameter (OD) from each other.
3. All conduit wall stubs shall be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.
4. Conduit crossovers are not permitted.

V. Horizontal conduit entrance in communications rooms – ceiling entry

1. Horizontal conduits shall enter or be extended from the equipment room ceiling 12 to 18 inches above the top of the cable tray.
2. Ceiling conduit stubs shall be spaced in increments equal to the conduit outside diameter (OD) from each other.
3. All ceiling conduit stubs shall be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.
4. Conduit crossovers are not permitted.

W. Horizontal conduit entrance in communications rooms – floor entry

1. Horizontal conduits shall enter the communications room floor 2 to 4 inches on center from the wall and shall be stubbed 3 inches AFF.
2. Conduit floor stubs shall be spaced in increments equal to the conduit OD from each other.
3. Conduit crossovers are not permitted.
4. Provide vertical ladder rack or d-hooks properly secured to wall to transverse cable to cable tray over-head.

X. Horizontal conduit to cable tray

1. Non-communications conduit shall NOT be attached to the cable tray in any fashion.
2. Conduit terminating end shall be attached to cable tray side rail with “conduit-to-cable tray” clamps. No other form of attachment shall be permitted.
    a. If the conduit-to-cable tray clamp is not UL-listed as a bonding device, then a separate bonding strap must be installed between the conduit and cable tray, or between the conduit and building steel.
3. Top or bottom cable tray conduit feeds and attachments are not permitted.

Y. Horizontal Junction/Outlet Boxes

1. Each horizontal conduit shall be terminated into an outlet box.
2. Each outlet box shall be a deep 4-inch square junction box with a minimum of two 1-inch knockouts on each of the sides.
3. Each conduit home run shall be provided with a deep 4-inch square junction box (w/cover) at 100-foot intervals and 6 inches above each ceiling and wall intersection.

Z. Riser conduit entrance in communications rooms – wall entry

1. Riser conduits shall enter the communications room wall a minimum of 24 inches above the top of the cable tray.
2. Conduit wall stubs shall be spaced in increments to equal the conduit OD from each other.
3. Riser conduits shall be installed in a single tier or row from left to right horizontally.
    a. If two tiers or rows are required, the conduits shall be staggered between tiers.

b. No more than two tiers or rows are permitted.

4. All conduit wall stubs shall be extended to and over the cable tray to access cable tray pathway.

5. All rise conduit stubs shall be provided with the proper universal drop-out/waterfall cable exit runway, which shall be supported by and mounted to channel strut.

6. Conduit crossovers are not permitted.

AA. Riser conduit entrance in communications rooms – floor entry

1. Riser conduits shall enter the communications room floor 2 to 4 inches on center from the wall and shall stub up 6 inches AFF.

2. Conduit floor stubs shall be spaced in increments to equal the conduit OD from each other.

3. Riser conduits shall be installed in a single tier or row from left to right horizontally.

a. If two tiers or rows are required the conduits shall be staggered between tiers.

b. No more than two tiers or rows are permitted.

4. Exiting cable shall be extended to the bottom of the cable tray and be provided with cable support anchors and secured with supporting hardware every six inches above the conduit bushings.

5. Conduit floor stubs shall be extended 2 to 4 inches from wall on center and 3 inches above AFF.

6. The riser cable shall be extended in the cable tray to the terminating equipment, as noted in the Drawings.

7. Conduit crossovers are not permitted.

3.05 TESTING

A. Test cable trays to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. See NFPA 70B, Chapter 18, for testing and test methods.

B. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the "worst case" loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1; including test reports verifying rung load capacity in accordance with NEMA VE-1 Section 5.4.

END OF SECTION

27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

1.00 GENERAL

1.01 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. This section includes the minimum requirements for the labeling of communications infrastructure.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Equipment Rack Labels
2. 110-Block Labels
3. Patch Panel Labels
4. Cable Labels
5. Faceplate Labels
6. Conduit System Labels
7. Ground Tags
8. Innerduct Tags

1.02 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. ANSI American National Standards Institute
2. AWG American Wire Gauge
3. BICSI Building Industry Consulting Service International
4. EIA Electronics Industries Association
5. NECA National Electrical Contractors Association
6. NEMA National Electric Manufacturers Association
7. NFPA National Fire Protection Association
8. RCDD Registered Communications Distribution Designer
9. RFP Request for Proposal
10. STD Standard
11. TGB Telecommunications Grounding Busbar
12. TIA Telecommunications Industry Association
13. TMGB Telecommunications Main Ground Bus Bar

14. UL Underwriters Laboratories

1.03 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the Owner.

C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing communications labeling systems.

D. Contractor’s Qualifications:

1. Firms regularly engaged in the installation of Communications Cabling and that have five (5) years of installation experience with systems similar to that required for this project.

2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.

3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.

4. Provide a BICSI RCDD certified professional for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD shall be a full time employee of the contractor.

5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the Owner.

E. Manufacturer’s Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015

2. ANSI/TIA/EIA-606-C – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2017

3. NFPA 70 – National Electric Code, 2016

4. BICSI – Telecommunications Distribution Methods Manual, 13th Edition

5. FC 3-580-01 – DoD Unified Facilities Criteria, Telecommunications Interior Infrastructure Planning and Design, June 1, 2016
6. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.04 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the Owner in writing prior to commencement of affected work.

1.05 PERMITS

A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.06 SCHEDULING

A. The Contractor shall comply with all scheduling requests established by Owner, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.07 REQUIREMENTS

A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The Owner must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the Owner in writing.

E. The Owner reserves the right to waive these requirements at any time.

1.08 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.

2. Proposed format of as-built documentation.

3. In addition to the submittal requirements of other included sections, submit manufacturers' data sheets for all proposed equipment and hardware associated with this Specifications section.

a. A complete test plan per ANSI/TIA/EIA FOR ALL CABLING.

b. Manufacturers' catalog sheets and specifications for all test equipment referenced in the test plan.

c. Calibration reports for all test equipment used to test the telecommunications cabling system. The calibration shall be performed by a manufacturer certified calibration facility and be dated no more than sixty (60) days prior to the start of testing.

d. Manufacturers' data sheets for all proposed labeling materials. Include all instructions for handling, storage and installation.

e. Unedited results of all tests performed on the cabling system.

f. Submit all applicable Material Safety Data Sheets.

1) For each adhesive, sealant, paint or coating applied onsite, submit MSDS sheets showing compliance with Section 01 6116 – Volatile Organic Compound (VOC) Content Restrictions, provide the product MSDS sheets to corroborate VOC compliance.

1.09 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.

2. Provide above closeout documentation as an electronic file in PDF format.

B. Warranty and Maintenance:

1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the Owner.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.

B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

2.00 PRODUCTS

2.01 GENERAL

A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

B. Labels and markings shall be physically and chemically resistant to damage that would render the label unreadable.

C. All labels shall be TIA/EIA-606-C compliant labeling products. All cables, faceplates, patch panels, 110 blocks, conduit, Innerduct and patch cords shall be labeled to TIA/EIA-606-C standards.

2.02 ADHESIVE COMPONENT LABELS

A. Outlet Label - 2-Port Identifier

1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
3. Label shall be 1.25" (31.8 mm) W x 0.30" (7.6 mm) H.
4. The label shall be white in color, with black machine-printed characters.
5. Acceptable products:
    a. Panduit
        1) C125X030FJC Network Label, P1 Cassette
        2) C125X030FJJ Network Label, Laser/Ink Jet
        3) C125X030YPT Network Label, Thermal Transfer
    b. Brady
    c. HellermannTyton
    d. Owner approved equal

B. Copper Patch Panel and Work Area Outlet Label, 4-Port

1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
3. Label shall be 2.52" (64.0 mm) W x 0.30" (7.6 mm) H.
4. The label shall be white in color, with black machine-printed characters.
5. Acceptable products:
    a. Panduit
        1) C252X030FJC Component Label, P1 Cassette
        2) C252X030FJJ Component Label, Laser/Ink Jet
        3) C252X030YPT Component Label, Thermal Transfer

b. Brady

c. HellermannTyton

d. Owner approved equal

C. Copper Patch Panel Label, 6-Port

1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
3. Label shall be 3.79" (96.3 mm) W x 0.30" (7.6 mm) H.
4. The label shall be white in color, with black machine-printed characters.
5. Acceptable products:
   a. Panduit
      1) C379X030FJC Component Label, P1 Cassette
      2) C379X030FJJ Component Label, Laser/Ink Jet
      3) C379X030YPT Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

D. Fiber Patch Panel Port Labels

1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyester, or black-on-white vinyl tape.
2. Label shall be 3.50" (88.9 mm) W x 1.00" (25.4 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) T100X100VPC-BK Component Label, P1 Cassette
      2) C350X100YJJ Component Label, Laser/Ink Jet
      3) C350X100YJT Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

E. Rack and Cabinet Labels, and Cabinet Row End Labels

1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
3. Label shall be 2.00" (50.8 mm) W x 1.00" (25.4 mm) H.

4. The label shall be white in color, with black machine-printed characters.
5. Acceptable products:
    a. Panduit
        1) C200X100YPC Component Label, P1 Cassette
        2) C200X100YJJ Component Label, Laser/Ink Jet
        3) C200X100YJT Component Label, Thermal Transfer
    b. Brady
    c. HellermannTyton
    d. Owner approved equal

F. Cabinet Row End Labels
1. Labels shall be constructed of die-cut, adhesive polyester.
2. Label shall be 4.00" (101.6 mm) W x 4.00" (101.6 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
    a. Panduit
        1) C400X400YJJ Component Label, Laser/Ink Jet
        2) C400X400YJT Component Label, Thermal Transfer
    b. Brady
    c. HellermannTyton
    d. Owner approved equal

G. Raised Panel Rack and Cabinet Labels
1. Label to have a raised thermal transfer printable surface, with high-tack adhesive.
2. Label shall be 2.00" (50.8 mm) W x 1.00" (25.4 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
    a. Panduit
        1) C200X100APT Component Label, Thermal Transfer
    b. Brady
    c. HellermannTyton
    d. Owner approved equal

H. Raised Cabinet Row End Labels
1. Label to have a raised thermal transfer printable surface, with high-tack adhesive.
2. Label shall be 3.00" (76.2 mm) W x 2.50" (63.5 mm) H.

3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
    a. Panduit
        1) C300X250APT Component Label, Thermal Transfer
    b. Brady
    c. HellermannTyton
    d. Owner approved equal

2.03 ADHESIVE WIRE MARKER LABELS

A. Category 6/6A UTP Cable and Patch Cord Labels
    1. Label shall be constructed of self-laminating vinyl.
    2. Label shall be 1.50" (38.1 mm) L x 1.00" (25.4 mm) W.
    3. Label shall accommodate an outside diameter of 0.16" (4.0 mm) to 0.32" (8.1 mm).
    4. The print-on area height shall be 0.50" (12.7 mm) and shall be white in color, with black machine-printed characters.
    5. Acceptable products:
        a. Panduit
            1) S100X150VAC Self-Laminating Label, P1 Cassette
            2) S100X150YAJ Self-Laminating Label, Laser/Ink Jet
            3) S100X150VAT Self-Laminating Label, Thermal Transfer
        b. Brady
        c. HellermannTyton
        d. Owner approved equal

B. Fiber (2 mm & 3 mm) Cable Labels
    1. Label shall be constructed of self-laminating vinyl.
    2. Label shall be 1.60" (40.6 mm) L x 1.00" (25.4 mm) W.
    3. Label shall accommodate an outside diameter of 0.25" (6.4 mm).
    4. The print-on area height shall be 0.80" (20.3 mm) and shall be white in color, with black machine-printed characters.
    5. Acceptable products:
        a. Panduit
            1) S100X160VAC Self-Laminating Label, P1 Cassette
            2) S100X160YAJ Self-Laminating Label, Laser/Ink Jet
            3) S100X160VAT Self-Laminating Label, Thermal Transfer

b. Brady

c. HellermannTyton

d. Owner approved equal

C. Fiber Duplex and Ribbon Cable Labels

1. Label shall be constructed of self-laminating vinyl.
2. Label shall be 2.20" (55.9 mm) L x 1.00" (25.4 mm) W.
3. Label shall accommodate an outside diameter of 0.48" (12.2 mm).
4. The print-on area height shall be 1.10" (27.9 mm) and shall be white in color, with black machine-printed characters.
5. Acceptable products:
   a. Panduit
      1) S100X220VAC Self-Laminating Label, P1 Cassette
      2) S100X220YAJ Self-Laminating Label, Laser/Ink Jet
      3) S100X220VAT Self-Laminating Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

D. Copper Riser Cable

1. Label shall be constructed of self-laminating vinyl.
2. Label shall be 2.25" (57.2 mm) L x 1.00" (25.4 mm) W.
3. Label shall accommodate an outside diameter of 0.24" (6.1 mm) to 0.48" (12.2 mm).
4. The print-on area height shall be 0.75" (19.1 mm) and shall be white in color, with black machine-printed characters.
5. Acceptable products:
   a. Panduit
      1) S100X225VAC Self-Laminating Label, P1 Cassette
      2) S100X225YAJ Self-Laminating Label, Laser/Ink Jet
      3) S100X225VAT Self-Laminating Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

2.04 WIRE MARKER LABEL CORES

A. Fiber Label Core

1. Label identification sleeve for fiber jumpers.
2. Sleeve locates on a straight section of cable of at least 2.00" from fiber boot.
3. Sleeve made of flexible PVC material.
4. Acceptable products:
    a. Panduit
        1) NWSLC-2Y for 2 mm Simplex Fiber, Yellow
        2) NWSLC-3Y for 3 mm Simplex Fiber, Orange
        3) NWSLC-7Y for 3 mm Duplex Fiber, White
    b. Owner approved equal

2.05 NON-ADHESIVE LABELS

A. Outlet Label, 2-Port
    1. Label shall be constructed of die-cut, non-adhesive polyester.
    2. Label shall be 1.25" (31.8 mm) W x 0.40" (10.2 mm) H.
    3. The label shall be white in color, with black machine-printed characters.
    4. Acceptable products:
        a. Panduit
            1) C195X040Y1C Component Label, P1 Cassette
            2) C195X040Y1J Component Label, Laser/Ink Jet
            3) C195X040Y1T Component Label, Thermal Transfer
        b. Brady
        c. HellermannTyton
        d. Owner approved equal
B. Copper Patch Panel and Work Area Outlet Label, 4-Port
    1. Label shall be constructed of die-cut, non-adhesive polyester.
    2. Label shall be 2.61" (66.3 mm) W x 0.35" (8.9 mm) H.
    3. The label shall be white in color, with black machine-printed characters.
    4. Acceptable products:
        a. Panduit
            1) C261X035Y1C Component Label, P1 Cassette
            2) C261X035Y1J Component Label, Laser/Ink Jet
            3) C261X035Y1T Component Label, Thermal Transfer
        b. Brady
        c. HellermannTyton

d. Owner approved equal

C. Copper Patch Panel Label, 6-Port

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 3.90" (99.1 mm) W x 0.30" (7.6 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C390X030Y1C Component Label, P1 Cassette
      2) C390X030Y1J Component Label, Laser/Ink Jet
      3) C390X030Y1T Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

D. 110 Termination Block Label Insert

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 7.50" (190.5 mm) W x 0.50" (12.7 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C750X050Y1C Component Label, P1 Cassette
      2) C750X050Y1J Component Label, Laser/Ink Jet
      3) C750X050Y1T Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

E. Giga-Punch Block Label Insert

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 7.88" (200.2 mm) W x 0.50" (12.7 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C788X050Y1C Component Label, P1 Cassette
      2) C788X050Y1J Component Label, Laser/Ink Jet

3) C788X050Y1T Component Label, Thermal Transfer

b. Brady

c. HellermannTyton

d. Owner approved equal

3.00 EXECUTION

3.01 GENERAL

A. Labeling shall be by mechanical means. Hand-lettered labels are not permitted unless otherwise noted.

1. Utilize Panduit, or equivalent, labeler and software

B. Tags shall be non-removable.

1. Exceptions:

a. Faceplate labels that are placed in recessed label holders

b. Patch panel labels that are placed in recessed label holders

c. Telecommunications Ground tags secured with cable ties

d. Innerduct tags secured with cable ties

C. Labels shall match hardware layout and design.

D. Labels shall be as large as practicable while fitting properly.

E. No lettering shall be smaller than 10-point.

3.02 LABELING STANDARDS

A. Room Identification

1. Label Communications Backboard or Equipment Rack closest to entry door with unique identifying code.

2. Characters shall be 1-inch minimum.

B. Equipment Rack Identification

1. Label each Equipment rack with a unique alpha numeric character indicating a TR/MER and a rack number

a. Example: TR3-01

2. Position labels at top of rack.

3. Characters shall be 1-inch minimum

C. Wall Field Identification

1. Each wall field chassis must be labeled with the TR/MER ID then an alphabetical code ‘AA’ to ‘ZZ’.

2. Each wall field row must be labeled numerically starting with ‘01’ at the top.

3. Each chassis port shall be labeled by Destination Faceplate ID – Chassis# - Row#
    a. Example: TR3-017-AF-04-02

D. Patch Panel and Port Labeling
1. Patch panel ports are numbered from left to right, top to bottom starting with ’01’ to ‘24’, then for a 48 port patch panel ‘25’-‘48’.
2. The top line of the data port label shall indicate the Destination Faceplate
    a. Example: TR3-017
3. The second line (port label) shall be labeled by Cabinet/Rack# - Rack Unit – Port#
    a. Example: 03-24-15

E. Patch Panel to Patch Panel Labeling
1. The top line of the label shall indicate Destination Cabinet-Rack ID
    a. Example: TR3-09
2. The second line of the label shall indicate Destination Rack Unit – Port #
    a. Example: 24-15

F. Telecommunications Outlet Identification
1. Label each Telecommunications Outlet connector with a unique identifying code
    a. Position labels in recessed label holders on faceplate and cover with plastic covers.
2. Telecommunications Outlet Faceplate labeling code shall be as follows:
    a. TR/MER – Faceplate number where:
        1) “TR/MER” is identifier for room where cable terminates in horizontal cross-connect.
        2) Faceplate number starts with ‘001’ to ‘999’
        3) Example: TR2-117
    b. WAO Jack ID
        1) Destination Cabinet/Rack #-Rack unit-Port # (e.g. YY-YY-YY).
            a) Port number starts with ‘01’ to ‘24’ for 24-port patch panel or ‘48” if connected to a 48-port patch panel.

G. Horizontal Cabling
1. All horizontal cables shall be labeled at Telecommunications outlet and horizontal cross-connect with self-laminating labels via Panduit labeler and software.
2. Cables shall be labeled at each end with information indicating termination point of both ends of cable as follows:
    a. TR/MER – Faceplate #, Rack #/Wall Field ID – Rack Unit/Row – Port #
        1) Example:
            a) Data Cable: TR2-017-03-21-03

b) Voice Cable: TR2-0122-AA-21-03

3. Cables shall be labeled on a visible part of the cable within three to six (3-6) inches of termination point for ease of identification after termination.
4. Labels at the telecommunications outlet shall be visible by removing the faceplate.
5. Rooms with multiple outlet locations shall be numbered sequentially beginning clockwise from the first outlet to the left of the main entrance to the room.

H. Backbone Cabling

1. All backbone cabling shall be labeled at each end with self-laminating labels via Panduit labeling system.
2. Cables shall be labeled at each end with information indicating termination point of both ends of the cable as follows:
    a. TR/MER -Cabinet Rack/Wall Field ID – Rack Unit-Row/Destination Cabinet Rack/Wall Field ID- Rack Unit-Row
        1) Example:
            a) Data: TR2-03-06/ MER1-02-03
            b) Voice: TR2-AD-02/MER1 –AB-03
3. Cables shall be labeled on a visible part of the cable within twelve (12) inches of termination point for ease of identification after termination.
4. Fiber backbone cabling shall be labeled at each end with information indicating the building identifier, owner, room, cable number and “FO” indicating fiber.
    a. “S” shall be used after the FO to indicate the use of single-mode fiber.
    b. “M” shall be used after the FO to indicate the use of multi-mode fiber.
    c. Fiber shall be labeled on the front of the fiber enclosure.
        1) SMF for single-mode fiber.
        2) MMF for multi-mode fiber.

I. Outside Plant Cabling (Fiber and Copper)

1. All outside plant cabling shall be labeled at each end with self-laminating labels via Panduit labeling system.
2. Cables shall be labeled at each end with information indicating termination point of both ends of the cable as follows:
    a. Field Number – MER/TR –Cabinet/Rack #-Rack Unit / Destination Field number – MER/TR – Cabinet Rack # - Rack Unit
    b. Example: 2349-MER1-02-14 / 2476 –TR5-01-16

J. Fiber Optic Patch Cable Labeling

1. All backbone cabling shall be labeled at each end with self-laminating labels via Panduit labeling system.

2. Cables shall be labeled at each end with the origin / destination by TR/ER # - Cabinet/Rack # - Rack Unit # - strand # or switch port
    a. Example: MER1-03-40-17/18 /TR3-01-44-17/18

K. Telecommunications Grounds
1. Label Grounds on a visible part of the ground cable within twelve (12) inches of termination point for ease of identification after termination.
2. Tags shall be secured to ground cable using self-locking ties

L. Innerduct
1. Innerduct containing fiber optic cable shall be labeled where exposed.
    a. Includes areas where Innerduct is installed in trays and equipment rooms.
2. Label tags to include unique identifiers and pair counts of cable(s) contained therein.
    a. Use Backbone Cable labeling formats as described above.
    b. Hand lettering is acceptable.
        1) Use indelible type ink
3. Tag shall be secured to Innerduct using self-locking ties.

END OF SECTION

27 11 00 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS

1.00 GENERAL

1.01 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. This section includes the minimum requirements for the installation of cabinets, racks, frames and enclosures in data centers, computer rooms and communications equipment rooms.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Wall Mount Equipment Cabinets
2. Vertical Wire Management
3. Horizontal Wire Management

1.02 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. AHJ Authority Having Jurisdiction
2. ANSI American National Standards Institute
3. ASTM American Society for Testing and Materials International
4. AWG American Wire Gauge
5. BICSI Building Industry Consulting Service International
6. EIA Electronics Industries Alliance
7. NEC National Electric Code
8. NEMA National Electric Manufacturers Association
9. NFPA National Fire Protection Association
10. RCDD Registered Communications Distribution Designer
11. RFP Request for Proposal
12. RU Rack Unit
13. STD Standard
14. TGB Telecommunications Grounding Busbar
15. TIA Telecommunications Industry Association
16. TMGB Telecommunications Main Ground Bus Bar
17. UL Underwriters Laboratories

1.03 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the Owner.

C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing the products specified in this section.

D. Contractor’s Qualifications:

1. Firms regularly engaged in the installation of Electrical Systems or Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.

2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.

3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.

4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician shall be a full time employee of the contractor.

5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the Owner.

E. Manufacturer’s Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015

2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006

3. ANSI/TIA-568.0-D – Generic Telecommunications Cabling for Customer Premises, 2015

4. ANSI/TIA-568.1-D – Commercial Building Telecommunications Cabling Standard, 2015

5. ANSI/TIA/EIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces, 2015
6. ANSI/TIA/EIA-606-C – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2017
7. ANSI-J-STD-607-C – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2015
8. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2017
9. NFPA 70 – National Electric Code, 2016
10. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
11. NEMA – VE 1 – Metal Cable Tray Systems, 2009
12. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006
13. UFC 3-580-01 – DoD Unified Facilities Criteria, Telecommunications Interior Infrastructure Planning and Design, June 1, 2016
14. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.04 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the Owner in writing prior to commencement of affected work.

1.05 PERMITS

A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.06 SCHEDULING

A. The Contractor shall comply with all scheduling requests established by Owner, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.07 REQUIREMENTS

A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The Owner must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the Owner in writing.

E. The Owner reserves the right to waive these requirements at any time.

1.08 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. Produce Shop Drawings for ALL Telecommunications Rooms which shall include dimensions, rack/cabinet placement, cable tray/ladder racking placement, rack/cabinet elevations, and each wall within the space.

D. Provide all submittal requirements under this section as a single package.

E. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.

2. Proposed format of as-built documentation.

1.09 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.

2. Provide above closeout documentation as an electronic file in PDF format.

3. Laminated as-built drawing sheet of TR service area representing each level, with a scale of not less than 1/8in, mounted on the wall of each TR.

B. Warranty and Maintenance:

1. Record drawings of final room configurations

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the Owner.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

A. Warranty labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01, or for a period of 1 year from date of final completion, whichever is longer. Repair or replace defects occurring in labor or product within the Warranty period without charge.

B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

2.00 PRODUCTS

2.01 GENERAL

A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.02 EQUIPMENT RACKS

A. Free-standing Equipment Racks

1. Racks shall be manufactured from aluminum extrusion.
2. Each rack will have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack will assemble with nut and bolt hardware. The base angles will be pre-punched for attachment to the floor.
3. Equipment mounting channels will be 3” deep and punched on the front and rear flange with the EIA-310-D universal hole pattern to provide 45 rack-mount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.
4. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19” EIA rack-mount equipment. Attachment points will be threaded with 12-24 roll-formed threads. The rack will include assembly and equipment-mounting hardware. Racks will include 50 each combination pan head, pilot point mounting screws.
5. The assembled rack outside dimensions will be 7’ (84”) high, 20” wide and 15” deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
6. The rack will be rated for 1,000 lb. of equipment.
7. The rack will be UL Listed.
8. Finish shall be epoxy-polyester hybrid powder coat in the color black.
9. Acceptable products:
    a. Chatsworth Products, Inc. (CPI)
    b. 55053-703, Standard Rack, 19” x 7’, Black, UL Listed.
    c. 40605-005, Equipment Mounting Screws, #12-24, 50 pack, Black
    d. 40604-003, Rack Installation Kit, Concrete Slab, Zinc
    e. Tripp-Lite IBAR12-20T, 12 Outlet, 15” Cord with Twist Lock Plug, 20 AMP 12AWG (NEMA-L5-20R TO NEMA-5-20P)
    f. Owner Approved Equivalent.

B. Vertical Wire Managers

1. Every rack/frame shall have a minimum of one vertical cable manager. The vertical cable manager shall create a space for storing and organizing cables along the side of the

rack/frame. The cable manager shall maintain separation between patch/equipment/jumper cords and premise cables.

2. The vertical cable manager shall match the height of the rack(s)/frame(s).
3. The vertical cable manager shall bolt to the side of racks/frames with included hardware.
4. The cable manager shall be sized to match cabling requirements. Maximum cable fill shall be calculated by dividing 50% of the usable area within the cable manager by the area of a single cable.
5. A single vertical cable manager may be used in between bayed racks/frames if it is sized to match cable requirements for both racks/frames.
6. The double-sided vertical cable manager shall be a double-sided H-shaped trough with a front door and a rear door. The double-sided trough shall provide independent front and rear cable pathways. The front and rear sides of the cable manager shall have T-shaped cable guides separated by openings that align with each U space on the rack. The middle of the managers shall be mostly open to allow easy cable pass-through. Three movable mid-sections shall allow attachment of cable management accessories inside the cable manager. The movable mid-sections shall adjust front-to-rear to allow a 40/60, 50/50 or 60/40 front/rear split of the interior cable management space.
7. The door shall be removable, hinged to open from the right or left side, with a single knob on the right and left side to secure the door in the closed position. The front door shall have a two-tone finish: black with a vertical aluminum panel at the center. The rear door on double-sided cable managers shall be flat with a black finish.
8. The T-shaped cable guides shall be made from a composite plastic material (not metal) and shall have rounded edges to protect cables. Openings between the T-shaped guides will be evenly spaced. When the cable manager is attached to a rack/frame, each cable opening shall align with a rack-mount space (U) on the rack/frame. Each opening shall pass a minimum of 24 each .25” OD patch cords.
9. The cable manager shall be delivered individually boxed, and available in several widths as specified below and in the contract documents.
10. The vertical cable manager shall be manufactured from steel, aluminum and plastic.
11. Finish shall be epoxy-polyester hybrid powder coat paint in the color as specified below and in the contract documents. T-shaped cable guides and latch hardware is black.
12. Optional internal cable management accessories will include cable management spools that attach to the panels/mid-sections to provide slack management for patch cords; a cable lashing bar kit to provide tie points for cable bundles at the rear/mid of the manager; and a fiber segregation kit that creates a separate pathway inside the manager to separate fiber from other cables.
13. Acceptable products:
    a. CommScope 760089342/VCM-DS-84-6R
    b. Approved equivalent.

C. Horizontal Wire Managers

1. Place horizontal cable managers as per rack layout per detail. The horizontal cable manager will guide patch/equipment cords between the vertical cable manager and individual network port connections.
2. The horizontal cable manager shall match the rack-mount width of the rack(s)/frame(s).
3. The horizontal cable manager shall attach to the front or rear of the rack/frame with screws and shall be sized to fit in standard EIA-310-D or EIA-310-E Universal rack-mount spacing (1-3/4in high U).
4. The horizontal cable manager shall be sized to match cabling requirements. Provide a minimum of 2U of horizontal cable management for every 2U of connectivity. Cables must be able to access the cable manager so that no ports are blocked by the cables.
5. A single horizontal cable manager may be used to support multiple patch panels as long as it is sized to match cable fill requirements. Cables must be able to access the cable manager so that no ports are blocked by the cables.
6. The horizontal cable manager shall be a double-sided trough with a cover. 2U high cable managers shall have three edge-protected oval openings at the rear to facilitate front-to-rear cabling through the horizontal manager. The front of the cable manager shall have T-shaped cable guides along the top and bottom surfaces of the cable manager. Evenly spaced cable openings in between the T-shaped cable guides shall allow cables to enter/exit the cable manager from/into the rack-mount space. The cover shall be removable.
7. The horizontal cable manager shall be delivered individually boxed, and available in the width(s) and height(s) as specified below and in the contract documents.
8. The horizontal cable manager shall be manufactured from steel, aluminum and plastic.
9. Finish shall be epoxy-polyester hybrid powder coat paint in the color as specified below and in the contract documents. Edge-protectors, T-shaped cable guides and latch hardware is black.
10. Acceptable products:
    a. NEAT-PATCH NP2
    b. Approved equivalent

2.03 CABLE RUNWAY

A. Ladder Rack

1. Ladder rack shall be manufactured from 3/8” wide by 1-1/2” high tubular steel.
2. Ladder rack (side stringers) will be 9’-11½“ long. Cross members will be welded in between stringers on maximum 12” centers beginning 5-3/4” from one end so that there are a minimum 10 cross members per ladder rack. There will be a maximum 10-1/2” of open space in between each cross member.
3. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.
4. Refer to the drawing set to determine the width.

5. Acceptable products: (“xx” denotes nominal width)
    a. Chatsworth 10250-7xx
    b. Cooper B-Line SB17TxxBFB
    c. Approved equivalent

B. Ladder Rack Splices
1. Splice kits will provide a method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.
2. Grounding kits will provide a method of bonding ladder rack sections and turns together that is independent of the pathway splices. The grounding kit should be constructed of UL Listed components. The preferred solution is a #6 AWG green insulated stranded copper conductor connected on both ends to ladder rack using two-hole compression lugs and stainless steel hardware.
3. Splices (splice plates) will be manufactured from steel. Splice, grounding and insulator bar kits will include installation hardware.
4. Finish (of splice plates and hardware) shall be zinc plate in the color(s) specified below. Colors are applied as a chem. film over the zinc plate.
5. Acceptable products:
    a. Chatsworth Products, Inc. (CPI)
        1) 11301-701 Butt Splice Kit
        2) 11302-701 Junction Splice Kit
        3) 40164-001 Runway Grounding Strap
    b. Cooper B-Line
        1) SB2107BZ Butt Splice Kit
        2) SB2101ABZ Junction Splice Kit
        3) SB669¾x10½ Runway Grounding Strap
    c. Approved equivalent

C. Ladder Rack Supports
1. Supports will be sized to match the width of the ladder rack that is supported. Some supports will Work with all widths of ladder rack.
2. Each support will include a means of securing ladder rack to the support.
3. Supports will be manufactured from steel or aluminum.
4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below or zinc plate with a gold chem. finish specified gold. Included hardware shall be zinc plated with a gold chem. finish.
5. Acceptable products:
    a. Chatsworth Products, Inc. (CPI) (“xx” denotes nominal width)

1) 11312-7xx Triangular Support Bracket
2) 11421-7xx Wall Angle Support Kit
3) 11310-001 Threaded Ceiling Kit, 3/8" Rod
4) 10608-001 Vertical Wall Brackets
5) 10595-7xx Rack-To-Runway Mounting Plate

b. Cooper B-Line

1) SB213xxKFB Triangular Support Bracket
2) SB2113xxFB Wall Angle Support Kit
3) SB2221AYZ Threaded Ceiling Kit, 3/8" Rod
4) SB2114AYZ Vertical Wall Brackets
5) SB2133xxFB Rack-To-Runway Mounting Plate

c. Owner Approved Equivalent

D. Ladder Rack Accessories

1. Provide end caps to cover exposed ladder rack ends.
   a. End caps used to cover the ends of ladder rack will be manufactured from a black fire-retardant rubberized material. End caps will be sized for 3/8” wide by 1-1/2” high side stingers and will be sold in pairs.
2. Provide one radius drop for each rack and cabinet.
   a. Radius drops used to create a radius to form cables over as the cables exit or enter the ladder rack will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3”. Radius drops will attach to either the side stringer or the cross member of the ladder rack using a clevis pin. Radius drops will include 1-1/2” high cable spools that attach to the top of the radius drop to guide cables.
3. Provide moveable cross members, as required.
   a. Movable cross members used to support cross member radius drops in between welded cross members on ladder rack will be manufactured from 3/8” by 1-1/2” aluminum bar. Movable cross members will attach to ladder rack at the side stringers with included hardware so that the location of the movable cross member can be adjusted. Moveable cross member will support a cross member radius drop.
4. Touch-up paint used on ladder rack and ladder rack system components will be color-matched to the finish on the ladder rack or component. A spray on and brush on option will be available.
5. Unless otherwise noted, finish on all metal components shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below. Hardware will be zinc plated with a gold chem. finish.
6. Acceptable products: (“xx” denotes nominal width)
   a. Chatsworth Products, Inc. (CPI)

1) 10642-001 Cable Runway Protective End Caps
2) 12100-7xx Radius Drop, Cross Member
3) 12101-7xx Radius Drop, Stringer
4) 12115-7xx Moveable Cross Member
5) 11700-7xx End Closing Kit

b. Cooper B-Line

1) SB110A1B Cable Runway Protective End Caps
2) SB2129xxFB Radius Drop, Cross Member
3) SB2120DSxxFB Radius Drop, Stringer
4) SB17RKxxFB Moveable Cross Member
5) SB210506xx Runway Termination Kit

c. Owner Approved Equivalent

3.00 EXECUTION

3.01 INSTALLATION

A. The installation recommendations contained within ANSI/TIA-568-B, ANSI/TIA-569 and the BICSI Telecommunications Distribution Methods Manual (TDMM), including the Manufacturer's recommended installation methods or practices for a Standards-based Structured Cabling System, are mandatory minimum standards and requirements.

B. Mount equipment and enclosures plumb and level. Permanently installed equipment to be firmly and safely held in place. Equipment supports must support loads imposed with a safety factor of at least five.

C. Relay Racks

1. Assemble relay racks according to manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.
2. All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below.
3. Racks shall be grounded to the TGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the AHJ.
4. In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.
5. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.

6. The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.

D. Free-standing Equipment Cabinets

1. Provide all components of the cabinet system (cabinet, mounting rails, shelves, cable managers, power strips, environmental sensors, and thermal management accessories) from a single manufacturer.
2. Install and adjust to position all accessories including vertical cable managers, vertical power strips, equipment-mounting rails, airflow baffles using the manufacturer's installation instructions prior to baying and/or placing the cabinet for attachment to the building. Shelves, horizontal cable managers and filler panels, if used, may be installed after the cabinet is placed.
3. Cabinets shall be secured to the structural floor using manufacturer's installation instructions and appropriate hardware as defined by local code or the authority having jurisdiction (AHJ). Installers shall provide installation hardware. When placed over a raised floor, secure the cabinet to the structural floor through the raised floor panels using threaded rod.
4. Where Cabinets must be moved away from a wall to gain access to the rear of the cabinet a Caster set shall be used. The Cable Harness must be 42" in length and run from the wall along the floor into the Cabinet. A Nylon Split Loom shall be used to protect the Cable Harness.
5. When used in a multi-cabinet bay, cabinets shall be attached side-by-side using included baying kits according to the manufacturer's instructions.
6. Attach overhead ladder rack or cable tray to the ceiling, independent of the cabinet. A 3" (75 mm) minimum clearance between the top of the cabinet and the bottom of the ladder rack/cable tray shall be maintained. Ladder rack/cable tray shall be positioned so that it does not interfere with hot air exhaust through the cabinet's top panel. Use radius drops where cable enters/exits the ladder rack/cable tray. Alternately, attach ladder rack/cable tray to the top of cabinets using an elevation kit so that ladder rack/cable tray is a minimum of 3" (75 mm) above the cabinet.
7. Cabinets shall be securely bonded to the Telecommunications Grounding Busbar (TGB). Attach a bonding conductor sized as defined in J-STD-607-B and as defined by local code or the authority having jurisdiction (AHJ) between the Telecommunications Grounding Busbar and the cabinet. Attach the bonding conductor to the cabinet using included hardware according to the manufacturer's installation instructions. The installer shall provide the bonding conductor and other necessary hardware required to make the connections between the cabinet and the Telecommunications Grounding Busbar.

E. Wall-Mounted Cabinets

1. Provide all components of the cabinet system (cabinet, mounting rails, cable managers, power strips, and accessories) from a single manufacturer.
2. Attach the cabinet to the wall so that the front door and cabinet body can be opened fully without obstruction by other building, storage or architectural components. Follow the manufacturer's installation instructions when securing the cabinet to the wall and

backboard. When not attached to the wall, the floor, shelf or tabletop surface on which the cabinet is placed must be able to hold the combined weight of the cabinet and the equipment within the cabinet. The cabinet should not be attached to sheet rock (gypsum wall board). The cabinet must be attached directly into studs through a 3/4in (19 mm) plywood backboard. The cabinet may be attached to a masonry wall when the installer provides hardware. Use included hardware or the appropriate hardware as defined by local code or the authority having jurisdiction. The top of the cabinet when installed should not exceed 84in (2133.6 mm) above the finished floor.

3. Cables shall enter/exit the cabinet through conduit knockouts in the top and/or bottom of the rear panel of the cabinet or through the rectangular cut out in the back of the rear panel of the cabinet. Use edge-protection grommets on conduit knockouts when cables pass through a conduit knockout but are not enclosed in conduit.
4. Install and adjust to position all accessories including power strips, equipment-mounting rails, fan and filter kits and lights, prior to installing equipment into the cabinet. Verify that fans, light and power strips work prior to installing equipment. Shelves, if used, may be installed with equipment.
5. Provide a telecommunications ground for equipment within the cabinet. Attach a 19inEIA bus bar to the equipment mounting rails so that the mounting rails are bonded together. Attach a bonding conductor sized as defined in J-STD-607-B and as defined by local code or the authority having jurisdiction between the Telecommunications Grounding Busbar and the 19in EIA bus bar within the cabinet using two-hole compression lugs to connect the bonding conductor to each busbar. The installer will provide the 19in EIA bus bar, antioxidant compound, the bonding conductor and other necessary hardware required to make the connections between the cabinet and the Telecommunications Grounding Busbar.

F. Vertical Cable Managers

1. When more than one cable manager is used on a rack/frame or group of racks/frames, use the same make, style and size of vertical cable manager on the rack/frame or in between racks/frames.
2. The color of the rack(s)/frame(s) and cable manager(s) must match.
3. Attach vertical cable managers to the side of the rack/frame using the manufacturer’s installation instructions and included hardware.
4. When a single vertical cable manager is used in between two racks/frames, attach the vertical cable manager to both racks/frames.
5. Dress cables through the openings in between the T-shaped guides on the manager so that cables make gradual bends as they exit or enter the cable manager into the rack-mount space (U). Do not twist, coil or make sharp bends in cables.
6. Doors shall be attached to the cable manager and in the closed position after cabling is complete.

G. Horizontal Cable Managers

1. When more than one horizontal cable manager is used on a rack/frame or group of racks/frames, use the same make and style of cable manager on the rack/frame or racks/frames.
2. The color of the rack(s)/frame(s) and cable manager(s) must match.
3. Attach horizontal cable managers to the rack/frame with four screws according to the manufacturer's installation instructions. Each cable manager shall be centered within the allocated rack-mount space (U).
4. Horizontal managers shall be located so that the number of ports (cables) that each manager supports shall not exceed each cable manager's cable fill capacity.
5. Dress cables through the openings in between the T-shaped guides on the cable manager so that cables make gradual bends as they exit or enter the cable manager into the rack-mount space (U). Do not twist, coil or make sharp bends in cables.
6. Covers shall be attached to the cable manager and in the closed position after cabling is complete.

H. Cable Tray and Ladder Rack

1. Provide all components of the ladder rack system (ladder rack, turns, splices, supports, and accessories) from a single manufacturer.
2. Ladder rack shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.
3. Ladder rack shall be secured to the structural ceiling, building truss system, wall, and the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).
4. Ladder rack splices will be made in mid-span, not over a support, with the manufacturer's recommended splice hardware.
5. Ladder rack shall be supported every 5' or less in accordance with TIA-569-D. Ladder rack shall be supported within 2' of every splice and within 2' on both/all sides of every intersection. Support ladder rack within 2' on both sides of every change in elevation. Support ladder rack every 2' when attached vertically to a wall.
6. Heavy-duty splices are recommended for ladder rack in excess of 18" width (18" wide ladder rack). Heavy-duty splices are required for any splice formed in the vertical orientation including changes in elevation formed using vertical-to-horizontal 90° turns or horizontal-to-vertical 90° turns. Use heavy-duty splices to secure all overhead turns to the overhead horizontal pathway(s).
7. When the pathway is overhead, ladder rack shall be installed with a minimum clearance of 12" above the ladder rack. Leave a minimum of 12" in between ladder rack and ceiling/building truss structure. Leave a minimum of 3" in between ladder rack and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack shall be installed with a minimum clearance of 12" in between each tier of ladder rack. When located above an acoustical drop ceiling, leave a minimum of 3" clearance between the top of the drop ceiling tiles and the bottom of the ladder rack.

8. When installed under a raised floor, ladder rack shall be installed with a minimum 3” clearance between the top of the ladder rack and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation. Maintain a 3” clearance between ladder racks wherever ladder racks cross.
9. Within each telecommunications room, ladder rack should be bonded together, electrically continuous, and bonded to the TGB, unless otherwise noted in the specifications and contract documents. Ladder rack and turns shall be bonded across each splice with a bonding kit. Ladder rack shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the ladder rack and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the ladder rack where bonding/ground lugs contact the ladder rack so that the lug will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack and ground lug. Use antioxidant joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual ladder rack sections and turns and through the bond to the TGB.
10. The quantity of cables within the ladder rack will not exceed a whole number value equal to 50% of the interior area of the ladder rack divided by the cross-sectional area of the cable. The interior area of ladder rack will be considered to be the width of the ladder rack multiplied by a height of 2”, unless cable retaining posts are added to the ladder rack. The interior area of ladder rack equipped with cable retaining posts will be considered to be the width of the ladder rack multiplied by a height of 6”. Actual cable fill for ladder rack that is not equipped with cable retaining posts will not exceed 2” in height. Actual cable fill for ladder rack equipped with cable retaining posts will not exceed 6” in height.
11. The combined weight of cables within the ladder rack will not exceed the stated load capacity of the ladder rack as stated in the manufacturer’s product specifications or load/design tables.
12. Cables (cable bundles) will be secured to the cross members of ladder rack with ¾” wide reusable straps. Straps are not required when ladder rack is equipped with cable retaining posts.
13. Add 8” high cable retaining posts to the open sides of ladder rack when cable fill exceeds 2” in height or when cable bundles cannot be secured directly to the ladder rack cross members with a strap. Cable fill within any ladder rack should not exceed 6” in height.
14. When a single ladder rack supports different types of cable media, the cable media will be separated within the pathway by cable spools that attach to the cross members on the ladder rack. Treat each type of cable media and divided area of the ladder rack separately when determining cable fill limits.
15. Use a radius drop to guide cables wherever cable exits overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field. If necessary, provide a moveable cross member also to attach and align the radius drop in between the welded cross members of a ladder rack.
16. Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps or an end closing kit.

17. Use auxiliary support brackets that attach to the side stringer of the ladder rack to support interconnect cabling (patch cords, equipment cords, jumper cords) that is routed between racks using the ladder rack. Auxiliary support brackets can be used to support other conductors that should be physically separated from cables within the ladder rack as defined by local code or the authority having jurisdiction (AHJ).
18. Whenever possible, maintain a 2’ separation between ladder rack used for communications cables and pathways for other utilities or building services.
19. The installer will provide touch-up paint color-matched to the finish on the ladder rack and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack system.

3.02 AC POWER AND GROUNDING

A. Coordinate and verify final connection of related electrical power, TMGB and TMB Grounding Busbar and ground conductors.
B. Provide a ground system compliant with the reference ANSI-J-607-C Standard, ANSI/NFPA-70 and authorities having jurisdiction.
C. Ground equipment chassis not having a three-wire power cord, other metal enclosures, and equipment rack frames in the ER and IDF room(s) to the ground bus bar in that room using # 6 AWG insulated conductor and bonding with 10/32 nuts, bolts and lock-washers.
D. Remove any finish and make-bare any metallic surface at the point where grounding wire is connected to and or terminated on equipment frames, racks or devices.

END OF SECTION

27 13 00– COMMUNICATIONS BACKBONE CABLING

1.00 GENERAL

1.01 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. This section includes the minimum requirements for the installation of backbone cabling between Telecommunications Rooms.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Multi-pair Category 3 UTP Cable
2. UTP Termination Hardware
3. Conventional Fiber Optic Cabling
4. Fiber Optic Splicing and Termination Hardware
5. Fiber Enclosures, Adapter Panels and Splice Trays
6. Fiber Optic Patch Cords.

1.02 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. ANSI American National Standards Institute
2. BICSI Building Industry Consulting Service International
3. CMR Communications Riser Cable
4. CMP Communications Plenum Cable
5. DCM Design Criteria Manual
6. EIA Electronics Industries Alliance
7. FOCIS Fiber Optic Connector Intermateability Standards
8. ICEA Insulated Cable Engineers Association
9. IDC Insulation Displacement Connector
10. IEEE Institute of Electrical and Electronics Engineers
11. MER Main Equipment Room
12. NECA National Electrical Contractors Association
13. NEMA National Electric Manufacturers Association
14. NFPA National Fire Protection Association
15. OAR Owner’s Authorized Representative

16. OLTS Optical Loss Test Set
17. OFNR Optical Fiber Nonconductive Riser
18. RCDD Registered Communications Distribution Designer
19. RFP Request for Proposal
20. STD Standard
21. TIA Telecommunications Industry Association
22. TR Telecommunications Room
23. UL Underwriters Laboratories
24. UTP Unshielded Twisted Pair

1.03 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing communications backbone cabling.

D. Contractor’s Qualifications:

1. Firms regularly engaged in the installation of Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
4. Provide a BICSI RCDD certified professional for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD shall be a full time employee of the contractor.
5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.

E. Manufacturer’s Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015
2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial building Telecommunications Cabling, 2006
3. ANSI/TIA-568.0-D – Generic Telecommunications Cabling for Customer Premises, 2015
4. ANSI/TIA-568.1-D – Telecommunications Cabling for Customer Premises – Addendum 1, Updated reference for balanced twisted Pair Cabling, 2015
5. ANSI/TIA-568.1-D – Commercial Building Telecommunications Cabling Standard, 2015
6. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards, 2011
7. ANSI/TIA-568.3-D – Optical Fiber Cabling Components Standard, 2015
8. EIA/TIA TSB-36 – Additional Cable Specifications for Unshielded Twisted Pair
9. EIA/TIA TSB-40 – Additional Transmission Specifications for Unshielded Twisted Pair
10. EIA/TIA TSB-67 – Transmission Performance Specifications for Field-testing of Unshielded Twisted Pair Cabling Systems
11. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant, 2015
12. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant, 2015
13. ANSI/TIA/EIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces, 2015
14. ANSI/TIA/EIA-606-C – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2017
15. ANSI-J-STD-607-C – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2015
16. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers
17. NFPA 70 – National Electric Code, 2011-2015
18. UL 13 – Standard for Safety for Power-Limited Circuit Cables
19. UL 444 – Standard for Safety for Communications Cables
20. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
21. IEEE 802 – Local Area Network Standard
22. UFC 3-580-01 – DoD Unified Facilities Criteria, Telecommunications Interior Infrastructure Planning and Design, June 1, 2016

23. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.

2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.

3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.

4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.04 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.05 PERMITS

A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.06 SCHEDULING

A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.07 REQUIREMENTS

A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.

E. The Owner reserves the right to waive these requirements at any time.

1.08 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. Produce Shop Drawings for ALL backbone cabling, to include but not limited to, proposed routing and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements.

D. Provide all submittal requirements under this section as a single package.

E. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.

2. Manufacturer's certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer's equipment.

3. Manufacturer's installation specifications for copper cabling and optical fiber, indicating minimum bend radius and maximum pull tension.

4. Outline of administration labeling scheme for voice and data communications cabling and termination locations per ANSI/EIA/TIA-606.

5. Proposed format of as-built documentation

1.09 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.

2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).

3. As-built cable schedules with recorded cable routing and lengths of each designated run.

4. As built documentation of all cabling systems.

5. As built documentation of all pathway systems to include cable tray, conduits (horizontal and vertical), and non-contiguous support.

6. As built documentation of TR modifications and associated cabinet elevations.

7. Laminated as-built drawing sheet of TR service area, with a scale of not less than 1/8IN, mounted in the wall of each TR.

B. Warranty and Maintenance:

1. Test Report Binder(s)

2. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01, or for a period of 1 year from date of final completion, whichever is longer. Repair or replace defects occurring in labor or product within the Warranty period without charge.

B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

2.00 PRODUCTS

2.01 GENERAL

A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.02 ACCEPTABLE DISTRIBUTORS

A. Contractor shall procure all horizontal cabling components through authorized Manufacturer product distributors.

2.03 UTP PRODUCTS

A. UTP Cable

1. Provide multi-pair Category 3 cabling for all copper backbone connectivity.
2. Conductors shall be 24 AWG solid annealed copper.
3. Pairs shall be formed into 25-pair binder groups.
4. The jacket shall be constructed of flame retardant PVC.
5. Comply with ICEA S-90-661 for mechanical properties.
6. Comply with ANSI/TIA-568.1-D for performance specifications.
7. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
8. Approved products:
    a. Commscope 107766057 100-Pair Category 3, CMP
    b. Owner approved equivalent.

B. UTP Cable Terminating Hardware

1. Terminate each end of copper backbone cables with wall mount, or rack mount 66 M50 Block style field termination kits, as required
2. Hardware to exceed the TIA/EIA-568-B.2 Category 3 standard.
3. Hardware to be field terminable.
4. Include required quantity of bases and connecting blocks, label holders and labels.
5. Kit shall include jumper troughs.
6. Provide 4- and 5-pair connecting blocks, as required.
7. Provide jumper spools for routing jumpers between blocks, as required.
8. Acceptable products:
    a. Commscope
        1) 107535585 110RD2-200-19 Rack Mount Termination Kit
        2) 107058943 110AB2-300FT Wall Mount Termination Kit w/Legs

3) 103801247 110C-4 Connecting Block

4) 103801254 110C-5 Connecting Block

b. CPI 15002-001 Jumper Spool

c. Owner approved equivalent.

2.04 FIBER OPTIC PRODUCTS

A. Innerduct

1. Provide plenum-rated plastic innerduct for carrying fiber optic cabling.
2. Innerduct to be of the corrugated variety.
3. The nominal diameter is to be 1-1/4”.
4. Include a pull tape in each run of innerduct.
5. Acceptable products:
   a. Carlon PLM125T
   b. Approved equivalent

B. Single mode Fiber

1. Provide singlemode fiber optic backbone cabling, as indicated in the drawing set.
2. Optical fibers shall be minimum OS1 compliant.
3. Maximum attenuation coefficient shall be:
   a. 0.65 dB/km at 1310 nm
   b. 0.65 dB/km at 1383 nm
   c. 0.65 dB/km at 1550 nm.
4. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
5. Jacket to be yellow in color.
6. Jacket to be imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.
7. Refer to the drawing set for exact fiber counts.
8. Approved products:
   a. CommScope 024EWP-T4101DA3
   b. Approved equivalent.

C. Fiber Optic Connectors

1. Provide LC field terminated connectors for each end of each fiber.
2. Quick-connect, duplex, type LC connectors.
3. Connector to comply with FOCIS specifications of TIA-604-10B.

4. Insertion loss of not more than 0.75 dB.
5. Acceptable Products:
    a. Corning 95-201-98-SP Anaerobic Connector, Singlemode, LC
    b. Approved equivalent

D. Fiber Enclosures
1. Provide rack mount modular fiber enclosures.
2. Enclosures shall accept splice modules and fiber adapter modules.
3. Populate unused fiber adapter panel openings with blank filler plates.
4. Refer to the drawing set to determine exact size and configuration.
5. Acceptable Products:
    a. Corning CCH-02U Rack Mount Fiber Enclosure 2RU
    b. Approved equivalent

E. Fiber Adapter Panel
1. Provide LC duplex fiber adapter panels for fiber enclosures.
2. Modules shall be LC duplex for either 24 fibers.
3. Modules shall be designed to install in rack mount fiber enclosures.
4. Provide a quantity to accommodate every fiber within each enclosure
5. Acceptable products:
    a. Corning CCH-CP24-D3 Singlemode Fiber Adapter Panel, 12 duplex LC
    b. Approved equivalent

F. Fiber Optic Patch Cords
1. Provide factory-made, duplex fiber jumpers.
2. Singlemode jumpers shall be constructed of 9/125µm (OS1 minimum) fiber.
3. Provide a variety of lengths (1M, 2M and 3M), as needed, based on the rack elevations in the drawing set.
4. Refer to the fiber usage schedules to determine patch cord quantities for each closet. Provide an additional 20% for spares.
5. Acceptable Products:
    a. Corning 0404-02-R5116-002-M LC to LC Jumper, Duplex, Singlemode, 2m
    b. Corning 0404-02-R5116-003-M LC to LC Jumper, Duplex, Singlemode, 3m
    c. Approved equivalent

3.00 EXECUTION

3.01 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.02 WIRING METHODS

A. Install cables in conduits, raceways and cable trays.

B. Install plenum cable in environmental air spaces where cabling will be exposed, including plenum ceilings.

C. Bundle, lace, and train cables within racks and enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and wiring troughs, as required.

3.03 INSTALLATION OF CABLES

A. General Requirements for Cabling:

1. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

2. Install 110-style IDC termination hardware unless otherwise indicated unless otherwise specified on the drawings.

3. Terminate all conductors; no cable shall contain unterminated elements.

4. UTP Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and no more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

5. Verify that installed cable’s minimum bend radius does not exceed the installed conduit’s bend radius at any point. Coordinate any conduit bend radius conflicts with Installing/General Contractor prior to installation of cable.

B. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.

2. Install cabling after the flooring system has been installed in raised floor areas.

3. Coil cable 6 feet long no less than 12 inches in diameter below each feed point.

3.04 POST-INSTALLATION TESTING

A. Contractor shall test each pair or strand of every cable prior to acceptance. (100% PASS)

B. Contractor shall supply all of the required test equipment used to conduct acceptance tests.

C. Contractor shall submit acceptance documentation as defined below. No cabling installation is considered complete until test results have been completed, submitted and approved.

D. Standards Compliance and Test Requirements:

1. Copper backbone shall exceed ANSI/TIA-568-C.2 Backbone Cabling requirements and meet the manufacturer’s specifications for the installed product.

2. Optical fiber shall exceed ANSI/TIA-568.3-D Optical Fiber Cabling Components Standard requirements and meet the manufacturer's specifications for the installed product.
3. Contractor shall certify to TIA/TSB-140 Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.

E. Cable Test Documentation:

1. Optical Fiber: Testing shall be performed on all fibers in the completed end-to-end system.
    a. Power Meter and Source Loss Reports: Testing shall consist of a bi-directional, dual wave length end to end test. The system loss measurements shall be provided at 850 and 1300 nanometers for multi-mode fibers and 1310 and 1550 for single mode fibers.
    b. Optical Time Domain Reflectometer (OTDR) Reports: Testing shall consist of a bi-directional end to end OTDR trace performed per TIA/EIA 455-61. Reflective events (connections) shall not exceed 0.75 dB.
    c. Non-reflective events (splices) shall not exceed 0.3 dB.
    d. Fibers shall be inspected at 250X or 400X magnification. 250X magnification is suitable for inspecting multimode and single mode fibers. 400X magnification may be used for detailed examination of single mode fibers.
    e. Testing shall be performed on each cabling segment (connector to connector).
    f. Testing of the cabling shall be performed using high-quality test cords of the same fiber type as the cabling under test. The test cords for optical loss test set (OLTS) testing shall be between one meter and five meters in length. The test cords for OTDR testing shall be approximately 100 meters for the launch cable and at least 25 meters for the receive cable.
    g. Testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per the owner's instructions.
2. Test results saved within the field-test instrument shall be transferred into a Windows™ based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., "as saved in the field-test instrument". The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.
3. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information:
    a. The identification of the customer site as specified by the end-user.
    b. The name of the test limit selected to execute the stored test results.
    c. The name of the personnel performing the test.
    d. The date and time the test results were saved.
    e. The manufacturer, model and serial number of the test instrument.
    f. The version of the test software and the version of the test limit database held within the test instrument.

g. The fiber identification number.

h. The length for each optical fiber.

i. The index of refraction used for length calculation when using a length capable OLTS.

j. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).

k. Test results to include OTDR link and channel traces and event tables at the appropriate wavelength(s).

l. The length for each optical fiber as calculated by the OTDR

m. Overall Pass/Fail evaluation of the link-under-test for OLTS and OTDR measurements.

n. Circuit IDs reported by the test instrument should match the specified label ID.

3.05 FIELD QUALITY CONTROL

A. Perform tests and inspections in accordance with project specifications. Provide minimum 24 hours notice to OAR prior to testing. All testing shall be witnessed by OAR, at OAR's discretion.

B. Tests and Inspections:

1. Furnish proposed test procedures, recording forms, list of testing personnel and test equipment to OAR for review prior to commencement of testing.

2. Follow recommended procedures for testing as published by test equipment manufacturer.

C. Copper Cable Testing:

1. Testing of all copper wiring shall be performed prior to system cutover. 100% of riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage.

2. Category 3 riser cables shall be tested for conformance to TIA 568C.

3. OAR shall randomly perform unannounced, onsite reviews during installation. OAR shall perform final inspection and a complete review of test results before installation is accepted.

D. Optical Fiber Testing with OTDR

1. The Contractor shall test all optical fiber cable prior to installation. The Contractor shall assume all liability for the replacement of the cable should it be found defective at a later date.

2. All fiber testing shall be performed on all fibers in the completed system. Bidirectional end-to-end OTDR testing shall be performed in accordance with TIA 455-78-B. The system loss measurement shall be provided at 850 and 1310 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.

3. Fiber links shall have a maximum loss of (allowable cable loss per km) (km of fiber in the link) + (.4dB)(number of mated connectors) = maximum allowable loss.
4. Documentation shall be provided in both hard copy and CD format to the OAR.

E. Optical Fiber Testing with Power Meter

1. Multimode Horizontal Link Segments should be tested in both directions at 850-nm and 1300-nm wavelengths.
2. Multimode backbone and composite link segments should be tested in both directions at both 850-nm and 1300-nm wavelengths.
3. Singlemode horizontal link segments shall be tested in both directions at 1300-nm and 1550-nm wavelengths.
4. Singlemode backbone and composite link segments should be tested in both direction at both 1310-nm and 1550-nm wavelengths.

F. Testing documentation shall be submitted in accordance with TIA/EIA 526-14-A “Optical Power Loss Measurement in Installed Multimode Fiber Cable Plant” and TIA/EIA 526-7 “Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant”. At minimum, the following information shall be documented during testing:

1. Names of personnel conducting the test.
2. Type of test equipment used (manufacturer, model, serial number).
3. Date test is being performed.
4. Fiber identification.
5. End point locations.
6. Test direction.
7. Reference power measurement (when not using a power meter with a relative power measurement mode).
8. Measured attenuation of the link segment.
9. Acceptable link attenuation.
10. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

END OF SECTION

27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.00 GENERAL

1.01 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. This section includes the minimum requirements for the installation of horizontal cabling between Telecommunications Rooms and Work Area Outlets.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Category 6 Cable
2. Faceplates, Jacks, and Modules
3. Patch Panels
4. Patch Cords
5. Cable Ties

1.02 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. OWNEROwner
2. ANSI American National Standards Institute
3. AWG American Wire Gauge
4. BICSI Building Industry Consulting Service International
5. CMR Communications Riser Cable
6. CMP Communications Plenum Cable
7. DCM Design Criteria Manual
8. EIA Electronics Industries Alliance
9. FEP Fluorinated Ethylene Propylene
10. IDC Insulation Displacement Connector
11. IEC International Electrotechnical Commission
12. IEEE Institute of Electrical and Electronics Engineers
13. ISO International Standards Organization
14. LBF Pound Force
15. MER Main Equipment Room
16. NEMA National Electric Manufacturers Association

17. NEXT Near End Crosstalk
18. NFPA National Fire Protection Association
19. RCDD Registered Communications Distribution Designer
20. RFP Request for Proposal
21. RL Return Loss
22. STD Standard
23. STP Shielded Twisted Pair
24. TIA Telecommunications Industry Association
25. TR Telecommunications Room
26. TSB Technical Services Bulletin
27. UL Underwriters Laboratories
28. UTP Unshielded Twisted Pair

1.03 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the Owner.

C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing communications cabling.

D. Contractor’s Qualifications:

1. Firms regularly engaged in the installation of Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.

2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.

3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.

4. Provide a BICSI RCDD certified professional for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD shall be a full time employee of the contractor.

5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be

assigned for the duration of the project and shall not be replaced without written consent from the Owner.

E. Manufacturer's Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling
3. ANSI/TIA-568.0-D – Generic Telecommunications Cabling for Customer Premises, 2015
4. ANSI/TIA-568.1-D – Commercial Building Telecommunications Cabling Standard, 2009
5. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards, 2011
6. EIA/TIA TSB-36 – Additional Cable Specifications for Unshielded Twisted Pair
7. EIA/TIA TSB-40 – Additional Transmission Specifications for Unshielded Twisted Pair
8. EIA/TIA TSB-67 – Transmission Performance Specifications for Field-testing of Unshielded Twisted Pair Cabling Systems
9. ANSI/TIA-568.3-D – Optical Fiber Cabling Components Standard, 2015
10. ANSI/TIA/EIA-569-D Commercial Building Standard for Telecommunications Pathways and Spaces, 2015
11. ANSI/TIA/EIA-606-C – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2017
12. ANSI-J-STD-607-C – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2015
13. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers
14. NFPA 70 – National Electric Code, 2011-2015
15. UL 13 – Standard for Safety for Power-Limited Circuit Cables
16. UL 444– Standard for Safety for Communications Cables
17. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
18. IEEE 802 – Local Area Network Standard
19. UFC 3-580-01 – DoD Unified Facilities Criteria, Telecommunications Interior Infrastructure Planning and Design, June 1, 2016
20. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.04 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the Owner in writing prior to commencement of affected work.

1.05 PERMITS

A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.06 SCHEDULING

A. The Contractor shall comply with all scheduling requests established by Owner, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.07 REQUIREMENTS

A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The Owner must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the Owner in writing.

E. The Owner reserves the right to waive these requirements at any time.

1.08 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. Produce Shop Drawings for ALL horizontal cabling, to include but not limited to, proposed routing and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements as well as any horizontal cables that may exceed 295’ in length (including service loops).

D. Provide all submittal requirements under this section as a single package.

E. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.

2. Manufacturer’s certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer’s equipment.

3. Manufacturer’s installation specifications for UTP cabling and optical fiber, indicating minimum bend radius and maximum pull tension.

4. Outline of administration labeling scheme for voice and data communications cabling and termination locations per ANSI/EIA/TIA-606.

5. Proposed format of as-built documentation.

1.09 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.

2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).

3. As-built cable schedules with recorded cable routing and lengths of each designated run.

4. As built documentation of all cabling systems.

5. As built documentation of IDF/TR modifications and associated cabinet elevations.

6. Laminated as-built drawing sheet of TR service area representing each level, with a scale of not less than 1/8in, mounted on the wall of each TR.

B. Warranty and Maintenance:

1. Test Report Binder(s)

2. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the Owner.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01, or for a period of 1 year from date of final completion, whichever is longer. Repair or replace defects occurring in labor or product within the Warranty period without charge.

B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

C. In addition to the warranty outlined above, the Contractor shall facilitate a warranty between the Owner and the Manufacturer that provides coverage of the installed cabling system for a period of (25) twenty five years. This warranty will cover the installed horizontal cabling system (Patch Panel to Workstation). Category 6 copper links originating from patch panels shall be warranted against the link performance minimum expected results defined in the ANSI/TIA/EIA Telecommunications Systems Bulletin (TSB-67), now incorporated into TIA/EIA 568-B, for Category 6 performance requirements. Category 6 copper links originating from wall mounted 110-style termination blocks shall be warranted against link performance minimum expected results for Category 6 performance

requirements. Installation shall be performed by a Cabling System Manufacturer Certified Installer.

2.00 PRODUCTS

2.01 GENERAL

A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.02 ACCEPTABLE DISTRIBUTORS

A. Contractor shall procure all horizontal cabling components thru an approved cabling system Manufacturer product distributor.

2.03 ACCEPTABLE VENDORS AND MATERIALS

A. Subject to compliance with requirements, install products from the following manufacturers, except where noted:
   1. Cable, Copper
      a. CommScope
      b. Owner Approved Equivalent
   2. Termination Components
      a. CommScope
      b. Owner Approved Equivalent

B. Part numbers are provided for convenience purposes only; the contractor is responsible for complete material list and quantities. All materials listed are manufactured by CommScope unless otherwise noted. Colors shall be approved by Owner.

2.04 CATEGORY 6 PRODUCTS

A. UTP Cable (Voice/Data)
   1. Provide Category 6 cabling for all voice and data work area outlet locations.
   2. Cable shall far exceed ANSI/TIA/EIA-568-B.2-1 and ISO/IEC 11801 Class E standards.
   3. The conductors shall be 23 AWG construction with FEP (CMP) or polyolefin (CMR) insulation.
   4. The copper conductors shall be twisted in pairs, separated by an integrated pair divider and shall be covered by a low smoke, flame retardant (CMP) jacket or a flame retardant (CMR) jacket.
   5. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.

6. The jacket color for voice cables shall be white.
7. The jacket color for data cables shall be green.
8. The jacket color for JSIIDs and AI phone cables will be Blue.
9. Approved products:
    a. CommScope 2071E Category 6 UTP Copper Cable, White, Plenum
    b. CommScope 2071E Category 6 UTP Copper Cable, Green, Plenum
    c. CommScope 2071E Category 6 UTP copper cable, Blue, Plenum
    d. Owner approved equivalent

B. UTP Jack Modules
1. Provide Category 6 jack modules to terminate both ends of each horizontal cable unless otherwise specified on the drawings.
2. Module shall exceed requirements of ANSI/TIA-568-C.2 Category 6, IEEE 802.3an-2006, and ISO 11801 Class E channel standards and exceed requirements of ANSI/TIA-568-C.2 Category 6 and IEC 61156-5 Category 6 component standards.
3. Module shall meet requirements of IEEE 802.af and IEEE 802.3at for Power over Ethernet (PoE) applications.
4. Module shall be 100% tested to ensure NEXT and RL performance and be individually serialized for traceability.
5. Voice modules at work area outlet locations shall be white in color.
6. Data modules at work area outlet locations shall be green in color.
7. Approved products:
    a. CommScope MGS400-242 Category 6 Jack Module, White
    b. CommScope MGS400-226 Category 6 Jack Module, Green
    c. CommScope Category 6 Jack Module, Black

C. Category 6 Patch Cords
1. Provide Category 6 patch cords for voice and data work area outlets.
2. Patch cord shall exceed ANSI/TIA-568-C.2 Category 6 and ISO 11801 Class E standards.
3. Shall meet requirements of IEEE 802.af and IEEE 802.3at for PoE applications.
4. Each patch cord shall be 100% performance tested and wired T568B.
5. Patch cord shall be constructed of Category 6, 23 AWG UTP stranded cable Modular RJ-45 Plugs.
6. Patch cord plugs shall meet all applicable ANSI/TIA/EIA-968-B requirements and exceeds IEC 60603-7 specifications.
7. Plugs shall use an integral pair manager to optimize performance and consistency by reducing untwisting of conductors within the plug.

8. Patch cord shall perform in center of TIA/EIA component range, ensuring interoperability and excellent performance.
9. Patch cord shall be labeled with an identification of performance level, length, and a quality control number.
10. Provide a quantity of 10’ length blue patch cords for every port on every work area outlet.
11. Provide a quantity of 2’ length patch cords for every patch panel port in each TR.
    a. Patch cords installed in each TR shall be patched from the patch panel, have one loop stored inside the Neat Patch, then patched to the switch adjacent to the Neat Patch.
    b. Voice cables are to be patched with white patch cords.
    c. Data cables are to be patched with green patch cords.
12. Provide plenum rated patch cords for work area outlets installed above the ceiling and not patched inside of a raceway (i.e. the patch cord is exposed inside the plenum). These scenarios include, but are not limited to:
    a. Wireless access points
13. Approved products:
    a. CommScope:
        1) CPC3312-0ZF002 Category 6 Copper Patch Cord, 2’, Blue
        2) CPC3312-0ZF010 Category 6 Copper Patch Cord, 10’, Blue
        3) CPC3312-04F002 Category 6 Copper Patch Cord, 2’, Green
        4) CPC3312-08F002 Category 6 Copper Patch Cord, 2’, White
    b. Owner approved equivalent

2.05 WORK AREA OUTLET PRODUCTS

A. Wall Mount Faceplates
1. Provide wall mount faceplates for voice and data work area outlets.
2. Faceplate shall accept four (4) or six (6) modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
3. Include label/label covers for easy port identification.
4. Raised rail design for aesthetic appeal.
5. Faceplate shall be white in color.
6. Approved products:
    a. CommScope M14L Faceplate, 4Port, White.
    b. Owner approved equivalent.

B. Wallphone Faceplates

1. Provide wallphone faceplates, as shown in the drawing set.
2. Faceplate shall be of stainless steel construction.
3. Faceplate shall accept modules for UTP cabling, which snap in and out for easy moves, adds, and changes.
4. Approved products:
    a. CommScope M10LW4 Wallphone Plate, Stainless
    b. Owner approved equivalent.

C. Surface Mount Outlet Box
1. Provide surface mount outlet boxes for work area outlet locations where outlets cannot be recessed.
2. Shall accept CommScope Jack Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
3. Mount easily with supplied mounting screws, adhesive tape or optional magnet.
4. Cable entry from side and rear knockouts and from opening in center of base.
5. Outlet box shall be white in color.
6. Approved products:
    a. CommScope M102SMB Surface Mount Box, White.
    b. Owner approved equivalent

D. Blank Modules
1. Populate any unused faceplate module openings with blank modules.
2. Blank module color shall match the faceplate color.
3. Populate any unused patch panel module openings with blank modules.
4. Blank module color shall match the patch panel color.
5. Approved products:
    a. CommScope Blank Module
    b. Owner approved equivalent.

E. Patch Panels
1. Provide patch panels in TR locations for all horizontal cabling.
2. Use of two label pocket faceplate allowing both port and panel identification.
3. Can be clearly identified with Hand-Held Thermal Transfer Printers.
4. Use 48-port patch panels in TR locations.
5. Approved products:
    a. CommScope 360-IPR-1100-E-GS3-2U-48 Patch Panel, 48 Port
    b. Owner approved equivalent.

2.06 MISCELLANEOUS PRODUCTS

A. Cable Ties

1. Provide “hook & loop” cable ties for bundling cables.
2. The material shall consist of nylon loops with polypropylene hooks.
3. Use plenum-rated ties in plenum spaces.
4. Approved products:
    a. CommScope
    b. Panduit
    c. Owner approved equivalent.

3.00 EXECUTION

3.01 EXAMINATION

A. Verify conduit, raceways, boxes, fittings and bodies are properly installed as described in Division 26.

B. Verify grounding and bonding following Section 270526.

C. Verify supporting devices are properly installed following Section 270528.

D. Verify conduit has a minimum 1-inch diameter for UTP home runs.

E. All protected telecommunication terminations require bonding, grounding and a busbar.

3.02 INSTALLATION

A. General

1. Cables shall be pulled in accordance with the manufacturers recommended practices and in compliance with the NEC and the BICSI Telecommunications Distribution Methods Manual. Planning and care shall be taken to prevent abuse and damage during the handling or installation phase. Specified minimum cable bend radius shall be met without deviation.
2. Pull cables simultaneously where more than one is being installed in same raceway. Use pulling compound or lubricant where necessary. Compound used must not deteriorate conductor or insulation. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.
3. Protect cable from tension, compression, torsion, bending, squeezing and vibration. Do not pull cables improperly or exceed the Manufacturer’s tensile rating. This value shall be not more than thirty-two (32) lbf (provide breakable link for all cable pulling). There shall be no coils of excess cable left in the ceilings, cable trays, or raised floor areas unless specified otherwise. A trailer pull string shall be left in all conduits before and after cables have been installed. The cabling within the wiring closets/cabinets shall be routed and dressed neatly to their termination points such that no excess cable is present. As cables are pulled into the cabinet, bundle them in groups with Velcro type

straps according to their terminating row position. Strap exposed cables for strain relief at the termination in the communications rooms.

4. All strapping and lashing of cable within the TR(s) and TER(s) shall be made with "Velcro" type straps for easy access to cable bundles to facilitate future "adds and changes". No plastic tie-wraps will be allowed for support of cable.
5. All cabling will be rated for a minimum operation range of -20°C to 75°C
6. All floor and wall penetrations shall be fire-stopped in accordance with local codes and restrictions.
7. New cabling will be installed in cable tray, conduit, and/or J-hooks throughout entirety of cable path.

B. Horizontal Cable

1. Install voice and data cable locations and configurations as depicted on drawings.
2. Test all cable prior to installation. Upon failure to perform testing, the installer shall accept the cable as good and assume all liability for the replacement of the cable should it be found defective at a later date.
3. All conformance standards must be certified for multipair and individual cable runs.
4. Jacketing and insulation must satisfy the Underwriter’s Laboratories (UL) listed fire rated cable insulation requirements in plenum areas.
5. Any pulling compound or lubricant used in cable installation must not deteriorate the conductor or the insulation. Provide 3M type WLC or an approved equal.
6. Copper cable runs shall not exceed 295 feet. All runs shall be continuous. No splicing is allowed.
7. The Contractor shall install copper cable with a minimum bend radius of six times the diameter of the cable.
8. Provide a 10-foot, patch cable with RJ45 connectors for 100% of each work area outlet insert installed. Provide 2-foot patch cords for each termination in the TR rooms, as required on the contract drawings. The patch cable rating and connector shall match the horizontal cable/connector rating.
9. Install 10-feet of spare copper cable (service loop) in each closet prior to termination. Provide Velcro type tie wrap for cable support and organization.
    a. Service loop shall be placed in the cable tray, and laid out in a horseshoe or figure-eight fashion.
10. Install minimum 12-inches of spare copper cable in ceiling plenum prior to dropping down wall to outlet. Support slack to structure with J-Hook and Velcro ties. If there is no plenum, loop shall be located in the box prior to termination. Provide box of sufficient size to accommodate spare cable, termination equipment if applicable and maintain bending radius.
11. Install 10-feet of spare copper cable (service loop) at each above ceiling outlet prior to termination. Provide Velcro type tie wrap for cable support and organization.
12. All horizontal cable shall be rated for plenum use.

13. The maximum pulling tension for 4-pair 23 AWG horizontal UTP cables shall not exceed 32 Ibf. The Contractor shall provide a tension meter during the pulling of all cables. If the meter shows that the tension has exceeded 32 Ibf, the Contractor shall discard the cable and pull new cable.

3.03 WORKSTATION TERMINATION

A. At the workstation termination point, cables shall be routed and dressed to provide a service loop in case re-termination is necessary. Leave 12 inches of slack at the junction box. Provide strapping of voice and data cable to provide strain relief of cable in relation to outlet termination.

B. Each horizontal workstation cable shall terminate on a modular jack connector and attached to the outlet faceplate. All unused faceplate ports will have a blank insert.

C. The Contractor shall adhere to the latest termination procedures as specified by manufacturer's instructions.

D. Follow TIA/EIA 568-B termination procedures.

3.04 PATCH SYSTEM

A. Each horizontal data cable will terminate on a loaded patch panel.

B. Mount the distribution panels starting at the upper most position of the racks/rails beginning with contractor provided fiber patch panels. Allow for sufficient space between the distribution panels to allow for horizontal wire managers and cross connect component installation. Provide a detail of your elevation plan to the OWNER or Owner's Representative before proceeding.

C. Provide and install Category 6 patch cables (as described in parts list) for channel testing. Two (2) patch cables will be provided and installed for each data link. Ten foot cables used for WAO and 2-foot cables for IT space patching.

3.05 TESTING

A. Copper Media Testing:

1. Contractor shall utilize personnel trained in the operation of the following Level II rated test equipment:

    a. Fluke DSX Series

    b. Ideal LanTEK II

    c. Viavi Certifier40G

    d. Approved equal

2. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable channel performance under installed conditions. The Contractor prior to system acceptance shall verify all conductors of each cable useable. Any defect in the cable system installation including but not limited to cable, connectors, patch panels and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

3. Perform end to end link testing of all cabling and connections with specified equipment and certify as meeting the criteria as defined in Category 6 UTP cabling systems within the most current publication of TIA/EIA 568-B.
4. Provide equipment calibration reports with test results.
5. Provide 72 hours' notice to the Owner prior to testing.

3.06 CLEANING

A. Upon completion of the installation, make all components free of any oil, grease, dust and debris.

B. Work areas will be cleaned at the end of each work day and a final cleanup will occur at project completion.

3.07 DOCUMENTATION

A. Electronic submittal, via CD ROM, of required cable test results, As-Built drawings, and warranty information will be submitted to the Owner or Owner's representative at least ten (10) working days before Certificate of Occupancy is awarded. CAD files shall be submitted in AutoCAD (.dwg) format. When proprietary software is needed to view cable test results, the contractor will provide a licensed copy for OWNER IT Department.

3.08 ACCEPTANCE

A. Review test results and conduct a final inspection and punch list walk-thru with Owner and/or Owner, to inspect installation and obtain concurrence. Concurrence does not waive the responsibility of the Contractor to correct deficiencies.

END OF SECTION

DIVISION 28
ELECTRONIC SAFETY & SECURITY

28 31 00 FIRE ALARM & MASS NOTIFICATION SYSTEM

1.00 GENERAL

1.01 SECTION INCLUDES

A. Expandable emergency evacuation fire alarm system.

1.02 REFERENCES

A. Electrical Industries Association (EIA):

1. RS-232-D – Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
2. RS-485 – standard defining the electrical characteristics of drivers and receivers for use in balanced digital multipoint systems

B. National Fire Protection Association (NFPA):

1. NFPA 12 – Standard on Carbon Dioxide Extinguishing Systems.
2. NFPA 13 – Installation of Sprinkler Systems.
3. NFPA 15 – Standard for Water Spray Fixed Systems for Fire Protection.
4. NFPA 16 – Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.
5. NFPA 16A – Standard for the Installation of Closed Head Foam-Water Sprinkler Systems.
6. NFPA 70 – National Electrical Code (NEC).
7. NFPA 72 – National Fire Alarm Code.
8. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems.
9. NFPA 101 – Life Safety Code.

C. Underwriters Laboratories (UL):

1. UL 268 – Standard for Smoke Detectors for Fire Alarm Signaling Systems.
2. UL 864 – Standard for Control Units and Accessories for Fire Alarm Systems.
3. UL 1971 – Standard for Signaling Devices for the Hearing Impaired.
4. UL 2572 – Standard for Control and Communication Units For Mass Notification Systems.

D. Unified Facilities Criteria (UFC):

1. UFC 3-600-01- Fire Protection Engineering for facilities

1.03 SYSTEM DESCRIPTION

A. A new intelligent reporting, Style 7 networked, fully peer-to-peer, microprocessor-controlled fire detection and emergency voice alarm communication system shall be installed in accordance with the specifications and as indicated on the Drawings.

B. Each Signaling Line Circuit (SLC) and Notification Appliance Circuit (NAC): Limited to only 80 percent of its total capacity during initial installation.

C. Basic Performance:

1. Network Communications Circuit (NetSOLO) Serving Network Nodes: Wired using single twisted non-shielded 2-conductor cable or connected using approved fiber optic cable between nodes in Class A configuration.

2. Signaling Line Circuits (SLC) Serving Addressable Devices: Wired Class A.

3. Initiation Device Circuits (IDC) Serving Non-addressable Devices Connected to Addressable Monitor Modules: Wired Class A.

4. Notification Appliance Circuits (NAC) Serving Strobes, Horns and Speakers: Wired Class A.

5. On Class A Configurations: Single ground fault or open circuit on Signaling Line Circuit shall not cause system malfunction, loss of operating power, or ability to report alarm.

6. Alarm Signals Arriving at INCC COMMAND CENTER: Not be lost following primary power failure until alarm signal is processed and recorded.

7. Transponders:

a. Operate in peer-to-peer fashion with other panels and transponders in system.

b. Each transponder shall store copy of audio evacuation messages and tones.

c. Systems that use centralized message storage and control at main fire alarm control panel shall not be acceptable.

8. Network Node Communications and Audio Evacuation Channels:

a. Communicated between panels and transponders on single twisted pair of copper wires or fiber optic cables.

b. To enhance system survivability, ability to operate on loss of INCC Command Center, short or open of entire riser at INCC Command Center shall be demonstrated at time of system acceptance testing.

9. Signaling Line Circuits (SLC):

a. Reside in remote transponders with associated audio zones.

b. SLC modules shall operate in peer-to-peer fashion with all other panels and transponders in system.

c. On loss of INCC Command Center, each transponder shall continue to communicate with remainder of system, including all SLC functions and audio messages located in all transponders.

d. Systems that provide a “Degraded” mode of operation upon loss of INCC Command Center or short in riser shall not be acceptable.

10. Audio Amplifiers and Tone-Generating Equipment: Electrically supervised for normal and abnormal conditions.

11. Amplifiers: Located in transponder cabinets.

12. Speaker NAC Circuits: Arranged such that there is a minimum of 1 speaker circuit per fire alarm zone.
13. Notification Appliance Circuits (NAC), Speaker Circuits, and Control Equipment: Arranged such that loss of any 1 speaker circuit will not cause loss of any other speaker circuit in system.
14. Speaker Circuits:
    a. Electrically supervised for open and short circuit conditions.
    b. If short circuit exists on speaker circuit, it shall not be possible to activate that circuit.
    c. Arranged for 25 or 70 VRMS and shall be power limited in accordance with NEC
    d. 20 percent spare capacity for future expansion or increased power output requirements.
15. Speaker Circuits and Control Equipment:
    a. Arranged such that loss of any 1 speaker circuit will not cause loss of any other speaker circuit in system.
    b. Systems utilizing “bulk” audio configurations shall not be acceptable.

D. Basic System Functional Operation: When fire alarm condition is detected and reported by 1 of the system alarm initiating devices, the following functions shall immediately occur:
1. System Alarm LEDs: Flash.
2. Local Piezo-Electric Signal in Control Panel: Sound at a pulse rate.
3. 80-Character LCD Display: Indicate all information associated with fire alarm condition, including type of alarm point and its location within protected premises.
4. Historical Log: Record information associated with fire alarm control panel condition, along with time and date of occurrence. History Log shall have capacity for recording up to 4,100 events.
5. System output programs assigned via control-by-event equations to be activated by particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
    a. Close Fire Doors
    b. Shut down air handlers as required by code
    c. Notify the Central Station.
6. Strobes flash synchronized continuously.
7. Audio Portion of System: Sound alert tone followed by pre-recorded message determined by event and this scenario repeating or other message as approved by local authority until system is reset.

E. Fire Alarm System Functionality:

1. Provide complete, electrically supervised distributed, Class A networked analog/addressable fire alarm and control system, with analog initiating devices, and integral multiple-channel voice evacuation.
2. Fire Alarm System:
    a. Consist of multiple-voice channels with no additional hardware required for total of 4 channels.
    b. Incorporate multiprocessor-based control panels, including model E3 Series modules includes Intelligent Network INCC Command Center(s) (INCC), Intelligent Loop Interface (ILI-MB-E3 or ILI95-MB-E3), Intelligent Network Transponders (INX), communicating over peer-to-peer token ring network with standard capacity of up to 64 nodes expandable to 122.
3. Each ILI-MB-E3 or ILI95-MB-E3 Node: Incorporate 2 Signaling Line Circuits (SLC), with capacity to support in Velociti ® mode up to 159 analog addressable detectors and 159 addressable modules per ILI-MB-E3 SLC or support in Apollo mode up to 126 detectors and modules per ILI95-MB-E3 SLC.
4. Voice, Data: Transmit over single pair of wires or fiber optic cable.
5. Each Intelligent Network Transponder: Capable of providing 16 distributed voice messages, SLC loop for audio control devices, and integral network interface.
6. Each Network Node: Incorporate Boolean control-by-event programming, including as a minimum AND, OR, NOT, and Timer functions.
7. Control Panels: Capability to accept firmware upgrades via connection with laptop computer, without requirement of replacing microchips or software key.
8. Network:
    a. Based on peer-to-peer token ring technology operating at 625 K baud, using Class A configuration.
    b. Capability of using twisted-pair wiring, pair of fiber optic Multi-mode cable strands up to 200 microns or Single-mode optimized for 9/125 microns, or any combination, to maximize flexibility in system configuration.
9. Each Network Node:
    a. Capability of being programmed off-line using Windows-based software supplied by fire alarm system manufacturer. Capability of being downloaded by connecting laptop computer into any other node in system. Systems that require system software to be downloaded to each transponder at each transponder location shall not be acceptable.
    b. Capability of being grouped with any number of additional nodes to produce a “Region”, allowing that group of nodes to act as 1, while retaining peer-to-peer functionality. Systems utilizing “Master/Slave” configurations shall not be acceptable.
    c. Capability of annunciating all events within its “Region” or annunciating all events from entire network, on front panel LCD or touchscreen display without additional equipment.

10. Each SLC Network Node: Capability of having integral DACT (digital alarm communicator transmitter) that can report events in either its region, or entire network to single Central station monitoring account.
11. Each Control Panel: Capability of storing its entire program, and allow installer to activate only devices that are installed during construction, without further downloading of system.
12. Password Protection: Each system shall be provided with 4 levels of password protection with up to 16 passwords. Passwords will be determined by owner.
13. Have the capacity for multiple pre-recorded messages (at least sixteen (16), but more if required by local AHJ) and address a list of subjects.
    a. Fire evacuation and relocation
    b. Intruder or hostile person sighted within or around the building grounds
    c. Directions to occupants to take cover within building
    d. Emergency weather conditions appropriate for local area
    e. All Clear

1.04 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Include sufficient information, clearly presented, to determine compliance with the specifications and the Drawings.

C. Equipment Submittals:
    1. Cover Page: Indicate the following:
        a. Project name and address.
        b. Engineered systems distributor's name and other contact information.
        c. Installing contractor's name and other contact information.
        d. Date of equipment submittals. Indicate on revised submittals the original submittal date and revised submittal date.
    2. Table of Contents: Lists each section of equipment submittal.
    3. Scope of Work Narrative: Detail indented scope of work.
    4. Sequence of Operations: Use matrix or written text format, detailing activation of each type of device and associated resulting activation of the following:
        a. Control panel. Complete specifications on system being installed.
        b. Notification appliances.
        c. Building fire safety functions.
    5. Bill of Material: Indicate for each component of system the following:
        a. Quantity.
        b. Model number.

c. Description.

6. SLC Circuit Schedule: Detail address and associated description of each addressable device. Clearly provide information that indicates number of both active and spare addresses.

7. Battery Calculations: Show load of each of, and total of, components of system along with standby and alarm times that calculations are based on. Show calculated spare capacity and size of intended battery.

D. Shop Drawings:

1. Cover Page: Indicate the following:

a. Project name and address.

b. Engineered systems distributor's name and other contact information.

c. Installing contractor's name and other contact information.

d. Date of equipment submittals. Indicate on revised submittals the original submittal date and revised submittal date.

2. Floor Plans:

a. If a floor plan must be split using match lines to fit on the page, provide match lines and match line references that refer to sheet number that shows area on opposite side of match line.

b. Prepare using AutoCAD.

c. Prepare to scale 1/8 inch = 1'-0", unless otherwise required by the Architect or Engineer.

d. Show equipment and device locations.

e. Show wiring information in point-to-point format.

f. Show conduit routing, if required by the AHJ.

3. Title Block: Provide on each sheet and include, at a minimum, the following:

a. Project name.

b. Project address.

c. Sheet name.

d. Sheet number.

e. Scale of drawing.

f. Date of drawing.

g. Revision dates, if applicable.

4. Control Panel: Provide sheet that details exterior and interior views of control panel and clearly shows associated wiring information.

E. Certification: Submit with equipment submittals and shop drawings, letter of certification from major equipment manufacturer, indicating proposed engineered system distributor is an authorized representative of major equipment manufacturer.

F. Project Record Drawings:

1. Submit complete project record drawings within 14 calendar days after acceptance test.
2. Project record drawings shall be similar to shop drawings, but revised to reflect changes made during construction.

G. Operation and Maintenance Manuals:

1. Submit complete operation and maintenance manuals within 14 calendar days after acceptance test.
2. Operation and maintenance manuals shall be similar to equipment submittals, but revised to reflect changes made during construction.
3. Include factory's standard installation and operating instructions.

1.05 QUALITY ASSURANCE

A. Codes and Standards:

1. NFPA: System shall comply with the following NFPA codes and standards:
   a. NFPA 12 – Standard on Carbon Dioxide Extinguishing Systems.
   b. NFPA 13 – Installation of Sprinkler Systems.
   c. NFPA 15 – Standard for Water Spray Fixed Systems for Fire Protection.
   d. NFPA 16 – Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.
   e. NFPA 16A – Standard for the Installation of Closed Head Foam-Water Sprinkler Systems.
   f. NFPA 70 – National Electrical Code (NEC).
   g. NFPA 72 – National Fire Alarm Code.
   h. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems.
   i. NFPA 101 – Life Safety Code.
2. ADA: System shall conform to American with Disabilities Act (ADA).
3. UFC: System shall comply with UFC 3-600-01 Fire Protection Engineering for Facilities.

B. To ensure reliability and complete compatibility, all items of fire alarm system, including control panels, power supplies, initiating devices, and notification appliances, shall be listed by Underwriters Laboratories Inc. (UL) and shall bear "UL" label.

C. Fire Alarm Control Panel Equipment: UL-listed under UL 864 Ninth Edition and UL 2572.

D. Equipment, Programming, and Installation Supervision:

1. Provide services of approved Platinum Level engineered systems distributor of equipment, programming, and installation supervision.
2. Provide proof of factory training within 14 calendar days of award of the Contract.

E. Software Modifications:

1. Provide services of factory-trained and authorized technician to perform system software modifications, upgrades, or changes at any time during warranty period or until installation is completed.
2. Provide use of all hardware, software, programming tools, programming key and documentation necessary to modify fire alarm system software on-site.
3. Modification includes addition and deletion of devices, circuits, zones, and changes to system operation and custom label changes for devices or zones.
4. System structure and software shall place no limit on type or extent of software modifications on-site.
5. Modification of software shall not require power-down of system or loss of system fire protection while modifications are being made.
6. Fire system shall have surge protection at all panel locations. Surge protection shall be located within the panel and shall have indicator lights showing condition of electrical circuit.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. AHJ will review the containers upon delivery to verify system components.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials from damage during handling and installation.

1.07 COORDINATION

A. Coordinate the Work of this section with the Work of other sections, including sprinkler systems as specified in Section 21 13 13 Wet-Pipe Sprinkler Systems, HVAC systems as specified in Division 23.

1.08 WARRANTY

A. Warranty Period for System Equipment: 1 year from date of final acceptance.

B. Fire system internal components shall be warranted according to the manufacture stamp. IE: Power supplies, cards, activation devices and controllers should come with a 2 year or more warranty.

2.00 PRODUCTS

2.01 MANUFACTURER(S)

A. List of Manufacturers:

1. Mircom
2. Silent Knight 5820XL, 5808 and 5700

3. Fire lite
4. No Proprietary systems are approved. AHJ will review all submittals to determine system components and programming.

B. References to manufacturer's model numbers and other information is intended to establish minimum standards of performance, function, and quality. Equivalent equipment from manufacturers listed in part 2, 2.1 Manufacturers, may be substituted for the specified Equipment, as long as minimum standards are met. No proprietary manufacturers will be considered for use on this project unless approved by the Texas Military Fire Marshal having jurisdiction.

C. Substitute equipment proposed as equal to equipment specified shall meet or exceed requirements of this section. For equipment other than Silent Knight or Mircom , provide proof that such substitute equipment equals or exceeds features, functions, performance, and quality of specified equipment and does not require a special dealer key for programming, reviewing or changing system functions.

This proof shall be provided by submission of a copy of specification with each copy of the submittals that has had each paragraph marked as either compliant or non-compliant along with a letter from engineering manager or product manager at factory that certifies information presented as either compliant or non-compliant including a detailed explanation of each paragraph identified as non-compliant.

2.02 DISTRIBUTED NETWORKED FIRE ALARM SYSTEM

A. Distributed Networked Fire Alarm System shall be provided.

2.03 INTELLIGENT NETWORK INCC COMMAND CENTER HARDWARE

A. Intelligent Network INCC Command Center (INCC): Supply user interface, including LCD or touch-screen 1/4 VGA display Intelligent Loop Interface Modules (ILI-MB-E3/ILI95-MB-E3), manual switching, phone, and microphone inputs to the network. INCC shall consist of the following units and components:

1. System Cabinet (B-, C-, or D-Size Cabinet) with associated inner door.
2. Power Supply Module (PM-9) with batteries.
3. Intelligent Network Interface Voice Gateway (INI-VG).
4. 80-Character LCD Display (LCD-E3).
5. Intelligent Loop Main Board Interface (ILI-MB-E3 or ILI95-MB-E3).
6. Optional DACT (DACT-E3).
7. Optional Auxiliary Switch Module (ASM-16).
8. Optional LED Driver Module (ANU-48)
9. Optional Microphone Assembly (INCC-MIC).

B. System Cabinet:

1. Surface or semi-flush mounted with texture finish. Red in color.
2. Consist of back box, inner door, and door.

3. Available in at least 3 sizes to best fit project configuration.
4. Houses 1 or more PM-9 Power Supply Modules, INI-VG Intelligent Network Interface Voice Gateway, 1 or more ILI-MB-E3/ILI95-MB-E3 assemblies, and other optional modules as specified.
5. Construction: Dead-front steel construction with inner door to conceal internal circuitry and wiring.
6. Wiring Gutter Space: A minimum of 1-inch wiring gutter space behind mounting plate.
7. Wiring: Terminated on removable terminal blocks to allow field servicing of modules without disrupting system wiring.

C. Power Supply Module (PM-9): Use latest technologies to provide system power, incorporates the following features:

1. Power-saving switching technology using no step-down transformers.
2. 9-amp continuous-rated output to supply up to all power necessary under normal and emergency conditions for INCC Command Center Modules.
3. Integral battery charger with capacity to charge up to 55 amp-hour batteries while under full load.

D. Batteries:

1. Sufficient capacity to provide power for entire system upon loss of normal AC power for a period of 60 hours with 15 minutes of alarm signaling at end of this 60-hour period, as required by NFPA 72, Auxiliary Systems.

E. Intelligent Network Interface Voice Gateway INCC Command Center (INI-VG): INI-VG shall be a multi-function board interchangeable in both INCC and INX. Functions of board shall have the following features as a minimum:

1. Microprocessor shall monitor all system events and perform all system programs, for all control-by-event (CBE) functions. System program shall not be lost upon failure of both primary and secondary power. Programming shall supporting Boolean logic including AND, OR, NOT, TIMING functions for maximum flexibility.
2. Network Interface: Operate at 625 K baud configurable with any combination of wire and/or fiber topologies. Interface shall communicate with up to122 nodes in peer-to-peer fashion.
3. Advanced Processing: INI-VG shall incorporate latest in digital signaling processing technology with supporting Boolean logic including AND, OR, NOT, TIMING, COUNT, SCHEDULE functions.
4. Microphone Input: On-board and allow for addition of local microphone when used as INCC Command Center, including speaker circuit control.
5. Signal Processing: INCC shall use advanced Digital Signal Processing (DSP) technology to allow maximum flexibility of digital audio and control capabilities and operation. Signals to and from INCC shall be transmitted over single pair of twisted unshielded wire or fiber optic pair.

6. Field Programmable: INCC shall be capable of being fully programmed or modified by Field Configuration Program (FCP), to be downloaded via portable computer from any node in system without using a program key.
7. Control-by-Event Programming (CBE): INCC shall be capable of programming using Boolean logic including AND, OR, NOT, COUNT, TIMING, and SCHEDULE functions to provide complete programming flexibility.
8. Remote INCC Command Center Options: System shall have capability of adding remote INCC Command Centers or re-locating INCC Command Centers utilizing only single pair of twisted unshielded wire or fiber optic pair for all functions.
9. Wiring: All data and voice shall transmit over single pair of twisted unshielded wire or fiber optic pair for all functions configured in Class A format. Any short or open in data, voice, or phone sections shall not affect transmission over remainder of network.
10. Class A Network: All communication between control panels and transponders shall be through supervised Style 7 token passing network. In event of single short, open, or ground, all system communication shall operate as normal and report fault. This protection shall incorporate all data and voice transmissions. Upon single short, open, or ground of either system data, live voice or pre-recorded channels, the function of each of these items shall continue to operate.

F. LCD Display Module (LCD-E3):

1. LCD Display: 80-character RS-485 based textual annunciator with capability of being mounted locally or remotely. Provides audible and visual annunciation of all alarms and trouble signals. Provide dedicated LEDs for:
   a. AC Power On: Green.
   b. Alarm: Red.
   c. Supervisory: Yellow.
   d. System Trouble: Yellow.
   e. Power Fault: Yellow.
   f. Ground Fault: Yellow.
   g. System Silenced: Yellow.
2. 80-Character Alphanumeric Display: Provide status of all analog/addressable sensors, monitor and control modules. Display shall be liquid crystal type (LCD), clearly visible in dark and under all light conditions.
3. Panel shall contain 4 functional keys:
   a. Alarm Acknowledge.
   b. Trouble Acknowledge.
   c. Signal Silence.
   d. System Reset/Lamp Test.
4. Panel shall contain 3 configuration buttons:
   a. Menu/Back.

b. Back Space/Edit.

c. OK/Enter.

5. Panel shall have 12-key telephone-style keypad to permit selection of functions.

G. Intelligent Loop Interface (ILI-MB-E3/ILI95-MB-E3): System shall be of multiprocessor design to allow maximum flexibility of capabilities and operation. Intelligent Loop Interface shall be capable of mounting in stand-alone enclosure or integrated with Intelligent Network INCC Command Center (INCC) as specified.

1. Field Programmable: System shall be capable of being programmed by Field Configuration Program (FCP), allowing programming to be downloaded via portable computer from any node on network without a software key.

2. RS-232C Serial Output: Supervised RS-232C serial port shall be provided to operate remote printers and/or video terminals, accept downloaded program from portable computer, or provide 80-column readout of all alarms, troubles, location descriptions, time, and date. Communication shall be standard ASCII code operating from 1,200 to 115,200 baud rate.

3. RS-485 Serial Output: Each ILI-MB-E3/ILI95-MB-E3 shall incorporate RS-485 bus via ribbon harness for connection of modules inside same cabinet, and via 4-wire quick connector for connection of modules up to 3,000 feet from cabinet. RS-485 bus shall support up to 16 ASM-16 auxiliary switch modules, 6 LCD-E3 main annunciators, and 5 LCD-7100 annunciators.

4. Peer-to-Peer Panel Configuration: All Loop Interface Modules shall incorporate own programming, log functions, Central Processor Unit, and control-by-event (CBE) programming. If any loop becomes disabled, each remaining loop driver shall continue to communicate with remainder of network and maintain normal operation. “Degrade” configurations under these conditions shall not be acceptable.

5. Control-by-Event (CBE) Program: ILI-MB-E3/ILI95-MB-E3 shall be capable of programming using Boolean logic including AND, OR, NOT, TIMING, COUNT, SCHEDULE functions to provide complete programming flexibility.

6. Alarm Verification: Smoke detector alarm verification shall be standard option while allowing other devices such as manual stations and sprinkler flow to create immediate alarm. This feature shall be selectable for smoke sensors that are installed in environments prone to nuisance or unwanted alarms.

7. Alarm Signals: All alarm signals shall be automatically latched or “locked in” at control panel until operated device is returned to normal and control panel is manually reset. When used for sprinkler flow, “SIGNAL SILENCE” switch may be bypassed, if required by AHJ. Specific programming will be reviewed by the AHJ.

8. Electrically Supervised:

a. Each SLC and NAC circuit shall be electrically supervised for opens, shorts, and ground faults. Occurrence of fault shall activate system trouble circuitry, but shall not interfere with proper operation of other circuits.

b. Yellow “SYSTEM TROUBLE” LEDs shall light and system audible sounder shall steadily sound when trouble is detected in system. Failure of power, open or short circuits on SLC or NAC circuits, disarrangement in system wiring, failure of microprocessor

c. or any identification module, or system ground faults shall activate this trouble circuit. Trouble signal shall be acknowledged by operating “TROUBLE ACKNOWLEDGE” switch. This shall silence sounder. If subsequent troubleconditions occur, trouble circuitry shall resound. During alarm, all trouble signals shall be suppressed with exception of lighting yellow “SYSTEM TROUBLE” LEDs.

9. Drift Compensation – Analog Smoke Sensors: System software shall automatically adjust each analog smoke sensor approximately once each week for changes in sensitivity due to effects of component aging or environment, including dust. Each sensor shall maintain its actual sensitivity under adverse conditions to respond to alarm conditions while ignoring factors which generally contribute to nuisance alarms. System trouble circuitry shall activate, display “DIRTY DETECTOR” and “VERY DIRTY DETECTOR” indications and identify individual unit that requires maintenance.

10. Analog Smoke Sensor Test: System software shall automatically test each analog smoke sensor a minimum of 3 times daily. Test shall be recognized functional test of each photocell (analog photoelectric sensors) and ionization chamber (analog ionization sensors) as required annually by NFPA 72. Failure of sensor shall activate system trouble circuitry, display “Test Failed” indication, and identify individual device that failed.

11. Off-Premises Connection:

    a. Fire Alarm System: Connect via leased telephone lines to central station or remote station.

    b. Fire Alarm System: Connect to local energy city master box.

    c. Fire Alarm System: Connect via Digital Alarm Communicator Transmitter (DACT) and telephone lines to central station or remote station. Panel shall contain disconnect switch to allow testing of system without notifying fire department.

12. Central Station Option: Fire alarm control panel shall provide integral Digital Alarm Communicator Transmitter (DACT) for signaling to central station. DACT shall contain “Dialer-Runaway” feature preventing unnecessary transmissions as result of intermittent faults in system and shall be Carrier Access Code (CAC) compliant, accepting up to 20-digit central station telephone numbers. AHJ will determine the monitoring company. Fire alarm system shall transmit both alarm and trouble signals, with alarm having priority over trouble signal. Contractor shall be responsible for all installation charges and Owner will be responsible for line lease charges.

13. Network Annunciator Option: Each ILI-MB-E3 or ILI95-MB-E3 and associated display shall provide option of being configured as network annunciator. Options for annunciation shall default as regional annunciator with capability of selecting global annunciation to provide system-wide protection and Acknowledge, Silence, and Reset capabilities.

14. Redundant History Log: Each ILI-MB-E3 or ILI95-MB-E3 shall contain full 4100 event history log supporting local and network functions. If a main processor or network node is lost the entire log shall be accessible at any other Loop Interface board. This shall be demonstrated by removing power from INCC Command Center followed by extraction of history log from any loop driver location, including INCC Command Center or Transponder.
15. LEDs Indicator and Outputs: Each ILI-MB-E3/ILI95-MB-E3 Loop Interface shall incorporate as a minimum the following diagnostic LED indicators:
    a. Power: Green.
    b. Alarm: Red.
    c. Supervisory: Yellow.
    d. General Trouble: Yellow.
    e. Ground Fault: Yellow.
    f. Transmit: Green.
    g. Receive: Green.
16. Auxiliary Power Outputs: Each ILI-MB-E3/ILI95-MB-E3 Loop Interface shall provide the following supply outputs:
    a. 24 VDC non-resettable, 1 amp. maximum, power limited.
    b. 24 VDC resettable, 1 amp. maximum, power limited.
17. Microprocessor: Loop interface shall incorporate 32-bit RISC processor. Isolated "watchdog" circuit shall monitor microprocessor and upon failure shall activate system trouble circuits on display. Microprocessor shall access system program for all control-by-event (CBE) functions. System program shall not be lost upon failure of both primary and secondary power. Programming shall support Boolean logic including AND, OR, NOT, TIME DELAY functions for maximum flexibility.
18. Auto Programming: System shall provide for all SLC devices on any SLC loop to be pre-programmed into system. Upon activation of auto programming, only devices that are present or changed shall activate.
19. Environmental Drift Compensation: System shall provide for setting Environmental Drift Compensation by device. When detector accumulates dust in chamber and reaches unacceptable level but yet still below allowed limit, control panel shall indicate maintenance alert warning. When detector accumulates dust in chamber above allowed limit, control panel shall indicate maintenance urgent warning.
20. NON-FIRE Alarm Module Reporting: Non-reporting type ID shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display message at panel LDC. Activation of NON-FIRE point shall activate control by event logic, but shall not cause indication on control panel.

21. 1-Man Walk Test:

    a. System shall provide both basic and advanced walk test for testing entire fire alarm system. Basic walk test shall allow single operator to run audible tests on panel. All logic equation automation shall be suspended during test and while annunciators can be enabled for test, all shall default to disabled state. During advanced walk test, field-supplied output point programming shall react to input stimuli, such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch input. Advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device, and wiring operation/verification.

    b. Test feature is intended to provide for certain random spot testing of system and is not intended to comply with requirements of testing fire alarm systems in accordance with NFPA 72, as it is impossible to test all functions and verify items such as annunciation with only 1 person.

22. Signaling Line Circuits: Each ILI-MB-E3 module shall provide communication with analog/addressable (initiation/control) devices via 2 signaling line circuits. Each signaling line circuit shall be capable of being wired Class B, Style 4 or Class A, Style 6. Circuits shall be capable of operating in NFPA Style 7 configuration when equipped with isolator modules between each module type device and isolator sensor bases. Each circuit shall communicate with a maximum of 159 analog sensors and 159 addressable monitor/control devices. Unique 40-character identifier shall be available for each device. Devices shall be of the Velocity series with capability to poll 10 devices at a time with a maximum polling time of 2 seconds when both SLCs are fully loaded.

23. Notification Appliance Circuits: 2 independent NAC circuits shall be provided on ILI-MB, polarized and rated at 2 amperes DC per circuit, individually over current protected and supervised for opens, grounds, and short circuits. They shall be capable of being wired Class B, Style Y or Class A, Style Z.

24. Alarm Dry Contacts: Provide alarm dry contacts (Form C) rated 2 amps at 30 VDC (resistive) and transfer whenever system alarm occurs.

25. Supervisory Dry Contacts: Provide supervisory dry contacts (Form C) rated 2 amps at 30 VDC (resistive) and transfer whenever system supervisory condition occurs.

26. Trouble Dry Contacts: Provide trouble dry contacts (Form C) rated 2 amps at 30 VDC (resistive) and transfer whenever system trouble occurs.

H. Auxiliary Switch Module (ASM-16):

1. Each ASM-16 has 16 programmable push-button switches.

2. Each push-button switch has 3 associated status LEDs (red, yellow, and green), configurable to indicate any combination of functions.

3. Flexible switch configurations to allow flexible set-up of phone, speaker, and auxiliary function circuits.

4. An insertable label to identify function of each switch and LEDs combination.

5. Provide capability to communicate with up to 16 ASM-16 modules locally, up to 3,000 feet from INCC Command Center.

6. Specialty modules that only perform 1 task such as speaker, phone, or auxiliary shall not be acceptable.

I. Microphone Assembly: Include the following items:

1. Mounting cabinet which occupies 1 module location on inner door of INCC.
2. Interconnect cable for connection of microphone to INI-VG.
3. 1 noise canceling microphone with push-to-talk button.

2.04 SUPPLEMENTAL NOTIFICATION APPLIANCE CIRCUIT (HPF24)

A. Supplemental Notification Appliance Circuit (HPF24) shall be Model [HPF24S6] offering [up to 6.0 amps (4.0 amps continuous)] of regulated 24-volt power. HPF24 shall include the following features:

1. Integral Charger: Charge up to 18.0 amp-hour batteries and support 60-hour standby.
2. 2 Input Triggers. Input trigger shall be Notification Appliance Circuit (from fire alarm control panel) or relay.
3. Surface-mount back box.
4. Ability to delay AC fail delay in accordance with applicable NFPA requirements.
5. Power limited circuitry in accordance with applicable UL standards.
6. Operates as sync follower or a sync generator.

2.05 SYSTEM PERIPHERALS - VELOCITI

A. Addressable Devices – General:

1. Provide address-setting means using rotary-decimal switches.
2. Use simple to install and maintain decade-type (numbered 0 to 15) address switches by using standard screwdriver to rotate 2 dials on device to set address. Devices which use binary address set via dipswitch packages, handheld device programmer, or other special tools for setting device address shall not be acceptable.
3. Detectors: Analog and addressable. Connect to fire alarm control panel's Signaling Line Circuits.
4. Addressable Thermal and Smoke Detectors: Provide 2 status LEDs. Both LEDs shall flash under normal conditions, indicating detector is operational and in regular communication with control panel, and both LEDs shall be placed into steady illumination by control panel, indicating alarm condition has been detected. If required, flashing mode operation of detector LEDs can be programmed off via fire control panel program.
5. Fire Alarm Control Panel: Permit detector sensitivity adjustment through field programming of system. Sensitivity can be automatically adjusted by panel on time-of-day basis.

6. Using software in INCC Command Center, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. Detectors shall be listed by UL as meeting calibrated sensitivity test requirements of NFPA 72, Chapter 7.
7. Detectors shall be ceiling-mounted and shall include separate twist-lock base with tamper-proof feature.
8. Following bases and auxiliary functions shall be available:
    a. Standard base with remote LED output.
    b. Sounder base rated at 85 dBA minimum.
    c. Intelligent Addressable Sounder base rated at 75 dBA minimum.
    d. Form-C relay base rated 30 VDC, 2.0 A.
    e. Isolator base.
9. Detectors shall provide test means whereby they will simulate alarm condition and report that condition to control panel. Such test shall be initiated at detector itself by activating magnetic switch or initiated remotely on command from control panel.
10. Detectors shall store internal identifying type code that control panel shall use to identify type of device (ION, PHOTO, THERMAL).

B. Addressable Manual Stations (MS-7AF):
1. Manual Fire Alarm Stations: Non-code, non-break glass type, equipped with key lock so they may be tested without operating handle.
2. Operated Station: Visually apparent, as operated, at a minimum distance of 100 feet (30.5 m) from front or side.
3. Stations shall be designed so after actual activation, they cannot be restored to normal except by key reset.
4. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on cover. The word FIRE shall appear on front of stations in raised letters, 1.75 inches (44 mm) or larger.
5. Addressable manual stations shall, on command from control panel, send data to panel representing state of manual switch and addressable communication module status.

C. Intelligent Thermal Detectors (ATD-RL2F): Intelligent addressable devices rated at 135 degrees F (58 degrees C) and have rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. Connect via 2 wires to fire alarm control panel signaling line circuit.

D. Intelligent Photoelectric Smoke Detectors (ASD-PL2F): Use photoelectric (light-scattering) principal to measure smoke density and shall, on command from control panel, send data to panel representing analog level of smoke density.

E. Intelligent Multi-Criteria Acclimating Detectors (MCS-ACCLIMATE2F):

1. Addressable device designed to monitor a minimum of photoelectric and thermal technologies in single-sensing device. Include ability to adapt to its environment by utilizing built-in microprocessor to determine its environment and choose appropriate sensing settings. Allow wide sensitivity window, with no less than 1 to 4 percent per foot obscuration. Utilize advanced electronics that react to slow smoldering fires and thermal properties within single sensing device.
2. Microprocessor: Capable of selecting appropriate sensitivity levels based on environment type it is in, such as office, manufacturing, or kitchen, and then have ability to automatically change setting as environment changes, as when walls are moved or as occupancy changes.
3. Intelligent multi-criteria detection device shall include ability to combine signal of thermal sensor with signal of photoelectric signal to react hastily in event of fire situation. Include inherent ability to distinguish between fire condition and false alarm condition by examining characteristics of thermal and smoke sensing chambers and comparing them to database of actual fire and deceptive phenomena.

F. Addressable Dry Contact Monitor Modules (AMM-2F):

1. Provide to connect 1 supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.
2. Mount in standard deep electrical box.
3. IDC Zone: Suitable for Style B operation.

G. Addressable Dry Contact Monitor Modules (AMM-4F):

1. Provide to connect 1 supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.
2. Mount in 4-inch (102-mm) square, 2-1/8-inch (54-mm) deep electrical box.
3. IDC Zone: Suitable for Style D or Style B operation.
4. LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

H. Addressable Dry Contact Monitor Modules (AMM-2IF):

1. Provide to connect 2 supervised IDC zones of conventional alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.
2. Mount in 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box.
3. IDC Zones: Suitable for Style B operation.
4. LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

I. Addressable Two Input and Two Output Modules (AMM-2RIF):

1. Provide two isolated sets of Form-C contacts, which operate as a single pole double throw switch. The module shall allow the control panel to switch these contacts on command. The module shall not provide supervision for the notification appliance circuit (NAC). Module shall have both normally open and normally closed connections available for field wiring. Two input modules shall connect two supervised initiating device circuit (IDC) or zone of conventional alarm initiating devices (any normally open dry contact device) to the fire alarm control panel signaling line circuit (SLC) Loop.
2. Mount in 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box.
3. IDC Zones: Suitable for Style B operation.
4. LEDs: Four LEDs that are controlled by the panel to indicate status of each input and output. Coded signals, transmitted from the panel, can cause the LED to blink, latch on, or latch off. Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

J. Addressable Dry Contact Monitor Modules (MMI-10F):

1. Provide to connect 10 supervised Style B IDC zones or 5 supervised Style D IDC zones of conventional alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.
2. Mount in factory-supplied MBB-2 or MBB-6 enclosure.
3. LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

K. Addressable Control Modules (AOM-2SF):

1. Provide to supervise and control operation of 1 conventional NAC of compatible, 24-VDC powered, polarized audio/visual notification appliances or UL-listed polarized relays for fan shutdown and other auxiliary control functions.
2. Mount in standard 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box or to surface-mounted back box.
3. Control Module NAC: Wire for Style Z or Style Y (Class A/B) with up to 1 amp of inductive signal or 2 amps of resistive signal operation. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.
4. Audio/Visual Power: Provide by separate supervised power circuit from main fire alarm control panel or from supervised, UL-listed remote power supply.

L. Addressable Relay Modules (AOM-2RF):

1. Provide two isolated sets of Form-C contacts, which operate as a double pole double throw switch. The module shall allow the control panel to switch these contacts on command. The module shall not provide supervision for the notification appliance circuit (NAC). Module shall have both normally open and normally closed connections available for field wiring.

2. Available for HVAC control and other building functions. Relay shall have 2 Form C sets of contacts that operate in tandem and are rated for a minimum of 2.0 amps resistive or 1.0 amps inductive. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.
3. Mount in standard 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box or to surface-mounted back box.
4. LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

M. Conventional Heat Detectors:

1. Combination rate-of-rise and fixed temperature rated at 135 degrees F (57.2 degrees C) for areas where ambient temperatures does not exceed 100 degrees F (37.7 degrees C), and 200 degrees F (93.3 degrees C) for areas where temperature does not exceed 150 degrees F (65.5 degrees C).
2. Low profile, ceiling-mount type with positive indication of activation.
3. Rate-of-Rise Element: Air chamber, flexible metal diaphragm, and factory-calibrated, moisture-proof, trouble-free vent, and operate when rate of temperature rise exceeds

   15 degrees F (9.4 degrees C) per minute.
4. Fixed-Temperature Element: Fusible-alloy retainer and actuator shaft.
5. Smooth Ceiling Rating: 2,500 square feet (762 m2).

N. Conventional Photoelectric Area Smoke Detectors:

1. 24-VDC, 2-wire, ceiling-mounted, light-scattering type using LEDs light source.
2. Each Detector: Remote LEDs output and built-in test switch.
3. Provide on twist-lock base.
4. Perform calibrated sensitivity and performance test on detector without need for generation of smoke. Test method shall test all detector circuits.
5. Visual Indication of Alarm: Provide by dual-latching LEDs on detector, seen from ground level over 360 degrees. LEDs shall flash every 10 seconds, indicating power is applied to detector.
6. Detector shall not go into alarm or trouble when exposed to air velocities of up to 3,000 feet (914.4 m) per minute.
7. Detector Screen and Cover Assembly: Easily removable for field cleaning of detector chamber.
8. Field-Wire Connections: Made to base through use of clamping plate and screw.

2.06 SYSTEM PERIPHERALS – E3 SERIES

A. Auxiliary Switch Module (ASM-16):

1. Each ASM-16 has 16 programmable push-button switches.

2. Each push-button switch has 3 associated status LEDs (red, yellow, and green), configurable to indicate any combination of functions.
3. Flexible switch configurations to allow auxiliary functions.
4. An insertable label to identify function of each switch and LEDs combination.
5. Provide capability to communicate with up to 16 ASM-16 modules locally, or up to 3,000 feet from the Control Panel.

B. LCD Display Annunciator:

1. Furnish and install as indicated on the Drawings a remote serial annunciator, Model LCD-7100. Annunciator shall provide 80-character display, which shall duplicate all information on basic system display, including any network nodes its host panel is annunciating, with exception of menus. Contain the following function keys:
   a. Alarm Acknowledge.
   b. Trouble Acknowledge.
   c. Signal Silence.
   d. System Reset/Lamp Test.
   e. System Drill Test.
2. Key Lock: Enable switches only when placed in “ON” position, with exception of Trouble Acknowledge, which is used to silence local trouble audible sounder. Annunciator shall contain the following LEDs:
   a. Alarm.
   b. Supervisory.
   c. System Trouble.
   d. Power Fault.
   e. System Silenced.
3. Mount on standard 3-gang surface or flush electrical box.
4. Each ILI-MB-E3/ILI95-MB-E3: Accommodate up to 5 remote LCD-7100 annunciators which shall be located up to 3,000 feet from control panel.

C. Speakers:

1. Operate on 25 VRMS or 70.7 VRMS with field-selectable output taps from 0.5 to 2.0 watts.
2. Speakers in Corridors and Public Spaces: Produce nominal sound output of 84 dBA at 10 feet (3 m).
3. Frequency Response: Minimum of 400 Hz to 4,000 Hz.
4. Back of Each Speaker: Sealed to protect speaker cone from damage and dust.

D. Strobes:

1. Compliance: ADA and UL 1971.

2. Maximum Pulse Duration: 0.2 second.
3. Strobe Intensity: UL 1971.
4. Flash Rate: UL 1971.
5. Strobe Candela Rating: Determine by positioning selector switch on back of device.

E. Speaker/Strobes:

1. Operate on 25 VRMS or with field-selectable output taps from 0.5 to 2.0 watt
2. Speakers in Corridors and Public Spaces: Produce nominal sound output of 84 dBA at 10 feet (3 m).
3. Frequency Response: Minimum of 400 Hz to 4,000 Hz.
4. Back of Each Speaker: Sealed to protect speaker cone from damage and dust.
5. Audibility: NFPA 72.
6. Maximum Pulse Duration: 0.2 second.
7. Strobe Intensity: UL 1971.
8. Flash Rate: UL 1971.
9. Strobe Candela Rating: Determine by positioning selector switch on back of device.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas and surfaces to receive fire alarm system.

1. Notify Architect of conditions that would adversely affect installation or subsequent use.
2. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

A. Install fire alarm system in accordance with the codes listed herein this specification, state and local codes, manufacturer's instructions, and as indicated on the Drawings.

B. Conceal conduit, junction boxes, and conduit supports and hangers in finished areas. Conceal or expose conduit, junction boxes, and conduit supports and hangers in unfinished areas.

C. Do not install smoke detectors before system programming and test period. If construction is ongoing during this period, take measures to protect smoke detectors from contamination and physical damage.

D. Flush-mount fire detection and alarm system devices, control panels, and remote annunciators in finished areas. Flush-mount or surface-mount fire detection and alarm system devices, control panels, and remote annunciators in unfinished areas.

E. Ensure manual stations are suitable for surface mounting or semi-flush mounting as indicated on the Drawings. Install not less than 42 inches, nor more than 48 inches, above finished floor measured to operating handle.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide service of competent, factory-trained technician authorized by manufacturer to technically supervise and participate during pre-testing and acceptance testing of system.

B. Testing:

1. Conduct complete visual inspection of control panel connections and test wiring for short circuits, ground faults, continuity, and insulation before energizing cables and wires.

2. Close each sprinkler system control valve and verify proper supervisory alarm at INCC Command Center.

3. Verify activation of flow switches.

4. Open initiating device circuits and verify that trouble signal actuates.

5. Open signaling line circuits and verify that trouble signal actuates.

6. Open and short notification appliance circuits and verify that trouble signal actuates.

7. Ground initiating device circuits and verify response of trouble signals.

8. Ground signaling line circuits and verify response of trouble signals.

9. Ground notification appliance circuits and verify response of trouble signals.

10. Check alert tone and prerecorded voice message to alarm notification devices.

11. Check installation, supervision, and operation of intelligent smoke detectors.

12. Introduce on system each of the alarm conditions that system is required to detect. Verify proper receipt and proper processing of signal at INCC Command Center and correct activation of control points.

13. Consult manufacturer's manual to determine proper testing procedures when system is equipped with optional features. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality, and similar.

C. Acceptance Testing:

1. Before installation shall be considered completed and acceptable by AHJ, a complete test using as a minimum, the following scenarios shall be performed and witnessed by representative approved by Engineer. Monitoring company and/or fire department shall be notified before final test in accordance with local requirements.

2. Contractor's job foreman, in presence of representative of manufacturer, representative of Owner shall operate every installed device to verify proper operation and correct annunciation at control panel.

3. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.

4. Completely disconnect INCC Command Center from rest of network, including Voice INCC Command Center. Activate initiating device from transponder. All speaker circuits activated from each transponder shall transmit the correct evacuation or alert message. These messages shall be same messages transmitted with INCC Command Center activated. Default tones or messages shall not be acceptable.
5. Completely disconnect INCC Command Center from rest of network. Activate initiating device. All control outputs supported by transponder SLC circuits shall operate under project programming mode. Default or degrade mode programming shall not be acceptable.
6. All audio risers shall be directly shorted between INCC Command Center and first audio transponder, followed by activation of alarm initiating device. Correct pre-recorded messages shall transmit from all speakers, including evacuation and alert channels. Default or degrade messages shall not be acceptable.
7. When testing has been completed to satisfaction of both Contractor's job foreman and representatives of manufacturer and Owner, a notarized letter co-signed by each attesting to satisfactory completion of said testing shall be forwarded to Owner.
8. Leave fire alarm system in proper working order and, without additional expense to Owner, replace defective materials and equipment provided within 1 year (365 days) or date of manufacture part from date of final acceptance by the owner.

3.04 DEMONSTRATION

A. Coordinate instruction as required for operating fire alarm system with the AHJ.

B. Coordinate hands-on demonstrations of operation of fire alarm system components and functions with the AHJ.

END OF SECTION

DIVISION 31
EARTHWORK

31 05 13 SOILS FOR EARTHWORK

1.00 GENERAL

1.01 WORK INCLUDED

A. This Section of the specifications describes the various classes of Earth Fill. All of the classes of Earth Fill contained in this specification may not be used on this project. The classes of Earth Fill used on this project are shown on the drawings or specified in other sections of the specifications. This Section does not include specifications for placement and compaction of Earth Fill. Specifications for placement and compaction of Earth Fill are included in other sections of the specifications and/or shown on the drawings.

1.02 STANDARDS

A. Soil materials shall be classified into the appropriate class of Earth Fill shown below according to ASTM D2487 “Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)” or other appropriate methods as designated by the Engineer.

2.00 PRODUCTS

2.01 MATERIALS; CLASSIFICATIONS

A. Class 1 Earth Fill: Limited to clays and sandy clays classified as CH material with a liquid limit greater than or equal to 50, a plasticity index greater than or equal to 25, and a minimum of 60 percent passing the No. 200 sieve, which are free of organic materials.

B. Class 2 Earth Fill: Limited to clays and sandy clays classified as CH and CL materials with a coefficient of permeability less than or equal to 1.0×10^{-7} cm/sec, a liquid limit greater than or equal to 30, a plasticity index greater than or equal to 15, and more than 50 percent passing the No. 200 sieve, which are free of organic materials.

C. Class 3 Earth Fill: Consist of any materials classified as CH, CL, SM, SP, SP-SM, SC, and GC, which have a minimum plasticity index of 4, which are free of organic materials.

D. Class 4 Earth Fill: Consist of materials which are classified as SP, SM, SC, CL, or dual classifications thereof, which have a liquid limit less than or equal to 35 and a plasticity index of a minimum of 7 and a maximum of 20, which are free of organic materials.

E. Class 5 Earth Fill: Consist of materials classified as SP or SP-SM which have a plasticity index less than or equal to 4 and a maximum of 12 percent passing the No. 200 sieve, which are free of organic materials.

F. Class 12 Earth Fill: Consist of soils suitable for topsoil which are relatively free of stones or other objectionable debris, which have sufficient humus content to readily support vegetative growth. The suitability of soils for topsoil shall be subject to the approval of the Engineer.

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

31 05 16 AGGREGATES FOR EARTHWORK

1.00 GENERAL

1.01 WORK INCLUDED

A. This Section of the specifications describes the various classes of Aggregate Fill. All of the classes of Aggregate Fill contained in this specification may not be used on this project. The classes of Aggregate Fill used on this project are shown on the drawings or specified in other sections of the specifications. This Section does not include installation. Installation of Aggregate Fill is included in other sections of the specifications and/or on the drawings.

1.02 QUALITY ASSURANCE

A. Classification Testing:

1. Contractor Testing:

a. Arrange and pay for the services of an independent testing laboratory to sample and test proposed Aggregate Fill materials.

b. Submit the test results to the Engineer, and obtain approval prior to providing Aggregate Fill.

2. Owner Testing: The Owner shall arrange and pay for additional testing on the Aggregate Fill after delivery to the project site as determined necessary by the Engineer.

B. Contamination Certification:

1. Obtain a written, notarized certification from the Supplier of each proposed Aggregate Fill source stating that to the best of the Supplier's knowledge and belief there has never been contamination of the source with hazardous or toxic materials.

2. Submit these certifications to the Engineer prior to proceeding to furnish Aggregate Fill to the site. The lack of such certification on a potential Aggregate Fill source shall be cause for rejection of that source.

1.03 STANDARDS

A. Aggregate Fill shall be classified into the appropriate class listed below according to ASTM testing procedures as specified for the various classes.

1. American Society for Testing and Materials (ASTM) Standards:

ASTM C33	Specification for Concrete Aggregates
ASTM C88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium sulfate
ASTM C125	Terminology Relating to Concrete and Concrete Aggregates
ASTM C131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C535	Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D448	Classification for Sizes of Aggregate for Road and Bridge Construction

2.00 PRODUCTS

2.01 MATERIALS; CLASSIFICATIONS

A. Class 1 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 57:

Sieve Size Square Opening	Percent Passing
1-1/2”	100
1”	95-100
1/2”	25-60
No. 4	0-10
No. 8	0-5

B. Class 2 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 67:

Sieve Size Square Opening	Percent Passing
1”	100
3/4”	90-100
3/8”	20-55
No. 4	0-10
No. 8	0-5

C. Class 3 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 7:

Sieve Size Square Opening	Percent Passing
3/4”	100

1/2”	90-100
3/8”	40-70
No. 4	0-15
No. 8	0-5

D. Class 4 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 467:

Sieve Size Square Opening	Percent Passing
2”	100
1-1/2”	95-100
3/4”	35-70
3/8”	10-30
No. 4	0-5

E. Class 5 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 357:

Sieve Size Square Opening	Percent Passing
2-1/2”	100
2”	95-100
1”	35-70
1/2”	10-30
No. 4	0-5

F. Class 6 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 1:

Sieve Size Square Opening	Percent Passing
4”	100
3-1/2”	90-100
2-1/2”	25-60
1-1/2”	0-15
3/4”	0-5

G. Class 7 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and shall have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 6:

Sieve Size Square Opening	Percent Passing
1”	100
3/4”	90-100
1/2”	20-55
3/8”	0-15
No. 4	0-5

H. Class 8 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and shall have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 56:

Sieve Size Square Opening	Percent Passing
1-1/2”	100
1”	90-100
3/4”	40-85
1/2”	10-40
3/8”	0-15
No. 4	0-5

I. Class 9 Aggregate Fill:

1. Consist of washed and screened gravel and natural sands or sands manufactured by crushing stones complying with the requirements of ASTM C33, except that the gradation shall be as follows:

Sieve Size Square Opening	Percent Passing
1/2”	100
3/8”	95-100
No. 4	80-95
No. 8	65-85
No. 16	50-75
No. 30	25-60
No. 50	10-30
No. 100	0-10

2. Class 9 Aggregate Fill shall have not more than 45 percent passing any sieve and retained on the next consecutive sieve of those shown above, and its fineness modulus, as defined in ASTM C125, shall be not less than 2.3 nor more than 3.1.

J. Class 10 Aggregate Fill:

1. Consist of washed and screened natural sands or sands manufactured by crushing stones complying with the requirements and tests of ASTM C33. The gradation as included in ASTM C33 is as follows:

Sieve Size Square Opening	Percent Passing
3/8”	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	0-10

2. Class 10 Aggregate Fill shall have not more than 45 percent passing any sieve and retained on the next consecutive sieve of those shown above, and its fineness modulus, as defined in ASTM C125, shall be not less than 2.3 nor more than 3.1.

K. Class 11 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation:

Sieve Size Square Opening	Percent Passing
1-3/4”	100
7/8”	65-90
3/8”	50-70
No. 4	35-55
No. 40	15-30
No. 100	0-12 (Wet Sieve Method)

L. Class 12 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation:

Sieve Size Square Opening	Percent Passing
1-1/2”	100
1”	85-100
3/4”	60-95
3/8”	50-80
No. 4	40-65
No. 16	20-40
No. 100	0-12 (Wet Sieve Method)

M. Class 13 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and shall meet the following gradation:

Sieve Size Square Opening	Percent Passing
1-3/4”	100
7/8”	65-90
3/8”	50-70
No. 4	35-55
No. 40	15-30
No. 100	0-3 (Wet Sieve Method)

N. Class 14 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation:

Sieve Size Square Opening	Percent Passing
1-1/2"	100
1"	85-100
3/4"	60-95
3/8"	50-80
No. 4	40-65
No. 16	20-40
No. 100	0-3 (Wet Sieve Method)

O. Class 15 Aggregate Fill: Consist of durable particles of silica sand, washed clean, chemically inert, and packaged by the Supplier. The material shall meet applicable regulatory requirements for monitor well filter pack. The source of the material shall be approved by the Engineer and shall meet the following gradation requirements:

Sieve Size Square Opening	Percent Passing
No. 20	98-100
No. 40	0-2

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

31 25 13.13 SEEDING FOR EROSION CONTROL

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and incidentals necessary to seed the slopes and other areas as specified. This specification includes seedbed fertilization, watering, mulching, and emulsifying or tacking the mulch and maintenance until final acceptance by the Owner.

1.02 QUALITY ASSURANCE

A. Soil Testing: Fertilizer requirements for each planting area and for significantly different soil types within planting areas, will be determined by a qualified laboratory such as the Texas A&M University - Agricultural Extension Service soil testing laboratory. Representative composite soil samples will be collected from the planting areas and submitted to an approved soil testing laboratory.

1.03 STANDARDS

A. The seed used on this project will conform to ITEM 164.2 Standard Specifications for Construction of Highways, Streets and Bridges, Texas Department of Transportation.

1.04 DELIVERY AND STORAGE

A. Deliver seed with each variety separately bagged.

1.05 OPTIONS

A. If dry mechanical methods are used, the fertilizer may be spread at the same time as the seed. After sowing, straw mulch will be mechanically spread over the seeded area.

B. When seed and fertilizer are to be distributed as a water slurry, apply the mixture within 30 minutes of mixing.

2.00 PRODUCTS

2.01 MATERIALS

A. Seed: From the previous season’s crop, labeled in accordance with the Texas Seed Law.

1. Seed for Fall planting (temporary) shall be one or more of the following small grains as designated by the Engineer: Wheat, oats, rye, or barley.

2. Seed for spring planting (permanent) shall be Bermuda grass.

B. Fertilizer: Insert requirements.

C. Mulch:

1. Consisting of straw, wood-fiber, mulch nettings, wood chips or other suitable material approved by the Engineer and free of Johnson grass and other noxious weed seeds.

2. Straw mulch shall be oat, wheat or rice straw, prairie hay, Bermuda grass hay, or other hay harvested before seed production and approved by the Engineer. The straw mulch

will be kept dry and shall not be rotted or molded. A minimum of 50 percent by weight of the herbage making up the hay shall be 10 inches in length or longer.

D. Topsoil: As specified for Class 12 earth fill in Section 31 05 13 “Soils for Earthwork.”

E. Herbicide: Contractor shall be responsible for using herbicides in a manner consistent with label requirements and precautions. Only registered herbicides having a minimal residual effect shall be used. Contractor shall strictly adhere to all Federal, State, and local laws governing herbicide usage.

3.00 EXECUTION

3.01 TOPSOIL PLACEMENT

A. Place topsoil as specified for Class 12 earth fill in Section 31 23 23.16 “Compacted Earth Fill [Landfills and Heavy Earthwork Projects, Excluding Dams].”

3.02 FALL PLANTING

A. Fall planting will be temporary only and will be required if construction is completed between May 15 and November 30. The fall planting is to be followed by a spring planting of perennial vegetation.

B. Seedbed Preparation: Use a one-way plow, tandem disk, bedder, or equipment which will accomplish similar results. Break or mix the surface of the soil with the tillage equipment. Additional tillage operations will be necessary if required so planting can be on a clean, firm seedbed. Chiseling will be necessary on areas which have been severely compacted.

C. Seeding:

1. Seeding will be required on disturbed or excavated areas and on new embankments of whatever nature unless requested otherwise by the Engineer.

2. Optimum fall planting dates are September 1 to November 30. Accomplish the seeding for fall planting within these dates unless approval to do otherwise is obtained from the Engineer. Planting rates when drilled or broadcast are as follows:

Seeding	lb./acre
Wheat	120 lb./acre
Oats	128 lb./acre
Rye	112 lb./acre
Barley	114 lb./acre

3.03 SPRING PLANTING

A. Follow procedures for spring planting if construction is completed between November 30 and May 15, or after a temporary fall planting has been made:

1. Seedbed Preparation: Seedbed preparation for Spring planting is the same as that stated in the Fall planting of temporary cover with one addition: Any temporary cover crop must be top killed using an approved contact herbicide or by mechanically undercutting the growing cover crop, leaving residues on or near the soil surface.

2. Mulching:

    a. Spread mulch material on the area to be planted if construction was completed too late for planting a temporary fall crop or if insufficient residues are produced by the fall planting. Mulch the planting areas to control soil erosion and seed loss by wind and water and to promote grass establishment. Apply Mulch hay at the rate of 2 tons per acre and spread uniformly so that about 25 percent of the ground surface is uniformly visible through the mulch.

    b. Anchor the mulch hay by treading into the soil with a straight disk type mulch tiller. Perform disking across the slope along contours. Other types of mulch such as wood cellulose fiber or cotton bur mulch may be used at recommended rates, if approved by the Engineer. Apply mulch in a manner that will not hinder emergence of seedlings.

    c. Other methods of mulch anchoring are available, including mulch netting, peg and twine, pick chain, slit, and asphalt mulch tie-down. Descriptions of these methods are available in the 1976 Soil Conservation Service report entitled, “Erosion and Sediment Control Guidelines for Developing Areas in Texas.

3. Seeding:

    a. Plant Bermuda grass seed between March 1 and May 15. Sow the seed at the rate of 50 pounds of pure live seed (PLS) per acre, or more if required to obtain a complete stand of grass. The PLS content is determined by multiplying the seed package weight by the product of the percent purity and the percent germination, which are contained on the seed label.

    b. Accomplish seeding by mechanical means using either broadcasting or drilling type equipment to provide uniform distribution of the seed in the planting areas. Cover Bermuda grass seed by 1/4 to 1/2 inch of soil. If seed is drilled, the distance between drill rows shall not exceed 12 inches. Hydro seeding may be used to apply seed, fertilizer, and wood-fiber mulch with the approval of the Engineer.

3.04 MAINTENANCE

A. Irrigation: Supply the seeded areas with adequate moisture (3- to 4-inch penetration) at 10-day intervals, if needed, for seed germination and plant growth until acceptance by the Owner. Water the seed in a manner which will prevent erosion of the soil. Furnish all water to be used.

B. Repair: Repair washouts and other bare soil areas in a seeded area either by re-seeding, sprigging, or spot sodding, and perform maintenance as needed to establish grass in the area.

C. Weed Control:

1. Control competitive weed growth during the establishment period by mowing and/or with herbicides. Chemical usage shall be in accordance with the current recommendations of the Texas Agricultural Experiment Station or local Soil Conservation Service Field Office Technical Guides. Strictly adhere to all Federal, State, and local laws governing herbicides.

2. Weed control shall be the Contractor's responsibility whether topsoil is from on-site or off-site sources and also for seeded areas which are specified not to receive topsoil.

3.05 SEEDING OF DISTURBED AREAS

A. Disturbed areas will require seeding as specified in this Section unless requested otherwise by the Engineer or shown otherwise on the drawings or in the specifications.

B. Any areas which are disturbed by the Contractor which are not shown on the drawings or specified to require disturbance including any approved areas not shown on the drawings, shall be considered as unauthorized disturbed areas. Any such areas shall be seeded as specified in this Section at the Contractor's expense and shall not be measured or paid under this Section.

3.06 FIELD QUALITY CONTROL; OBSERVATION AND ACCEPTANCE

A. Observation: Upon completion of the site preparation, mulching, fertilizing, seeding, and maintenance of seeded areas, the Engineer will observe the seeded areas periodically to determine the establishment success. The Engineer will consider soil coverage, purity of the grass stand, and maturity of the plants.

B. Establishment of Stand and Acceptance:

1. The Engineer will determine that a grassed area is established upon fulfillment of the following conditions:

2. The permanent grass stand uniformly covers the planting area, with no exposed soil areas more than 36 inches across in any dimension.

3. The permanent grass stand is free of over-topping weed species which would compete for sunlight, moisture, and nutrients. In addition, no area of pure weed species greater than 36 inches across in any dimension shall occur within a permanent grass stand.

4. The majority of the grass plants in a stand shall have a well-established root system to survive if irrigation is discontinued.

5. Establish the permanent grass stand before October 1 to preclude having to perform a temporary Fall seeding. In the event a fall seeding must be performed, follow-up the temporary seeding with a permanent seeding as specified. Upon final acceptance of the work under this contract, the Owner will assume the responsibility of maintaining the grassed areas.

END OF SECTION

APPENDIX A

A1.00 MEASUREMENT AND PAYMENT

A1.01 MEASUREMENT

A. Areas seeded shall be measured to nearest 0.1 acre by a survey performed by the Contractor. The Contractor shall cooperate with the Engineer to determine the adequacy and accuracy of the survey.

A1.02 PAYMENT

A. Payment for seeding will be made on the basis of the unit price bid per acre for "Seeding for Erosion Control." A maximum of 50 percent completion of any area will be approved for completion of seedbed preparation, mulching, and temporary and permanent seeding. The remaining percentage will be approved after stand establishment.

END OF APPENDIX A

DIVISION 32
EXTERIOR IMPROVEMENTS

32 12 16 ASPHALT PAVING

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to perform operations in connection with the construction of hot mix asphaltic concrete (HMAC) base course, leveling-up course and surface course or any other combination of these courses. Construct the pavement on the previously completed and approved subgrade, base, or existing pavement.

1.02 QUALITY ASSURANCE

A. Design Criteria: Use the services of an independent testing laboratory to prepare a mix design to comply with Texas Department of Transportation, Standard Specification Item 340 or may use a previously prepared mix design meeting the specification requirements with satisfactory substantiation of experience with the mix.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Submittal Procedures” and shall include:

1. Mix design as record data.

1.04 STANDARDS

A. Hot mix asphaltic concrete (HMAC) pavement shall conform to the requirements of the current Texas Department of Transportation (TXDOT), Standard Specification for “Dense-Graded Hot Mix Asphaltic “, Item 340.

B. Asphaltic material shall comply with Texas Department of Transportation (TXDOT) Standard Specification Item 300.

1.05 DELIVERY AND STORAGE

A. Haul the asphaltic mixture to the job site in tight vehicles previously cleaned of foreign materials. Arrange the dispatching of vehicles so that all material delivered shall be placed and all rolling shall be completed during daylight hours. In cool weather, or for long hauls, canvas covers may be required. The inside of the truck body may be given a light coating of oil, if necessary, to prevent the asphaltic mixture from adhering to the body.

1.06 JOB CONDITIONS

A. Do not apply prime coat when the air temperature is below 50 F and falling, but may be applied when the air temperature is above 40 F and rising, the air temperature being taken in the shade and away from artificial heat. Do not place asphaltic material when general weather conditions, in the opinion of the Owner’s Representative are not suitable.

B. The asphaltic mixture shall be at a temperature between 225 and 350 F when dumped from the mixer. The Owner’s Representative shall determine the temperature, within the above

limitations. The mixture when dumped from the mixer shall not vary from the selected temperature more than 30 F.

2.00 PRODUCTS

2.01 MATERIALS

A. Aggregate: Conform to TXDOT Standard Specification Item 340. The Type "B" mixtures and at least three bins when producing Type "D" mixture. These bins shall contain the following sizes of aggregate, in percentages by weight or by volume, as applicable.

1. Gradation for base course or leveling-up course shall comply with Type B listed as follows:

a. Type "B" (Fine Graded Base Course):

Sieve Size	Percent Passing by Weight or Volume
1"	98-100
3/4"	84-98
5/8"	75-95
3/8"	60-80
No. 4	40-60
No. 8	29-43
No. 30	13-28
No. 50	6-20
No. 200	2-7
VMA percent minimum	12
The asphaltic material shall form from 3.5 to 7 percent of the mixture by weight unless specified otherwise on the plans.	

2. Gradation for surface course shall comply with Type D listed as follows:

a. Type "D" (Fine-Graded Surface Course):

Sieve Size	Percent Passing by Weight or Volume
1/2"	98-100
3/8"	85-100
No. 4	50-70
No. 8	35-46
No. 30	15-29
No. 50	7-20
No. 200	2-7

VMA percent minimum	14
The asphaltic material shall form from 4 to 8 percent of the mixture by weight unless specified otherwise on the plans.	

B. Asphaltic Materials: Comply with TXDOT Standard Specification Item 300. In general, the grade of asphalt shall be AC-10. Other grades of asphalt shall be considered if weather conditions or mix design appear to warrant a change. Prime coat shall comply with TXDOT Standard Specification Item 300, Grade MC-30. Tack coat shall meet the requirements of cutback asphalt RC-250.

2.02 EQUIPMENT

A. The equipment necessary for the construction of the hot mix asphaltic concrete pavement shall be on the project site and shall be approved by the Owner's Representative as to condition before the Contractor shall be permitted to begin construction operations on which the equipment is to be used. Equipment shall be maintained in good repair and operating condition.

B. Spreading and Finishing Machines:

1. The spreading and finishing machine shall be of a type approved by the Owner's Representative and capable of producing a surface that shall meet the requirements of the typical cross section and surface test.

2. Rollers:

a. Pneumatic Tire Roller: The roller shall consist of not less than seven pneumatic tire wheels, running on axles in such a manner that the rear group of tires shall cover the entire gap between adjacent tires of forward group; mounted in a rigid frame; and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such a manner that the roller may be turned within a minimum circle. The tire shall afford surface contact pressures up to 90 pounds per square inch or more. The roller shall be so constructed as to operate in both forward and a reverse direction with suitable provisions for moistening the surface of the tires while operating; and shall be approved by the Owner's Representative.

b. Two-Axle Tandem Roller: The roller shall be an acceptable power-driven, steel-wheel tandem roller weighing not less than 8 tons. The roller must operate in forward and reverse directions; contain provisions for moistening the surface of the wheels while in motion; and shall be approved by the Owner's Representative.

c. Three-Wheel Roller: The roller shall be an acceptable power-driven, all steel three wheel roller weighing not less than 10 tons. The roller must operate in forward and reverse directions; contain provisions for moistening the surface of the wheels while in motion; and shall be approved by the Owner's Representative.

d. Vibratory Steel Wheel Roller: If approved for use by the Owner's Representative, this roller shall have a minimum weight of 6 tons. The compactor shall be equipped with amplitude and frequency controls and shall be specifically designed to compact

the material on which it is used. The roller shall be operated in accordance with the Manufacturer's recommendations.

3. Straightedges: The Contractor shall provide acceptable straightedges for the surface testing. Satisfactory templates shall be provided as required by the Owner's Representative.

3.00 EXECUTION

3.01 PREPARATION

A. Prime Coat: Apply a uniform coat of prime coat asphaltic material to the surface of the prepared subgrade, sub-base, or base, applied at a rate of not less than 0.30 gallon per square yard of surface. Apply a thin uniform coat of the prime coat material to contact surfaces of gutters, manholes, and other structures.

B. Tack Coat: Thoroughly clean the surface of the asphalt base course and apply a uniform coat of tack material meeting the requirements for cutback asphalt RC-250.Apply a tack coat when the surface to be paved is Portland cement concrete, brick, or asphaltic pavement. Apply the tack coat using sprayer at a rate not exceeding 0.05 gallon per square yard surface. Paint contact surfaces of curbs, gutters, vertical faces, and other structures in actual contact with asphaltic mixes with asphaltic material to provide a closely bonded, water-tight joint.

C. Compacted Thickness of Asphaltic Concrete Surface Courses and Base Courses:

1. Surface Course: The compacted thickness or depth of the asphaltic concrete surface shall be as indicated on the plans. Where the plans indicate a depth or thickness of the surface course greater than 2 inches compacted depth, same shall be placed in multiple courses of equal depth, each which shall not exceed 2 inches compacted depth. A tack coat is required between any of the multiple courses, and applied at the rate specified.

2. Base Course: The compacted thickness or depth of each base shall be as indicated. Where the plans indicate a depth or thickness of the course greater than 4 inches, same shall be accomplished by constructing multiple lifts of approximately equal depth, each of which shall not exceed these maximum compacted depths. An additional tack coat is required between any of the multiple lifts, and applied at a rate specified.

3.02 PLACEMENT

A. Place the asphaltic mixture on an approved base course with the previously specified spreading and finishing machine in such a manner that, when properly compacted, the finished course shall comply with the maximum thickness requirements, shall be smooth, of uniform density and meet the requirements of the typical cross-sections and the surface test. During the placing and spreading of the asphaltic material, take care to prevent the spilling of the material onto adjacent pavement, gutters, or structures.

B. In small areas, which are inaccessible to the spreading and finishing machine, hand spreading may be authorized by the Owner's Representative, provided an acceptable surface can be obtained.

3.03 COMPACTION

A. Rolling with the three-wheel and tandem rollers shall start longitudinally at the sides and proceed toward the center of the surface course, overlapping on successive trips by at least half the width of the rear wheels. Alternate trips of the roller shall be slightly different in length. Rolling with the pneumatic tire roller shall be done as directed by the Owner's Representative. Rolling shall continue until no further compression can be obtained and all roller marks are eliminated. The motion of the rollers shall be slow enough at all times to avoid displacement of the asphaltic surface material. If displacement should occur, correct the situation at once by the use of rakes and fresh asphaltic mixtures. The roller shall not be allowed to stand on the surface course when it has not been fully compacted and allowed to cool. To prevent adhesion of the surface to the roller, the wheels shall be kept thoroughly moistened with water, but an excess of water shall not be permitted. Rollers must be in good mechanical condition. Take the necessary precautions to prevent the dripping of gasoline, oil, grease, or other foreign matter on the surface course while the rollers are in motion or when standing. In areas where surface course cannot be compacted with the roller, hand tamps, lightly oiled, shall be used to secure the required compaction.

B. With approval by the Owner's Representative, the vibratory steel wheel roller may be substituted for the three-wheel roller and tandem roller. Each course, after final compaction, shall contain from 5 to 9 percent air voids determined by TXDOT Test Method TEX207-F and TEX-227-F.

3.04 FIELD QUALITY CONTROL

A. Surface Tests: The finished surface of the pavement after compression shall be smooth and true to the established line, grade, and cross-section. When tested with a 16-foot straightedge placed parallel to the centerline of the roadway, the finished surface shall have no deviation in excess of 1/16 inch per foot from the nearest point of contact. The maximum ordinate measured from the face of the straightedge shall not exceed 1/4 inch at any point. Any point in the pavement surface not meeting these requirements shall be immediately corrected.

B. Pavement Thickness Test: Upon completion of the work and before final acceptance and final payment shall be made, pavement thickness test shall be made by the Owner or his authorized representative unless otherwise specified in the special provisions or in the plans. The number and location of tests shall be at the discretion of the Owner's Representative. The cost for the initial pavement thickness test shall be at the expense of the Owner. In the event a deficiency in the thickness of the pavement is revealed during normal testing operations, subsequent tests necessary to isolate the deficiency shall be at the Contractor's expense. The cost for the additional coring test shall be at the same rate charged by commercial laboratories.

END OF SECTION

32 16 13 CURBS AND GUTTERS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to construct reinforced concrete curb and gutter in accordance with the lines, grades, and section indicated on the plans or as directed by the Owner's Representative.

1.02 OPTIONS

A. A curb and gutter laydown machine may be used for placing reinforcing steel and forming and placing concrete.

2.00 PRODUCTS

2.01 MATERIALS

A. Concrete: Conforming to the requirements for 3000-psi concrete in Section 03 30 00 "Cast-In-Place Concrete."

B. Reinforcing Steel: Conforming to the requirements in Section 03 03 00 "Cast In-Place Concrete."

C. Expansion Joint Material: Conforming to the requirements in Section 03 30 00 "Cast-In-Place Concrete."

2.02 MIXES

A. Mortar: 1 part Portland cement and 2 parts fine aggregate.

3.00 EXECUTION

3.01 PREPARATION, EXCAVATION AND GRADING

A. Excavate, stabilize and shape the subgrade or foundation to line, grade and section as indicated on the plans or as directed by the Owner's Representative. Lightly sprinkle the subgrade or foundation material immediately before placing concrete.

B. Where curb and gutter is not adjacent to new pavement, use 2 inches of sand cushion. After the fine grading has been completed, evenly spread a 2-inch layer of sand or suitable gravel cushion over the subgrade for curb and gutter. Thoroughly wet and tamp sand cushion into place to the satisfaction of the Owner's Representative. Place the forms upon this sand or gravel base and use a screed to shape the sand cushion to parallel the top of gutter.

3.02 INSTALLATION

A. Forms:

1. Forms shall be made of wood or steel and framed, braced, or staked in a substantial and approved manner so as to insure perfect alignment and grade. Clean and oil the forms

immediately before placing concrete. Take care in removing forms to prevent marring or spalling of the concrete. Forms shall be of a depth equal to the depth of the curb and gutter and a minimum of 1-1/2 inches in width when wooden forms are used or a rage that provides equivalent rigidity and strength when metal forms are used.

2. Forms showing a deviation of 1/8 inch in 10 feet from a straight line shall be cause for rejection.

3. For curves with a radius of less than 250 feet, acceptable flexible metal forms or wood forms may be used upon approval by the Owner's Representative.

B. Reinforcing Steel:

1. Accurately place steel reinforcement as indicated and hold in place during progress of placing concrete, and do not allow movement from the true position. Wire the bars at intersections and laps or splices. Lap bars at splices a minimum of 20 diameters of the bar or 12 inches, whichever is greater.

2. Place the reinforcement necessary for a section of concrete, and have the Owner's Representative approve the reinforcement before any concrete is deposited in the section. Steel shall be free from paint and oil, and completely remove loose scale, rust, dirt, and other foreign substances before using.

3. Reinforcing steel shall conform to requirements in Section 03 03 00 "Cast In-Place Concrete."

C. Expansion Joints:

1. Form expansion joints using preformed expansion joint material as specified herein. Place expansion joints in the curb and gutter at 36-foot intervals and at intersection returns or as otherwise shown on the plans or as directed by the Owner's Representative. Place "Flagging" or a tooled joint at 6-foot intervals to provide a plane of weakness, unless otherwise shown on the plans or as directed by the Owner's Representative. Place expansion joints at abutting structures such as concrete driveways, sidewalks, buildings, inlets, etc. Expansion joints shall be 1/2 inch in thickness and shall extend the full depth of the concrete. Neatly trim any expansion material extending above the finished work to the surface of the finished work. The expansion joints in concrete pavement shall coincide with the expansion joints in the curb and gutter. Longitudinal dowels, across the expansion joints in the curb and gutter, shall be required. There shall be three No. 3 round, smooth bars for dowels at each expansion joint spaced in accordance with standard reinforcement steel. The dowel shall be a minimum of 24 inches in length. Coat one end of the dowel with asphalt and terminated with an expansion cap. The cap shall provide a minimum of 1 inch free expansion. Support dowels by an approved method to provide a true horizontal and longitudinal alignment.

2. Seal joints through the gutter with a joint sealant material as specified herein.

3. Construct joints in a neat and workmanlike manner with edges rounded in conformity with the plans and specifications, and at locations as indicated on the plans or as designated by the Owner's Representative.

3.03 PLACEMENT

A. Deposit concrete so as to maintain a horizontal surface and thoroughly and continuously work into spaces and around all reinforcement to form a dense voidless mass.

B. Work the coarse aggregate away from contact with the forms so as to form a smooth, hard exposed concrete surface.

C. Continuously pour the concrete for curb and gutter between expansion joints. If construction joints are allowed at other locations by the Owner's Representative, properly construct joints with wood bulkheads so as to completely separate adjacent concrete sections.

3.04 FINISHING

A. After the concrete has been struck off and while still plastic, thoroughly work the exposed surfaces with a wooden float. Round the exposed edges by the use of an edging tool to the radius indicated. Float and trowel exposed surfaces. Brush exposed surfaces of curb and gutter to a smooth and uniform surface. Avoid excess working of the surface. Remove excess water, laitance and inert material from the surface.

3.05 CURING

A. Cure the completed curb and gutter in accordance with the requirements of Membrane Curing, as specified in Section 03 30 00 "Cast-In-Place Concrete." Other methods of curing as outlined herein shall be acceptable with a required curing period of 72 hours.

3.06 BACKFILLING

A. Backfill the curb and gutter to the full height of the concrete, and tamp and slope as indicated or as directed by the Owner's Representative.

3.07 FIELD QUALITY CONTROL

A. The top of the work and the face of the curbs shall be checked for irregularities as soon as the surface is finished, using a 10-foot straightedge. The maximum distance from the straightedges to the concrete shall not exceed 1/4 inch. Variations exceeding 1/4 inch shall be immediately corrected. Immediately chip out and patch honeycombed areas disclosed by removal of forms with mortar as specified.

END OF SECTION

32 31 13.53 HIGH-SECURITY CHAIN LINK FENCES AND GATES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. High-security chain-link fences.

2. Gates: Horizontal top trolly cantilever slide and swing.

B. Related Sections include the following:

1. Section 31 00 00 “Earthwork” for excavation, filling, and grading work.

2. Section 03 30 00.01 “Cast-In-Place Concrete” for concrete post concrete fill and continuous concrete grade beam.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide chain-link fences and gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Line Post Design: Provide line posts of size and in spacing indicated but not less than sizes and spacings required to comply with ASTM F1916, Tables 1 through 5 inclusive in resisting the following wind-load criteria, based on fence height, mesh size, and pattern indicated:

a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed and exposure category indicated below and according to CLFMI WLG 2445:

1). Wind Speed: 90 mph.

2). Exposure Category: C.

b. Fence Height: 6 feet.

c. Fence Framework Material Group: IA, ASTM F1043, Schedule 40 steel pipe.

2. Provide framework for fences that comply with ASTM F1043, based on the following criteria:

    a. Fence Framework Material Group: IA, Schedule 40 round steel pipe.

    b. Fence Height: 6 feet.

    c. Line Post Spacing: 10 feet (3 m).

3. Fabric Tension: Provide fences in which fabric deflections do not exceed those indicated in Table X1.1 of ASTM F1916 when tested by applying a 30-lbf (133-N) force at midpoint between rails and horizontally between posts for every eighth lower panel along the fence line.

4. Fence Post Rigidity: Provide fences in which post deflections do not exceed 3/4 inch (19 mm) when tested according to ASTM F1916 by applying a 50-lbf (222-N) force at mid-height of every eighth post along the fence line.

B. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.04 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates:

1. Fence and gate posts, rails, and fittings.

2. Chain-link fabric, reinforcements, and attachments.

3. Gates and hardware.

4. Accessories: Barbed tape.

B. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Product Certificates: For each type of chain-link fence, and gate, signed by product manufacturer.

1. Strength test results for framing according to ASTM F1043.

D. Qualification Data: For Installer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1. Engineering Responsibility: Preparation of data for chain-link fences and gates, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Mockups: Build mockups to set quality standards for fabrication and installation.

1. Include 10-ft. (3-m) length of fence complying with requirements.

a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.

b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

B. Interruption of Existing Utility Services: Do not interrupt utility services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner no fewer than 2] days in advance of proposed interruption of utility services.

2. Do not proceed with interruption of utility services without Owner's written permission.

1.07 COORDINATION

A. Coordinate, schedule, and obtain Owner's written approval of interruptions to existing perimeter security fences and systems for installation of new Work.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of high-security chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of gate operators and controls.

b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

c. Deflection of fence fabric beyond design limits.

2. Warranty Period: 5 years from date of Substantial Completion.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Chain-Link Fences and Gates:

   a. Ameristar Fence

   b. Southwest wire

   c. Merchants metal

   d. General Wire and Supply Co.

2. Barbed Tape:

   a. Razor Ribbon

   b. Birmingham Barbed Tape

   c. Puma Barbed Tape Co.

   d. Jacksons Security.

2.02 CHAIN-LINK FENCE FABRIC

A. Chain-Link Fence Fabric: 6 foot. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage. Comply with ASTM A392, CLFMI CLF 2445, and with requirements indicated below:

1. Steel Wire Fabric: Metallic coated.

2. Fabric 6 feet (1.8 m) high.

   a. Wire Diameter: 0.148 inch (3.76 mm).

   b. Mesh Size: 2 inch (51 mm) with 1 inch at Personnel gate.

   c. Weight of Metallic (Zinc) Coating: ASTM A392, Type II, Class 1, 1.2 oz/sq. ft. (366 g/sq. m) with zinc coating applied before weaving.

   d. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

3. Selvage: Twisted and barbed top and bottom.

2.03 SECURITY FENCE FRAMING

A. Posts and Rails: Comply with ASTM F1043 for framing of the following material group and strength requirement for fences of height indicated:

1. Framework Material Group: IA, round steel pipe, Schedule 40.

2. Fence Height: 6 feet (1.8 m).

3. Strength Requirement: Heavy industrial fence.

4. Post Diameter and Thickness: Provide posts of sizes indicated below that comply with ASTM F1043.

a. Top Rail: 1.66-inch (42.2-mm) diameter, 0.140-inch (3.6-mm) thickness.

b. Line Post: 2.875-inch (73-mm) diameter, 0.203-inch (5.2-mm) thickness].

c. End, Corner, and Pull Post: 4-inch (102-mm) diameter, 0.237-inch (6.02-mm) thickness.

d. Swing Gate Post: According to ASTM F900

e. Horizontal-Slide Gate Post: According to ASTM F1184.

1). Openings up to 24 Feet (7.3 m), Overhead Clearance up to 22 Feet (6.7 m): Steel post, 4-inch (102-mm) diameter, and 8.65-ft-lb (12.88-kg/m) weight.

2). Guide Posts for Class 1 horizontal-slide gates, equal gate post height, one size smaller, but weight is not less than 3.11 ft-lb (4.63-kg/m), installed adjacent to gate post to permit gate to slide in space between.

5. Metallic Coatings for Steel Framing:

a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A123/A123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating per ASTM A653/A653M.

2.04 TENSION WIRE

A. General: Provide horizontal tension wire at the following locations:

1. Location: Extended along bottom of fence fabric.

2. Location: Extended along top of barbed wire arms and top of fence fabric for supporting barbed tape.

B. Metallic-Coated Steel Wire: 0.177-inch (4.5-mm) diameter, marcelled tension wire complying with ASTM A824 and the following:

1. Metallic Coating: Type [II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:

a. Class 3: Not less than 2.0 oz./sq. ft. (610 g/sq. m) of uncoated wire surface.

2.05 SWING GATES

A. General: Comply with ASTM F900 for double swing gate types.

1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1043 and ASTM F1083 for materials and protective coatings.

2. Metal Pipe and Tubing: Steel. Comply with ASTM B429 and ASTM F1043 for materials and protective coatings.

B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F900 and the following:

1. Gate Fabric Height: 2 inches (51 mm) less than adjacent fence height.

2. Leaf Width: As indicated.

3. Frame Members:

a. Tubular Steel: 2.875 inches (73 mm) round.

C. Frame Corner Construction:

1. Welded and 3/8-inch (9.5-mm) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.

D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (305 mm)] [as indicated as required to attach barbed wire and tape assemblies.

E. Provide separate isolated gate frame according to ASTM F1916 and as indicated.

1. Group: IA, round steel pipe, Schedule 40].

2. Post: 4 inches (102 mm) and refer to drawings.

3. Separation between Hinge and Latch Post and Fence Termination Post: 2 inches (51 mm) minimum, 2-1/2 inches (63.5 mm) maximum.

F. Hardware:

1. Hinges: Offset type, malleable iron, 180-degree swing.

2. Latches permitting operation from both sides of gate. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.06 HORIZONTAL-SLIDE GATES

A. General: Comply with ASTM F1184 for single slide gate types and refer to drawings:

1. Classification: Type II Cantilever Slide, Class 2 with internal roller assemblies.

2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1184 for materials and protective coatings.

B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F1184 and the following:

1. Gate Fabric Height: 6 feet (1.8 m).

2. Gate Opening Width: 24 feet (1.2 m).

3. Frame Members:

a. Tubular Steel 1.90 inches (48.3 mm) round.

4. Bracing Members:

a. Tubular Steel 1.90 inches (48.3 mm) round.

C. Frame Corner Construction:

1. Welded frame with panels assembled with bolted or riveted corner fittings and 5/16-inch (7.9-mm) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.

D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (305 mm) as required to attach barbed tape assemblies.

E. Roller Guards: As required per ASTM F1184 for Type II, Class 1 gates.

F. Hardware:

1. Latches permitting operation from both sides of gate. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2. Padlocks and chains. Verify with owner’s keying requirements.

2.07 FITTINGS

A. General: Comply with ASTM F626.

1. Line post caps with loop to receive tension wire or top rail.

B. Rail and Brace Ends: Attach rails securely to each gate, corner, pull, and end post.

C. Rail Fittings: Provide the following:

1. Rail Clamps: Line and corner boulevard clamps for connecting intermediate rails in the fence line to line posts.

D. Tension and Brace Bands: Pressed steel, 0.105 inch (2.66 mm) thick, with 1.2-oz/sq. ft. (366-g/sq. m) metallic (zinc) coating.

E. Tension Bars: Steel, length not less than 2 inches (51 mm) shorter than full height of chain-link fabric with 1.2-oz/sq. ft. (366-g/sq. m) metallic (zinc) coating. Provide one bar for each gate and end post, and two for each corner and pull post unless fabric is integrally woven into post.

F. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

G. Barbed Wire Arms: Pressed steel or cast iron, with clips, slots, or other means for attaching strands of barbed wire , and means for attaching to posts , integral with post cap; for each post, unless otherwise indicated, and as follows:

1. Line posts with arms designed with opening to accommodate top rail or tension wire.

2. Corner arms at fence corner posts, unless extended posts are indicated.

3. Type I, single slanted arm.

4. Bolts or rivets for connection to post.

H. Tie Wires, Clips, and Fasteners: According to ASTM F626 and ASTM F1916.

1. High-Security Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

a. Weight of Metallic (Zinc) Coating: ASTM A641/A 641M, Class B, 2.0 oz./sq. ft. (610 g/sq. m).

2.08 BARBED WIRE

A. Zinc-Coated Steel Barbed Wire: Comply with ASTM A121, Chain-Link Fence grade for the following two-strand barbed wire:

1. Standard Size and Construction: 0.099-inch (2.51-mm) diameter line wire with 0.080-inch (2.03-mm) diameter, two-point round barbs spaced not more than 3 inches (76 mm) o.c.

2.09 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer for exterior applications.

2.10 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.

2. Material on or below Finished Grade: Copper.

3. Bonding Jumpers: Braided copper tape, 1 inch (25.4 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Listed in UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.

2. Grounding Rods: Copper-clad steel.

a. Size: 5/8 by 96 inches (16 by 2400 mm).

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.

   1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.

   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.03 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

3.04 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Exposed Concrete: Extend 2 inches (51 mm) above grade or to same elevation as concrete grade beam; shape and smooth to shed water.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.

D. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric 6 feet (1.8 m) or higher, on fences with top rail and at two-thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Barbed Wire Arms: Bolt or rivet to top of post. Angle single arms away from approach side of fence.

G. Tension Wire: Install according to ASTM F567 and ASTM F1916, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with

0.120-inch (3.05-mm) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric.

1. Bottom Tension Wire: Install tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.

H. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by fencing manufacturer.

I. Chain-Link Fabric: Apply fabric to inside of enclosing framework. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

1. Leave 1 inch (25.4 mm) between finish grade or surface and bottom selvage, unless otherwise indicated.

2. Overlapping Fabric: At or between post or rail according to ASTM F1916 with wire ties or steel strap method.

J. Concrete Grade Beams: Cast-in-place concrete, depth not less than 12 inches (305 mm) below grade and as indicated on Drawings; slope top surface to drain.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (381 mm) o.c.

L. Tie Wires: Power-fastened or manually fastened ties configured to wrap a full 360 degrees around rail or post and a minimum of one complete diamond of fabric. Twist ends one and one-half machine twists or three full manual twists, and cut-off protruding ends to preclude untwisting by hand.

1. Maximum Spacing: Tie fabric to line posts at 12 inches (305 mm) o.c. and to braces at 24 inches (610 mm) o.c.

2. Fasten fabric to line posts 12 inches (305 mm) o.c. and to braces 24 inches (610 mm) o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

N. Barbed Wire: Install barbed wire uniformly spaced as indicated on Drawings. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

O. Barbed Tape: Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement according to ASTM F1911.

P. Grounding Barrier Stakes: Stake coils at 10 feet (3 m) o.c., driven to full depth.

3.05 GATE INSTALLATION

A. Install gates according to manufacturer’s written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using

tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.06 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 100 feet (30 m) except as follows:

1. Gates and Other Fence Openings: Ground fence on each side of opening.

a. Bond metal gates to gate posts.

b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (457 mm) below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2, unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (152 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location, including the following:

1. Each Barbed Wire Strand. Make grounding connections to barbed wire with wire-to-wire connectors designed for this purpose.

2. Each Barbed Tape Coil: Make grounding connections to barbed tape with connectors designed for this purpose.

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.07 FIELD QUALITY CONTROL

A. Fabric Testing: Test fabric tension according to ASTM F1916.

B. Fence Post Rigidity Testing: Test line posts for rigidity according to ASTM F1916.

C. Grounding-Resistance Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than 2 full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.

3. Report: Prepare test reports, certified by testing agency, of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.08 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

END OF SECTION

ATTACHMENT C – HUB SUBCONTRACTING PLAN

Rev. 2/17

HUB Subcontracting Plan (HSP)

QUICK CHECKLIST

While this HSP Quick Checklist is being provided to merely assist you in readily identifying the sections of the HSP form that you will need to complete, it is very important that you adhere to the instructions in the HSP form and instructions provided by the contracting agency.

➤ **If you will be awarding <u>all</u> of the subcontracting work you have to offer under the contract to <u>only</u> Texas certified HUB vendors, complete:**

- ☐ Section 1 - Respondent and Requisition Information
- ☐ Section 2 a. - Yes, I will be subcontracting portions of the contract.
- ☐ Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors.
- ☐ Section 2 c. - Yes
- ☐ Section 4 - Affirmation
- ☐ GFE Method A (Attachment A) - Complete an Attachment A for each of the subcontracting opportunities you listed in Section 2 b.

➤ **If you will be subcontracting any portion of the contract to Texas certified HUB vendors and Non-HUB vendors, and the aggregate percentage of all the subcontracting work you will be awarding to the Texas certified HUB vendors with which you <u>do not</u> have a *<u>continuous contract</u>** in place for more than five (5) years *<u>meets or exceeds</u>* the HUB Goal the contracting agency identified in the "Agency Special Instructions/Additional Requirements", complete:**

- ☐ Section 1 - Respondent and Requisition Information
- ☐ Section 2 a. - Yes, I will be subcontracting portions of the contract.
- ☐ Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors and Non-HUB vendors.
- ☐ Section 2 c. - No
- ☐ Section 2 d. - Yes
- ☐ Section 4 - Affirmation
- ☐ GFE Method A (Attachment A) - Complete an Attachment A for each of the subcontracting opportunities you listed in Section 2 b.

➤ **If you will be subcontracting any portion of the contract to Texas certified HUB vendors and Non-HUB vendors or only to Non-HUB vendors, and the aggregate percentage of all the subcontracting work you will be awarding to the Texas certified HUB vendors with which you <u>do not</u> have a *<u>continuous contract</u>** in place for more than five (5) years *<u>does not meet or exceed</u>* the HUB Goal the contracting agency identified in the "Agency Special Instructions/Additional Requirements", complete:**

- ☐ Section 1 - Respondent and Requisition Information
- ☐ Section 2 a. - Yes, I will be subcontracting portions of the contract.
- ☐ Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors and Non-HUB vendors.
- ☐ Section 2 c. - No
- ☐ Section 2 d. - No
- ☐ Section 4 - Affirmation
- ☐ GFE Method B (Attachment B) - Complete an Attachment B for each of the subcontracting opportunities you listed in Section 2 b.

➤ **If you will not be subcontracting any portion of the contract and will be fulfilling the entire contract with your own resources (i.e., employees, supplies, materials and/or equipment), complete:**

- ☐ Section 1 - Respondent and Requisition Information
- ☐ Section 2 a. - No, I will not be subcontracting any portion of the contract, and I will be fulfilling the entire contract with my own resources.
- ☐ Section 3 - Self Performing Justification
- ☐ Section 4 - Affirmation

***<u>Continuous C</u>ontract:** Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service, to include under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.*

Rev. 2/17

HUB Subcontracting Plan (HSP)

In accordance with Texas Gov't Code §2161.252, the contracting agency has determined that subcontracting opportunities are probable under this contract. Therefore, all respondents, including State of Texas certified Historically Underutilized Businesses (HUBs) must complete and submit this State of Texas HUB Subcontracting Plan (HSP) with their response to the bid requisition (solicitation).

NOTE: Responses that do not include a completed HSP shall be rejected pursuant to Texas Gov't Code §2161.252(b).

The HUB Program promotes equal business opportunities for economically disadvantaged persons to contract with the State of Texas in accordance with the goals specified in the 2009 State of Texas Disparity Study. The statewide HUB goals defined in 34 Texas Administrative Code (TAC) §20.284 are:

- ***11.2 percent for heavy construction other than building contracts,***
- ***21.1 percent for all building construction, including general contractors and operative builders' contracts,***
- ***32.9 percent for all special trade construction contracts,***
- ***23.7 percent for professional services contracts,***
- ***26.0 percent for all other services contracts, and***
- ***21.1 percent for commodities contracts.***

- - Agency Special Instructions/Additional Requirements - -

*In accordance with 34 TAC §20.285(d)(1)(D)(iii), a respondent (prime contractor) may demonstrate good faith effort to utilize Texas certified HUBs for its subcontracting opportunities if the total value of the respondent's subcontracts with Texas certified HUBs meets or exceeds the statewide HUB goal or the agency specific HUB goal, whichever is higher. When a respondent uses this method to demonstrate good faith effort, the respondent must identify the HUBs with which it will subcontract. If using existing contracts with Texas certified HUBs to satisfy this requirement, only the aggregate percentage of the contracts expected to be subcontracted to HUBs with which the respondent **does not** have a **continuous contract*** in place for **more than five (5) years** shall qualify for meeting the HUB goal. This limitation is designed to encourage vendor rotation as recommended by the 2009 Texas Disparity Study.*

SECTION 1: RESPONDENT AND REQUISITION INFORMATION

a. Respondent (Company) Name: _____ State of Texas VID #: _____

Point of Contact: _____ Phone #: _____

E-mail Address: _____ Fax #: _____

b. Is your company a State of Texas certified HUB? ☐ **- Yes** ☐ **- No**

c. Requisition #: _____ Bid Open Date: _____ **(mm/dd/yyyy)**

Enter your company's name here: _____ Requisition #: _____

SECTION 2: RESPONDENT'S SUBCONTRACTING INTENTIONS

After dividing the contract work into reasonable lots or portions to the extent consistent with prudent industry practices, and taking into consideration the scope of work to be performed under the proposed contract, including all potential subcontracting opportunities, the respondent must determine what portions of work, **including contracted staffing, goods and services will be subcontracted**. Note: In accordance with 34 TAC §20.282, a "Subcontractor" means a person who contracts with a prime contractor to work, to supply commodities, or to contribute toward completing work for a governmental entity.

a. Check the appropriate box (Yes or No) that identifies your subcontracting intentions:

☐ - ***Yes***, I will be subcontracting portions of the contract. (If ***Yes***, complete Item b of this SECTION and continue to Item c of this SECTION.)

☐ - ***No***, I will not be subcontracting any portion of the contract, and I will be fulfilling the entire contract with my own resources, including employees, goods and services. (If ***No***, continue to SECTION 3 and SECTION 4.)

b. List all the portions of work (subcontracting opportunities) you will subcontract. Also, based on the total value of the contract, identify the percentages of the contract you expect to award to Texas certified HUBs, and the percentage of the contract you expect to award to vendors that are not a Texas certified HUB (i.e., Non-HUB).

Item #	Subcontracting Opportunity Description	HUBs		Non-HUBs
		Percentage of the contract expected to be subcontracted to HUBs with which you do not have a continuous contract* in place for more than five (5) years.	Percentage of the contract expected to be subcontracted to HUBs with which you have a continuous contract* in place for more than five (5) years.	Percentage of the contract expected to be subcontracted to non-HUBs.
1		%	%	%
2		%	%	%
3		%	%	%
4		%	%	%
5		%	%	%
6		%	%	%
7		%	%	%
8		%	%	%
9		%	%	%
10		%	%	%
11		%	%	%
12		%	%	%
13		%	%	%
14		%	%	%
15		%	%	%
	Aggregate percentages of the contract expected to be subcontracted:	**%**	**%**	**%**

(Note: If you have more than fifteen subcontracting opportunities, a continuation sheet is available online at https://www.comptroller.texas.gov/purchasing/vendor/hub/forms.php).

c. Check the appropriate box (Yes or No) that indicates whether you will be using **only** Texas certified HUBs to perform **all** of the subcontracting opportunities you listed in SECTION 2, Item b.

☐ - ***Yes*** (If ***Yes***, continue to SECTION 4 and complete an "HSP Good Faith Effort - Method A (Attachment A)" for **each** of the subcontracting opportunities you listed.)

☐ - ***No*** (If ***No***, continue to Item d, of this SECTION.)

d. Check the appropriate box (Yes or No) that indicates whether the aggregate expected percentage of the contract you will subcontract **with Texas certified HUBs** with which you **do not** have a **continuous contract*** in place with for **more than five (5) years**, **meets or exceeds** the HUB goal the contracting agency identified on page 1 in the "**Agency Special Instructions/Additional Requirements**."

☐ - ***Yes*** (If ***Yes***, continue to SECTION 4 and complete an "HSP Good Faith Effort - Method A (Attachment A)" for **each** of the subcontracting opportunities you listed.)

☐ - ***No*** (If ***No***, continue to SECTION 4 and complete an "HSP Good Faith Effort - Method B (Attachment B)" for **each** of the subcontracting opportunities you listed.)

****Continuous Contract:** Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.*

Enter your company's name here: _____ Requisition #: _____

SECTION 2: RESPONDENT'S SUBCONTRACTING INTENTIONS (CONTINUATION SHEET)

This page can be used as a continuation sheet to the HSP Form's page 2, Section 2, Item b. Continue listing the portions of work (subcontracting opportunities) you will subcontract. Also, based on the total value of the contract, identify the percentages of the contract you expect to award to Texas certified HUBs, and the percentage of the contract you expect to award to vendors that are not a Texas certified HUB (i.e., Non-HUB).

Item #	Subcontracting Opportunity Description	HUBs		Non-HUBs
		Percentage of the contract expected to be subcontracted to HUBs with which you do not have a continuous contract* in place for more than five (5) years.	Percentage of the contract expected to be subcontracted to HUBs with which you have a continuous contract* in place for more than five (5) years.	Percentage of the contract expected to be subcontracted to non-HUBs.
16		%	%	%
17		%	%	%
18		%	%	%
19		%	%	%
20		%	%	%
21		%	%	%
22		%	%	%
23		%	%	%
24		%	%	%
25		%	%	%
26		%	%	%
27		%	%	%
28		%	%	%
29		%	%	%
30		%	%	%
31		%	%	%
32		%	%	%
33		%	%	%
34		%	%	%
35		%	%	%
36		%	%	%
37		%	%	%
38		%	%	%
39		%	%	%
40		%	%	%
41		%	%	%
42		%	%	%
43		%	%	%
Aggregate percentages of the contract expected to be subcontracted:		**%**	**%**	**%**

***Continuous Contract:** Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.*

Enter your company's name here: _____ Requisition #: _____

SECTION 3: SELF PERFORMING JUSTIFICATION **(If you responded "No" to SECTION 2, Item a, you must complete this SECTION and continue to SECTION 4.)** If you responded "No" to SECTION 2, Item a, in the space provided below **explain how** your company will perform the entire contract with its own employees, supplies, materials and/or equipment.

SECTION 4: AFFIRMATION

As evidenced by my signature below, I affirm that I am an authorized representative of the respondent listed in SECTION 1, and that the information and supporting documentation submitted with the HSP is true and correct. Respondent understands and agrees that, if awarded any portion of the requisition:

- The respondent will provide notice as soon as practical to all the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor for the awarded contract. The notice must specify at a minimum the contracting agency's name and its point of contact for the contract, the contract award number, the subcontracting opportunity they (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting agency's point of contact for the contract no later than ten (10) working days after the contract is awarded.
- The respondent must submit monthly compliance reports (Prime Contractor Progress Assessment Report – PAR) to the contracting agency, verifying its compliance with the HSP, including the use of and expenditures made to its subcontractors (HUBs and Non-HUBs). (The PAR is available at https://www.comptroller.texas.gov/purchasing/docs/hub-forms/ProgressAssessmentReportForm.xls).
- The respondent must seek approval from the contracting agency prior to making any modifications to its HSP, including the hiring of additional or different subcontractors and the termination of a subcontractor the respondent identified in its HSP. If the HSP is modified without the contracting agency's prior approval, respondent may be subject to any and all enforcement remedies available under the contract or otherwise available by law, up to and including debarment from all state contracting.
- The respondent must, upon request, allow the contracting agency to perform on-site reviews of the company's headquarters and/or work-site where services are being performed and must provide documentation regarding staffing and other resources.

Signature	Printed Name	Title	Date (mm/dd/yyyy)

Reminder:

- If you responded "**Yes**" to **SECTION 2, Items c or d**, you must complete an "HSP Good Faith Effort - Method A (Attachment A)" for **each** of the subcontracting opportunities you listed in SECTION 2, Item b.
- If you responded "**No**" **SECTION 2, Items c and d,** you must complete an "HSP Good Faith Effort - Method B (Attachment B)" for **each** of the subcontracting opportunities you listed in SECTION 2, Item b.

Enter your company's name here: _____ Requisition #: _____

HSP Good Faith Effort - Method A (Attachment A)

Rev. 2/17

Enter your company's name here:_____ Requisition #: _____

IMPORTANT*:** If you responded "Yes***" to **SECTION 2, Items c** or **d** of the completed HSP form, you must submit a completed "HSP Good Faith Effort - Method A (Attachment A)" for **each** of the subcontracting opportunities you listed in **SECTION 2, Item b** of the completed HSP form. You may photo-copy this page or download the form at https://www.comptroller.texas.gov/purchasing/docs/hub-forms/hub-sbcont-plan-gfe-achm-a.pdf

SECTION A-1: SUBCONTRACTING OPPORTUNITY

Enter the item number and description of the subcontracting opportunity you listed in SECTION 2, Item b, of the completed HSP form for which you are completing the attachment.

Item Number:_____**Description:** _____

SECTION A-2: SUBCONTRACTOR SELECTION

List the subcontractor(s) you selected to perform the subcontracting opportunity you listed above in SECTION A-1. Also identify whether they are a Texas certified HUB and their Texas Vendor Identification (VID) Number or federal Employer Identification Number (EIN), the approximate dollar value of the work to be subcontracted, and the expected percentage of work to be subcontracted. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas' Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at http://mycpa.cpa.state.tx.us/tpasscmblsearch/index.jsp. HUB status code "**A**" signifies that the company is a Texas certified HUB.

Company Name	Texas certified HUB	Texas VID or federal EIN Do not enter Social Security Numbers. If you do not know their VID / EIN, leave their VID / EIN field blank.	Approximate Dollar Amount	Expected Percentage of Contract
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	- Yes - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%

REMINDER: As specified in SECTION 4 of the completed HSP form, if you (respondent) are awarded any portion of the requisition, you are required to provide notice as soon as practical to all the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor. The notice must specify at a minimum the contracting agency's name and its point of contact for the contract, the contract award number, the subcontracting opportunity they (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting agency's point of contact for the contract no later than ten (10) working days after the contract is awarded.

HSP Good Faith Effort - Method B (Attachment B)

Rev. 2/17

Enter your company's name here:_____ Requisition #: _____

IMPORTANT*:** If you responded "No***" to **SECTION 2, Items c** and **d** of the completed HSP form, you must submit a completed "HSP Good Faith Effort - Method B (Attachment B)" for **each** of the subcontracting opportunities you listed in **SECTION 2, Item b** of the completed HSP form. You may photo-copy this page or download the form at https://www.comptroller.texas.gov/purchasing/docs/hub-forms/hub-sbcont-plan-gfe-achm-b.pdf..

SECTION B-1: SUBCONTRACTING OPPORTUNITY

Enter the item number and description of the subcontracting opportunity you listed in SECTION 2, Item b, of the completed HSP form for which you are completing the attachment.

Item Number:_____**Description:** _____

SECTION B-2: MENTOR PROTÉGÉ PROGRAM

If respondent is participating as a Mentor in a State of Texas Mentor Protégé Program, submitting its Protégé (Protégé must be a State of Texas certified HUB) as a subcontractor to perform the subcontracting opportunity listed in **SECTION B-1**, constitutes a good faith effort to subcontract with a Texas certified HUB towards that specific portion of work.

Check the appropriate box (Yes or No) that indicates whether you will be subcontracting the portion of work you listed in SECTION B-1 to your Protégé.

☐ **- Yes** (If ***Yes***, continue to SECTION B-4.)

☐ **- No / Not Applicable** (If ***No*** or ***Not Applicable***, continue to SECTION B-3 and SECTION B-4.)

SECTION B-3: NOTIFICATION OF SUBCONTRACTING OPPORTUNITY

When completing this section you MUST comply with items **a**, **b**, **c** and **d**, thereby demonstrating your Good Faith Effort of having notified Texas certified HUBs and trade organizations or development centers about the subcontracting opportunity you listed in SECTION B-1. Your notice should include the scope of work, information regarding the location to review plans and specifications, bonding and insurance requirements, required qualifications, and identify a contact person. When sending notice of your subcontracting opportunity, you are encouraged to use the attached HUB Subcontracting Opportunity Notice form, which is also available online at https://www.comptroller.texas.gov/purchasing/docs/hub-forms/HUBSubcontractingOpportunityNotificationForm.pdf.

Retain supporting documentation (i.e., certified letter, fax, e-mail) demonstrating evidence of your good faith effort to notify the Texas certified HUBs and trade organizations or development centers. Also, be mindful that a working day is considered a normal business day of a state agency, not including weekends, federal or state holidays, or days the agency is declared closed by its executive officer. The initial day the subcontracting opportunity notice is sent/provided to the HUBs and to the trade organizations or development centers is considered to be "day zero" and does not count as one of the seven (7) working days.

a. Provide written notification of the subcontracting opportunity you listed in SECTION B-1, to three (3) or more Texas certified HUBs. Unless the contracting agency specified a different time period, you must allow the HUBs at least seven (7) working days to respond to the notice prior to you submitting your bid response to the contracting agency. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas' Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at http://mycpa.cpa.state.tx.us/tpasscmblsearch/index.jsp. HUB status code "**A**" signifies that the company is a Texas certified HUB.

b. List the **three (3) Texas certified HUBs** you notified regarding the subcontracting opportunity you listed in SECTION B-1. Include the company's Texas Vendor Identification (VID) Number, the date you sent notice to that company, and indicate whether it was responsive or non-responsive to your subcontracting opportunity notice.

Company Name	Texas VID (Do not enter Social Security Numbers.)	Date Notice Sent (mm/dd/yyyy)	Did the HUB Respond?
			☐ - Yes ☐ - No
			☐ - Yes ☐ - No
			☐ - Yes ☐ - No

c. Provide written notification of the subcontracting opportunity you listed in SECTION B-1 to two (2) or more trade organizations or development centers in Texas to assist in identifying potential HUBs by disseminating the subcontracting opportunity to their members/participants. Unless the contracting agency specified a different time period, you must provide your subcontracting opportunity notice to trade organizations or development centers at least seven (7) working days prior to submitting your bid response to the contracting agency. A list of trade organizations and development centers that have expressed an interest in receiving notices of subcontracting opportunities is available on the Statewide HUB Program's webpage at https://www.comptroller.texas.gov/purchasing/vendor/hub/resources.php.

d. List **two (2) trade organizations or development centers** you notified regarding the subcontracting opportunity you listed in SECTION B-1. Include the date when you sent notice to it and indicate if it accepted or rejected your notice.

Trade Organizations or Development Centers	Date Notice Sent (mm/dd/yyyy)	Was the Notice Accepted?
		☐ - Yes ☐ - No
		☐ - Yes ☐ - No

HSP Good Faith Effort – Method B (Attachment B) Cont.

Rev. 2/17

Enter your company's name here: _____ Requisition #: _____

SECTION B-4: SUBCONTRACTOR SELECTION

Enter the item number and description of the subcontracting opportunity you listed in **SECTION 2, Item b,** of the completed HSP form for which you are completing the attachment.

a. Enter the item number and description of the subcontracting opportunity for which you are completing this Attachment B continuation page.

Item Number: _____ **Description:** _____

b. List the subcontractor(s) you selected to perform the subcontracting opportunity you listed in **SECTION B-1**. Also identify whether they are a Texas certified HUB and their Texas Vendor Identification (VID) Number or federal Emplioyer Identification Number (EIN), the approximate dollar value of the work to be subcontracted, and the expected percentage of work to be subcontracted. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas' Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at http://mycpa.cpa.state.tx.us/tpasscmblsearch/index.jsp. HUB status code "**A**" signifies that the company is a Texas certified HUB.

Company Name	Texas certified HUB	Texas VID or federal EIN Do not enter Social Security Numbers. If you do not know their VID / EIN, leave their VID / EIN field blank.	Approximate Dollar Amount	Expected Percentage of Contract
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%
	☐ - Yes ☐ - No		$	%

c. If any of the subcontractors you have selected to perform the subcontracting opportunity you listed in **SECTION B-1** is **not** a Texas certified HUB, provide written justification for your selection process (attach additional page if necessary):

REMINDER: As specified in SECTION 4 of the completed HSP form, if you (respondent) are awarded any portion of the requisition, you are required to provide notice as soon as practical to **all** the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor. The notice must specify at a minimum the contracting agency's name and its point of contact for the contract, the contract award number, the subcontracting opportunity it (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting agency's point of contact for the contract no later than ten (10) working days after the contract is awarded.

Rev. 2/17

HUB Subcontracting Opportunity Notification Form

In accordance with Texas Gov't Code, Chapter 2161, each state agency that considers entering into a contract with an expected value of $100,000 or more shall, before the agency solicits bids, proposals, offers, or other applicable expressions of interest, determine whether subcontracting opportunities are probable under the contract. The state agency I have identified below in **Section B** has determined that subcontracting opportunities are probable under the requisition to which my company will be responding.

34 Texas Administrative Code, §20.285 requires all respondents (prime contractors) bidding on the contract to provide notice of each of their subcontracting opportunities to at least three (3) Texas certified HUBs (who work within the respective industry applicable to the subcontracting opportunity), and allow the HUBs at least seven (7) working days to respond to the notice prior to the respondent submitting its bid response to the contracting agency. In addition, at least seven (7) working days prior to submitting its bid response to the contracting agency, the respondent must provide notice of each of its subcontracting opportunities to two (2) or more trade organizations or development centers (in Texas) that serves members of groups (i.e., Asian Pacific American, Black American, Hispanic American, Native American, Woman, Service Disabled Veteran) identified in Texas Administrative Code §20.282(19)(C).

We respectfully request that vendors interested in bidding on the subcontracting opportunity scope of work identified in **Section C, Item 2**, reply no later than the date and time identified in **Section C, Item 1**. Submit your response to the point-of-contact referenced in **Section A**.

SECTION A: PRIME CONTRACTOR'S INFORMATION

Company Name: _____ **State of Texas VID #:** _____

Point-of-Contact: _____ **Phone #:** _____

E-mail Address: _____ **Fax #:** _____

CONTRACTING STATE AGENCY AND REQUISITION INFORMATION

Agency Name: _____

Point-of-Contact: _____ **Phone #:** _____

Requisition #: _____ **Bid Open Date:** _____ (mm/dd/yyyy)

SUBCONTRACTING OPPORTUNITY RESPONSE DUE DATE, DESCRIPTION, REQUIREMENTS AND RELATED INFORMATION

1. Potential Subcontractor's Bid Response Due Date:

If you would like for our company to consider your company's bid for the subcontracting opportunity identified below in Item 2,

we must receive your bid response no later than _____ **Central Time** **on** _____ **Date (mm/dd/yyyy).**

In accordance with 34 TAC §20.285, each notice of subcontracting opportunity shall be provided to at least three (3) Texas certified HUBs, and allow the HUBs at least seven (7) working days to respond to the notice prior to submitting our bid response to the contracting agency. In addition, at least seven (7) working days prior to us submitting our bid response to the contracting agency, we must provide notice of each of our subcontracting opportunities to two (2) or more trade organizations or development centers (in Texas) that serves members of groups (i.e., Asian Pacific American, Black American, Hispanic American, Native American, Woman, Service Disabled Veteran) identified in Texas Administrative Code, §20.282(19)(C).

(A working day is considered a normal business day of a state agency, not including weekends, federal or state holidays, or days the agency is declared closed by its executive officer. The initial day the subcontracting opportunity notice is sent/provided to the HUBs and to the trade organizations or development centers is considered to be "day zero" and does not count as one of the seven (7) working days.)

2. Subcontracting Opportunity Scope of Work:

3. Required Qualifications: ☐ **- Not Applicable**

4. Bonding/Insurance Requirements: ☐ **- Not Applicable**

5. Location to review plans/specifications: ☐ **- Not Applicable**

ATTACHMENT D – THIRD-PARTY BUILDING/MILESTONE INSPECTION GUIDELINES

THIRD PARTY INSPECTORS (TPI) BUILDING/MILESTONE INSPECTIONS PROGRAM

IMPLEMENTATION GUIDELINES

2017 Edition

Effective: March 28, 2017
Version: 1.2

Based on

Texas Military Department's 2010 Uniform General Conditions (Uniform Conditions for Construction Contracts), ARTICLE 17. Supplemental General Conditions, ARTICLE 8. *Quality Control* and ARTICLE 10. *Payments*. (Revised 03 April 2015).

Administered by

CONSTRUCTION AND FACILITIES MANAGEMENT OFFICE (CFMO)

Contents

SECTION 100 OVERVIEW

SECTION 200 DEFINITIONS

SECTION 300 GENERAL

Section 301 Service Fee Structure
Section 302 Third-party Inspector Qualifications and Approval
Section 303 Chain of Communication (Post Award)
Section 304 Authority of TMD and CFMO
Section 305 Conflict of Interest Policy (COI)
Section 306 Public Records
Section 307 Development of Milestones/Pay App Schedule of Values

SECTION 400 INSPECTIONS AND REPORTING PROCEDURES

Section 401 TPI Inspection Procedures
Section 402 TPI Procedures for Milestone Completion Certification Reports

SECTION 500 ATTACHMENTS

Section 501 Attachment "A"
Example Milestone Completion Schedule of Values (Example Project 1)
Section 502 Attachment "B"
Example Milestone Completion Schedule of Values (Example Project 2)
Section 503 Attachment "C"
General Contractor (GC) Payment Application Quick Sheet
Section 504 Attachment "D"
General Contractor (GC) Application and Certification for Payment (Example)

SECTION 100 OVERVIEW.

The **Third Party Inspector (TPI) – Project Milestones Inspections Program** is Texas Military Department (TMD), Construction Facilities Management Department's (CFMO) program for facilitating quality control and promoting expectation of project through code and specification compliance by "third party" inspections of construction projects, as required by *Uniform General Conditions* (UGC*) Article 8.*

> UGC Article 8. Quality Control
>
> The General Contractor at their expense will hire a third party inspector qualified in construction and certified in code compliance, whom will verify in writing the milestones and/or phase completion. The inspector will inspect and certify that milestones and/or phases meet building code and project plans/specifications. The third party inspector must be approved by TMD prior to any inspections being performed.

Questions should be directed to the CFMO Project Manager assigned to the Project.

Note: This document can also assist the General Contractor (GC) with TPI selection and TPI Statement of Qualifications.

SECTION 200 DEFINITIONS.

For the purposes of this program, listed words and terms have the indicated meanings. Words and terms not defined here have meanings as given in the *International Building Codes (IBC),* and common usage.

Construction Documents: Documents reviewed and approved by TMD, CFMO in support of issuing a construction contract. "Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit." (*International Building Code Chapter 2 Definitions*)

Third Party Inspection (performed by TPI): The observation of work and the review of testing documentation for certain components and elements to establish general conformance with TMD, CFMO-approved documents and the building code as required by *International Building Code* and this program.

Milestone Certification: A statement issued and signed by an approved TPI, which shall indicate the item(s) under consideration, in the TPI's opinion and to the best of their knowledge, generally complies with TMD approved construction documents and specifications and the requirements of applicable *International Building Codes* and governing regulations.

SECTION 300 GENERAL.

The **TPI – Milestones Inspections Program** requires that GC's of TMD construction projects engage a private sector, TPI to perform periodic inspections and observations as needed to comply with the UGC Section referenced in Section 100. The purpose of the independent inspections/observations are to verify Milestone completion, to ensure that the work performed is in general conformance with the approved construction documents and specifications, and to verify general compliance with applicable codes and regulations to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment. General compliance with additional regulations may also be verified as required by contract.

Per UGC's, private sector "third party" inspection firms and personnel (TPI) shall be engaged for services directly by the GC performing the work. Both the inspection firm and its personnel shall be approved by TMD and CFMO on a project-by-project basis ***prior*** to commencement of construction.

Section 301 - Service Fee Structure

All fees and costs related to the performance of a TPI are initiated by the GC, shall be borne by the GC and paid directly by the GC to the TPI.

TPI expenses, **approved per contract**, are paid by TMD to the GC.

Section 302 - Third Party Inspector Qualifications and Approval

GC's must submit a TPI statement of qualifications for review and approval by TMD. The statement of qualifications should include information for all salaried and/or contract employees supervising and/or performing inspections services. Evidence of qualifications to perform these services may include, but is not limited to the following:

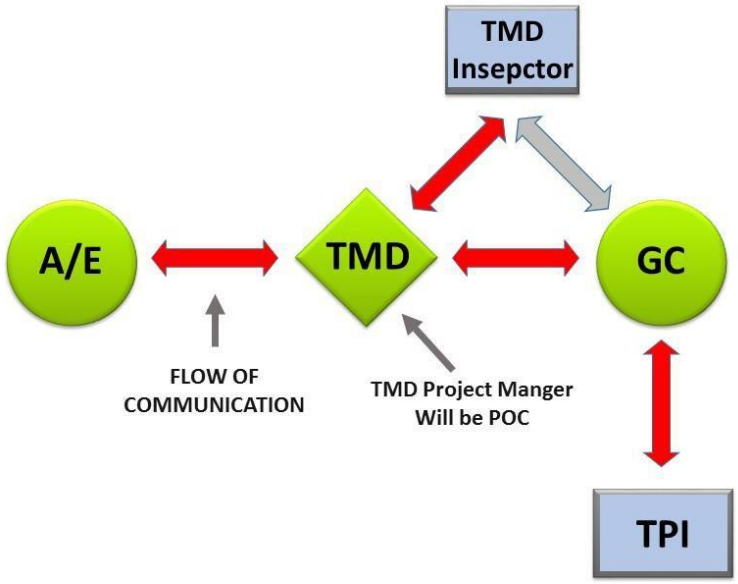
- experience with municipal and/or state plan review and inspections;
- professional education and accreditation;
- certification from model code organizations;
- applicable trade licenses;
- evidence of industry knowledge specific to the Project;
- other applicable accreditation(s).

Note: The TPI will not be performing "third-party" special inspections as required by *IBC* Chapter 17 Section 1704 *Special Inspections*. The TPI will not be performing any materials or construction testing as may be required by code or approved construction documents. The GC may need to engage *other* "third-party" inspection/engineering/testing firms to perform additional inspections and/or testing as required by code, specifications or contract documents.

This space is intentionally left blank.

Section 303 - Chain of Communication – (Post Award)

The flow of communication for Project participants, after contract is awarded to the GC, is described by the following diagram:



Because the TPI is engaged by the GC, the GC is responsible for delivery of the TPI's work product (reports, certifications, etc.) to TMD (Project Manager) and any other party involved in the Project. All TPI produced reports are delivered by the TPI to the GC.

Section 304 - Authority of TMD and CFMO

The Texas Military Department and Construction Facilities Management Office retain the authority, as the authority having jurisdiction, to render all code interpretations and retain the right to review and monitor all inspections performed by TPIs. In the event TMD determines that a TPI is not performing in a manner to ensure general compliance with all applicable codes, TMD may require the GC to retain the services of another TPI (subject to review and approval by TMD and CFMO staff) and/or perform inspections/observations using CFMO staff.

Section 305 - Conflict of Interest Policy (COI)

In order to maintain the integrity of this process, it is important that TPIs have no substantial business interest, direct or indirect, in projects on which they are retained to perform inspections, or in the owners, GC's or subcontractors of such projects.

A TPI, or any of its individual employees, is considered to have a substantial business interest in a project when:

- The organization or registered person has controlling interest in client or business entity.
- The organization or registered person owns or controls more than 1% of the voting interest in the client or business entity.
- The organization or registered person owns more than $25,000 of the fair of the fair market value of the client or business entity.
- The organization or registered person has a direct or indirect participating interest by shares, stocks or otherwise, regardless of whether voting rights are included, in or more than 10% of the profits, proceeds, or capital gains of the client or business entity.
- The organization or registered person receives more than 10% of its gross income for the previous year from the client, except for income derived for services as a third party organization or similar consultations,
- The registered person is an elected officer or a member of the board of directors or governing board of the client or business entity.
- The registered person fails to maintain an independent contractor relationship or becomes employed by the client or business entity.

A "client or business entity" means any entity recognized by law through which business for profit is conducted, including a sole proprietorship, partnership, firm, corporation, holding company, joint stock company, receivership or trust, which has hired the TPI to provide services under the TPI program.

Independence - The TPI:

- Is not financially affiliated with an owner, GC, or trade person regulated under the construction codes.
- Have the financial resources to act independently.

Organizational Structure – The TPI:

- Is impartial, does not charge fees contingent or based upon results from the inspections.
- Holds all employees, including contractors, to the same COI standards.

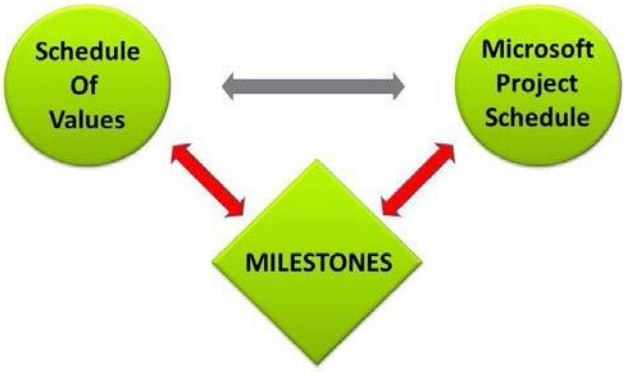
Section 306 - Public Records

Records, information, documents, whether finished, unfinished, or draft, that are developed, prepared, completed or acquired (hereinafter referred to as records) by the TPI during the performance of services shall be made available to TMD on request. Such records shall include calculations, data, studies, surveys, reports, correspondence, memoranda, maps, models, photographs, drawings, and audio or video recordings. All such materials shall be maintained by the TPI for a period of one year after the issuance of the Certificate of Occupancy or after the termination of the working arrangements between the TPI and the GC.

Section 307 - Development of Milestone Completion Schedule of Values

Through the coordinated efforts of the GC and Project Architect/Engineer (A/E), the development of Project Milestones can be accomplished by incorporating the Schedule of Values (SOV) – produced by the GC at the time of bid – with the Microsoft Project Schedule - produced by the GC at the time of bid - to establish a milestone completion schedule of values. This schedule contains milestones with an associated monetary value that will be paid for at 100% completion of said scheduled milestone. **TPI expenses and general conditions shall be incorporated, by pro-rata basis, into individual milestones' dollar values.**

By incorporating the GC's existing tools, SOV and Microsoft Project Schedule, the milestone schedule is intended to be an additional tool to determine and facilitate the logical sequential events that the Project requires from start to completion.



The milestone completion schedule of values can be phased through steps, but must be tied to the SOV and Microsoft Project Schedule, which at submission of payment application and TPI milestone certification, must be 100% complete. As an example: The approved milestone completion schedule of values for a large re-roof project may include several milestone *phases* (separate areas of the roof). Upon 100% completion of that milestone *phase* (or area) of the re- roof project, the GC may submit payment application to TMD for payment on the completed milestone *phases* (or areas). Refer to Attachment "A" Section 501 for an example phased project milestone completion schedule of values. The submittal documentation will include sufficient information from the TPI to certify completion and that the completed work generally conforms to contract documents and specifications and generally complies with applicable building codes. Please be aware that several TPI inspections/observations may be required to determine adequate milestone completion and certification.

Example milestone completion schedule of values are attached hereto (Attachment "A" Section 501 and Attachment "B" Section 502) for reference.

Note: GC's may engage TPI, at GC's expense, to assist in development of a milestone completion schedule of values for the awarded project.

SECTION 400 INSPECTION & REPORTING PROCEDURES.

TPI inspections shall not be conducted until TPI personnel have been approved by TMD, construction documents have been approved and issued, TMD gives Notice to Proceed (NTP) and TMD-approved documents are available on the job site for use by the TPIs.

The TPI shall not suggest, direct or authorize the GC to deviate from TMD-approved documents or building codes without written approval by the responsible A/E and TMD, as appropriate. If a conflict exists between TMD-approved documents and the provisions of the governing codes and ordinances, the GC shall notify TMD, and the inspection shall be rejected until revised construction documents are approved by TMD, or TMD gives permission to proceed and/or other direction.

Section 401 - TPI Inspection Procedures

1. Inspections shall be performed at appropriate times **prior to concealment of the work**. The GC shall provide notice to the TPI when the construction is ready for inspection.

2. All inspection reports shall be in writing, and shall include the project location; a brief description of the area inspected; and the inspection results (approved or rejected), which shall be reported to all affected parties. If the inspection results in rejection, deficiencies and reasons for rejection shall be reported to the GC's project manager and/or superintendent for correction. Items rejected or any code violations discovered by a TPI or TMD staff, shall be corrected and re-inspected prior to proceeding with the work. Inspection reports shall not contain "correct and proceed" instructions to GC. **Where appropriate, photographs shall be attached**.

3. The GC is responsible for providing any documentation required to satisfy the TPI's milestone verification, per the TPI's request. These may include but are not limited to the following: testing reports, batch tickets, receipts for stored materials, "third- party" special inspection reports, photographs, etc.

4. The TPI on the job site may request to see documentation verifying contractors' license, endorsement, or registration to perform such trade work.

5. The GC is responsible for delivering to TMD, CFMO all inspections/observations results conducted by the TPI at a project site through the payment application process.

Section 402 – TPI Procedures for Milestone Completion Certification Reports

Milestone Completion Certification Reports are produced by the TPI and delivered by the GC to TMD upon submittal of payment applications. At a minimum, the reports should include the following:

1. Cover Letter or Page with all pertinent project information and description of contents.

2. TMD approved Milestone Completion Schedule of Values clearly indicating the milestones and associated values to be approved with the current submittal and a **total dollar amount being submitted for payment**.

3. Certification by the TPI that all information is true and correct.

4. Back-up documentation to support the request for payment, including copies of all TPI inspection/observation reports, comments, **photographs**, etc.

5. Any additional back-up documentation as needed (e.g. receipts, other "third-party" reports, etc.)

Note: Approval of the payment application is at the sole discretion of TMD, CFMO. Please refer to Attachment "C" Section 503 (General Contractor Payment Application Quick Sheet) and Attachment "D" Section 504 (General Contractor Application and Certification for Payment) for payment application procedures and forms.

SECTION 500 ATTACHMENTS.

Section 501 Attachment “A”
Example Milestone Completion Schedule of Values (Example Project 1)

Section 502 Attachment “B”
Example Milestone Completion Schedule of Values (Example Project 2)

Section 503 Attachment “C”
General Contractor (GC) Payment Application Quick Sheet

Section 504 Attachment “D”
General Contractor (GC) Application and Certification for Payment (Example)

Section 501 – Attachment "A" – Example Milestone Completion Schedule of Values

Example Project 1 – Phased Re-Roof Project

Project (TX#)	TXxx-ENG(GC)-XX
GC: Bob the Builder	
3rd-party Inspector name:	
3rd-party Inspector company:	
NTP Date	1/1/2018
Current Days of Work (including CO days)	120
Current Contractual End Date	5/1/2018

Milestone	Scheduled Completion (NTP + DAY)		Value of Work	Complete Yes	Complete No	Value of work complete Prior Pay App	Value of work complete This pay period
Materials (stored on site)	5	1/6/2018	$ 13,000.00	x			$ 13,000.00
Sections 1, 2, 3							
Gravel removal	20	1/21/2018	$ 8,000.00	x			$ 8,000.00
Tear off/ build up insulation base sheet	25	1/26/2018	$ 15,000.00	x			$ 15,000.00
Gutter removal	28	1/29/2018	$ 400.00	x			$ 400.00
Gutter replacement	30	1/31/2018	$ 2,565.00		x		
Masonry Remodel	30	1/31/2018	$ -		x		
Exhaust/HVAC work	35	2/5/2018	$ -		x		
Section 14, 15, 16							
Gravel removal	35	2/5/2018	$ 9,000.00	x			$ 9,000.00
Tear off/ build up insulation base sheet	45	2/15/2018	$ 16,000.00	x			$ 16,000.00
Gutter removal	20	1/21/2018	$ 400.00	x			$ 400.00
Gutter replacement	21	1/22/2018	$ 2,565.00		x		
Masonry Remodel	15	1/16/2018	$ -		x		
Exhaust/HVAC work	45	2/15/2018	$ -	x			$ -
Section 17, 18							
Gravel removal			$ 10,000.00	x			$ 10,000.00
Tear off/ build up insulation base sheet			$ 15,000.00	x			$ 15,000.00
Gutter removal			$ 400.00	x			$ 400.00
Gutter replacement			$ 2,565.00		x		
Masonry Remodel			$ -		x		
Exhaust/HVAC work			$ -		x		
Section 11, 12, 13							
Gravel removal			$ 10,000.00	x			$ 10,000.00
Tear off/ build up insulation base sheet			$ 15,000.00		x		
Gutter removal			$ 400.00		x		
Gutter replacement			$ 2,565.00		x		
Masonry Remodel			$ -		x		
Exhaust/HVAC work			$ -		x		
Section 8, 9, 10							
Gravel removal			$ 9,000.00	x			$ 9,000.00
Tear off/ build up insulation base sheet			$ 15,000.00		x		
Gutter removal			$ 400.00		x		
Gutter replacement			$ 2,565.00		x		
Masonry Remodel			$ -		x		
Exhaust/HVAC work			$ -		x		
Section 4, 5, 6, 7							
Gravel removal			$ 10,000.00	x			$ 10,000.00
Tear off/ build up insulation base sheet			$ 16,000.00		x		
Gutter removal			$ 400.00		x		
Gutter replacement			$ 2,565.00		x		
Masonry Remodel			$ -		x		
Exhaust/HVAC work			$ -		x		

Total work this pay app, not including stored materials	$	103,200.00
% total of contract (materials and work complete)		64.99%
Minus: 5% Retainage on work complete		($5,160.00)
Minus: 15% Retainage on stored material		($1,950.00)
Plus: 10% Materials installed this period	$	884.00

Pay App Total this Period	$	109,974.00
Prior Pay App total	$	-
Remaining to be paid	$	68,816.00

sub total	$	178,790.00
contract total	$	178,790.00
difference	$	-

Materials, total on site	$	13,000.00
Value of stored materials installed	$	8,840.00
Amount of materials remaining to be installed	$	4,160.00
Percentage remaining of materials to be installed		32.00%

GC Rep certification signature: 3rd-party inspector certifying signature

Section 502 – Attachment "B" – Example Milestone Completion Schedule of Values

Example Project 2 – Readiness Center Project

Project (TX#)	TXxx-ENGxx
GC: Bob the Builder	
3rd-party Inspector name:	
3rd-party Inspector company:	
NTP Date	6/20/2018
Current Days of Work (including CO days)	180
Current Contractual End Date	12/17/2018

Milestone	Scheduled Completion (NTP + DAY)		Value of Work	Complete		Value of work complete	
				Yes	No	Prior Pay App	This pay period
Materials (stored on site)							
PHASE I - INTERIOR & EXTERIOR DEMO							
Asbestos remediation & disposal	5	6/25/2018	$ 22,199.68	x		$ 22,199.68	
VCT, base, book shelf, white boards	7	6/28/2016	$ 3,450.00	x		$ 3,450.00	
Electrical disconnects	6	6/27/2016	$ 17,664.00	x		$ 17,664.00	
Plumbing	10	7/5/2016	$ 3,864.00	x		$ 3,864.00	
Acoustical & sheetrock ceilings	10	7/1/2016	$ 6,900.00	x		$ 6,900.00	
Latrine slab	9	7/8/2016	$ 6,756.48		x		
HVAC	5	7/12/2016	$ 15,000.00	x		$ 15,000.00	
Studs & sheetrock	10	7/22/2016	$ 7,590.00	x		$ 7,590.00	
CMU wall, salvage glazed brick	10	7/18/2016	$ 2,760.00	x		$ 2,760.00	
			$ -				
EXTERIOR							
Concrete pad & sidewalk	3	6/28/2016	$ 2,000.00	x		$ 2,000.00	
Flagpole, sign, fence	3	7/1/2016	$ 1,366.20	x		$ 1,366.20	
Railroad ties	3	7/6/2016	$ 4,250.00	x		$ 4,250.00	
			$ -				
PHASE II - INTERIOR BUILDING DEMO							
Metal wire cages	3	8/4/2016	$ 690.00				
Hanging partition & beam	4	8/8/2016	$ 2,760.00				
HVAC - VRF Equipment		8/10/2016	$ 54,648.00				
HVAC Air Device Equipment		8/10/2016	$ 2,760.00				
HVAC Exhaust Fan equipment		8/10/2016	$ 1,380.00				
PHASE II - BUILDING & EXTERIOR IMPROVEMENTS							
In Slab Plumbing	10	7/27/2016	$ 9,315.00				
Latrine concrete foundation	5	7/29/2016	$ 5,057.70				
Floor Topping	5	7/29/2016	$ 8,280.00				
Metal stud framing	15	8/19/2016	$ 9,832.50				
Door Frames	5	8/26/2016	$ 15,000.00				
Blocking	2	8/23/2016	$ 2,070.00				
CMU Partitions	11	8/15/2016	$ 20,010.00				
CMU in fill kitchen, doors, window	12	8/31/2016	$ 18,959.82				
Expansion joint repair	15	8/15/2016	$ 5,520.00				
Switch Gear Materials		8/12/2016	$ 42,000.00				
HVAC RI - duct work	6	8/22/2016	$ 17,250.00				
Electrical RI - Feeder Material		8/22/2016	$ 20,700.00				
Electrical Fixture Material		8/31/2016	$ 49,680.00				
EXTERIOR							
Concrete pads & sidewalks	10	8/26/2016	$ 4,784.46				
Re-install Flag pole & sign	2	8/31/2016	$ 1,518.00				
Motor fencing	5	8/31/2016	$ 7,932.24				
PHASE III - BUILDING & EXTERIOR IMPROVMENTS							
Latrine metal stud framing	3	9/7/2016	$ 3,277.50				
Electrical RI- Box & Conduit-Branch Circuits	20	9/12/2016	$ 60,000.00				
Electrical RI -Box & Conduit Feeder	9	9/22/2016	$ 1,380.00				
Electrical RI - Data	5	9/28/2016	$ 14,766.00				
HVAC RI - Refrigerant piping	14	9/12/2016	$ 21,942.00				
HVAC RI - Condensate	6	9/20/2016	$ 6,900.00				
HVAC - Set Ceiling Cassettes	2	9/22/2016	$ 4,140.00				
Plumbing RI - Gas Piping	5	9/2/2016	$ 7,686.60				
Plumbing Top Out	10	9/12/2016	$ 9,315.00				
Gas Fired Heater Equipment		9/16/2016	$ 2,760.00				
Windows - Reglaze & repair	20	9/19/2016	$ 25,000.00				
Windows - New	10	10/3/2016	$ 5,796.00				
Latrine ceramic floor tille	5	9/23/2016	$ 14,156.04				
Sheetrock & Insulation	15	9/30/2016	$ 6,900.00				
EXTERIOR							
Electrical Service RI	10	9/23/2016	$ 12,420.00				
Masonry repairs	15	9/30/2016	$ 25,000.00				
PHASE IV - BUILDING & EXTERIOR IMPROVMENTS							
Hardie backer	3	10/3/2016	$ 3,933.00				
Latrine wall & shower tile	10	10/7/2016	$ 36,000.00				
Fab & Install window bars	5	10/7/2016	$ 2,587.50				
Install electical switch gear	7	10/18/2016	$ 5,520.00				
Tape, float & texture	13	10/19/2016	$ 7,866.00				
Pull Wire- Branch Circuit	10	10/28/2016	$ 15,180.00				
Plumbing fixtures & fountains	15	10/28/2016	$ 49,000.00				
Install metal cages	10	10/28/2016	$ 39,826.80				

PHASE V - BUILDING IMPROVMENTS						
Paint - New Partition walls	15	11/4/2016	$	22,000.00		
Toilet Partitions & accessories	3	11/9/2016	$	28,283.10		
FRP	3	11/9/2016	$	1,380.00		
Pull Wire for feeder curcuits	6	11/11/2016	$	20,700.00		
Paint Drill Hall	5	11/14/2016	$	43,000.00		
Electrical Plugs & Switches	5	11/16/2016	$	9,246.00		
Doors & hardware	10	11/18/2016	$	22,859.70		
Lockers & benches	5	11/11/2016	$	5,362.68		
Grid ceiling system	5	11/11/2016	$	12,834.00		
Install electrical fixtures	4	11/17/2016	$	4,140.00		
HVAC set condensing units	1	11/1/2016	$	690.00		
HVAC Trim	9	11/11/2016	$	4,830.00		
HVAC start ups	5	11/18/2016	$	6,900.00		
Prep & Seal concrete floor	5	11/29/2016	$	21,020.90		
Signage	1	11/8/2016	$	2,108.64		
VCT & base	10	11/11/2016	$	8,676.06		
PHASE VI - EXTERIOR IMPROVMEN TS						
North & West grading	10	11/17/2016	$	5,520.00		
Asphalt	5	11/22/2016	$	15,000.00		
Exterior cleaning/power wash	4	11/28/2016	$	2,070.00		
Exterior Paint touch ups	2	11/29/2016	$	6,900.00		
Stripe & Signage	2	11/29/2016	$	1,345.50		
Re-install RR ties	10	11/30/2016	$	10,494.90		
Hydro Mulch	1	11/30/2016	$	207.00		

Total work this pay app, not including stored materials	$	87,043.88
% total of contract (materials and work complete)		8.44%
Minus: 5% Retainage on work complete		($4,352.19)
Minus: 15% Retainage on stored material		$0.00
Plus: 10% Materials installed this period	$	-

Pay App Total this Period	$	82,691.69
Prior Pay App total	$	-
Remaining to be paid	$	948,177.31

sub total	$	1,030,869.00
contract total	$	1,030,869.00
difference	$	-

Materials, total on site		
Value of stored materials installed	$	-
Amount of materials remaining to be installed	$	-
Percentage remaining of materials to be installed		#DIV/0!

GC Rep certification signature:

3rd-party inspector certifying signature

This space is intentionally left blank.

Section 503 – Attachment "C" – GC Payment Application Quick Sheet

When a Pay Application it must include only those Milestones that are 100% complete for which the third party inspector has included in his report. It needs to be submitted on the Texas Military Department Application and Certification for Payment form and shall include the following:

- TMD Pay Application Form
- Milestone Schedule (indicating which milestones are being paid out at 100%)
- Third Party Inspector Report
- Subcontractor Invoices (if requesting payment for Stored Materials)
- HUB Subcontracting Plan Progress Assessment Report
- TMD Contractor's Affidavit of Payment of Debs and Claims Form
- TMD Solid Waste Reporting Form (even if amount disposed of is $0.00)

TMD's Contractor's Affidavit of Release of Liens form ONLY needs to be submitted with the Final Pay Application (in addition to all of the above items.

Pay Applications shall be submitted to the Project Manager and the A/E at Progress Meetings for review and correction. Formal submission of a Pay Application shall be sent to the Project Manager's attention via US Mail to:

Texas Military Department
2200 W. 35th Street, CFMO, Building 37
Austin, TX 78730

To expedite payment send an email including all required documents to:

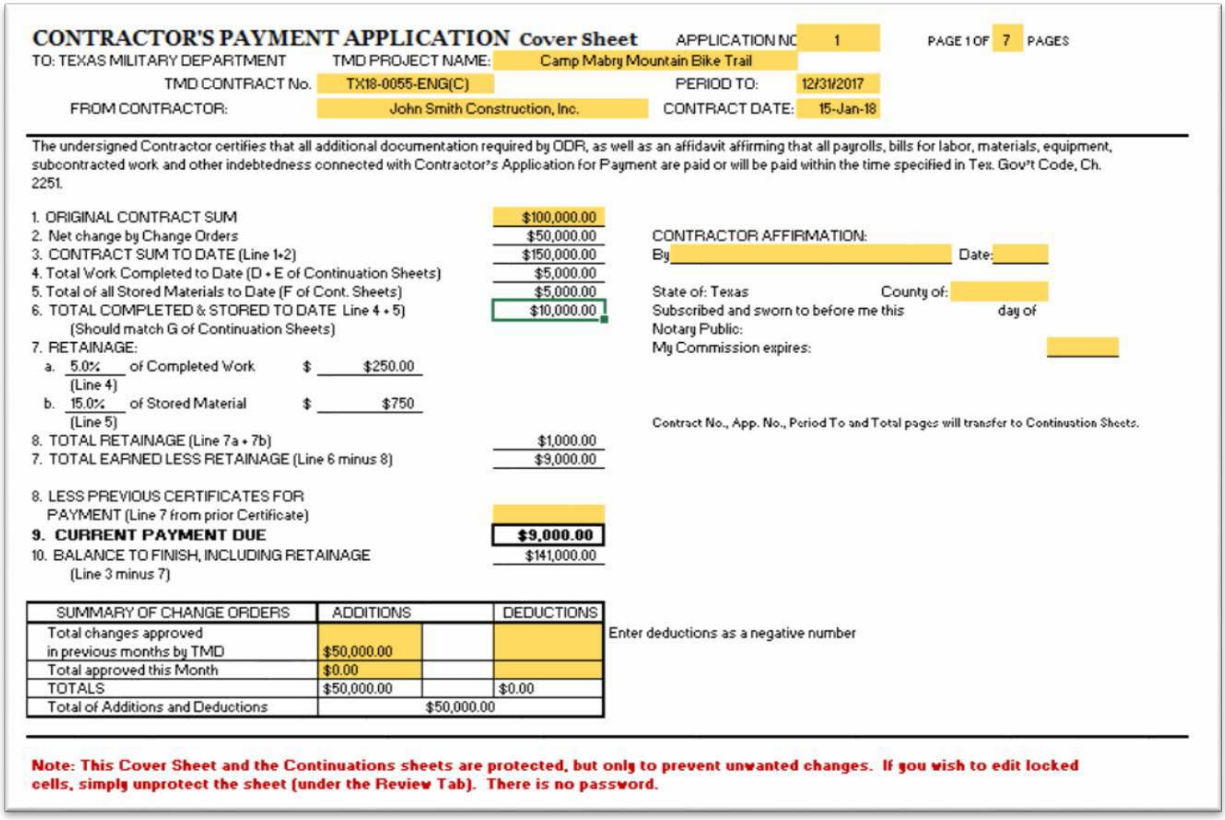
bmc.workflow@cfmo.mil.texas.gov, copying the Project Manager.

Pay Applications will be date-stamped upon receipt by the CFMO and payment will be remitted in accordance with the Prompt Payment Act, which states, in part:

"To maximize interest earned on funds held by the state, agencies are required to schedule their payments in USAS. …payments are made 30 days from the … received invoice…"
To read this law in its entirety,
see Chapter 2155.382 of the Texas Government Code.

Inquires as to the status of payment need to wait until *after* 30 days have passed from the time of submission. If payment has not been received after 30 days, such inquires need to be directed to the Financial Services Manager, 512-782-5001, extension 4750 or to accountspayable@military.texas.gov.

Section 504 – Attachment "D" – GC Application and Certification for Payment - Example



CONTRACTOR'S PAYMENT APPLICATION Cover Sheet APPLICATION NO: 1 PAGE 1 OF 7 PAGES

TO: TEXAS MILITARY DEPARTMENT TMD PROJECT NAME: Camp Mabry Mountain Bike Trail

TMD CONTRACT No. TX18-0055-ENG(C) PERIOD TO: 12/31/2017

FROM CONTRACTOR: John Smith Construction, Inc. CONTRACT DATE: 15-Jan-18

The undersigned Contractor certifies that all additional documentation required by ODR, as well as an affidavit affirming that all payrolls, bills for labor, materials, equipment, subcontracted work and other indebtedness connected with Contractor's Application for Payment are paid or will be paid within the time specified in Tex. Gov't Code, Ch. 2251.

1. ORIGINAL CONTRACT SUM	$100,000.00
2. Net change by Change Orders	$50,000.00
3. CONTRACT SUM TO DATE (Line 1+2)	$150,000.00
4. Total Work Completed to Date (D + E of Continuation Sheets)	$5,000.00
5. Total of all Stored Materials to Date (F of Cont. Sheets)	$5,000.00
6. TOTAL COMPLETED & STORED TO DATE Line 4 + 5) (Should match G of Continuation Sheets)	$10,000.00
7. RETAINAGE:	
a. 5.0% of Completed Work (Line 4)	$ $250.00
b. 15.0% of Stored Material (Line 5)	$ $750
8. TOTAL RETAINAGE (Line 7a + 7b)	$1,000.00
7. TOTAL EARNED LESS RETAINAGE (Line 6 minus 8)	$9,000.00
8. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 7 from prior Certificate)	
9. CURRENT PAYMENT DUE	**$9,000.00**
10. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 minus 7)	$141,000.00

CONTRACTOR AFFIRMATION:

By: Date:

State of: Texas County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

Contract No., App. No., Period To and Total pages will transfer to Continuation Sheets.

SUMMARY OF CHANGE ORDERS	ADDITIONS		DEDUCTIONS
Total changes approved in previous months by TMD	$50,000.00		
Total approved this Month	$0.00		
TOTALS	$50,000.00		$0.00
Total of Additions and Deductions	$50,000.00		

Enter deductions as a negative number

Note: This Cover Sheet and the Continuations sheets are protected, but only to prevent unwanted changes. If you wish to edit locked cells, simply unprotect the sheet (under the Review Tab). There is no password.

ATTACHMENT E – WAGE RATES

http://www.wdol.gov/dba.aspx

https://wdol.gov/wdol/scafiles/davisbacon/TX305.dvb?v=0

General Decision Number: TX180305 01/05/2018 TX305

Superseded General Decision Number: TX20170305

State: Texas

Construction Type: Building

County: Hidalgo County in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.35 for calendar year 2018 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.35 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2018. The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2018

BOIL0074-003 01/01/2017

	Rates	Fringes
BOILERMAKER	$ 28.00	22.35

ENGI0178-005 06/01/2014

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
(1) Tower Crane	$ 29.00	10.60
(2) Cranes with Pile Driving or Caisson Attachment and Hydraulic Crane 60 tons and above	$ 28.75	10.60
(3) Hydraulic cranes 59 Tons and under	$ 27.50	10.60

* IRON0084-011 06/01/2017

	Rates	Fringes
IRONWORKER, ORNAMENTAL	$ 23.27	7.12

PLUM0412-004 04/01/2013

	Rates	Fringes
PLUMBER	$ 31.14	12.43

SUTX2014-031 07/21/2014

	Rates	Fringes
BRICKLAYER	$ 16.17	0.00
CARPENTER	$ 14.21	2.22
CEMENT MASON/CONCRETE FINISHER	$ 12.46	0.00
ELECTRICIAN	$ 18.44	4.53
INSULATOR - MECHANICAL (Duct, Pipe & Mechanical System Insulation)	$ 11.54	2.17
IRONWORKER, REINFORCING	$ 12.01	0.00
IRONWORKER, STRUCTURAL	$ 15.04	4.34
LABORER: Common or General	$ 8.00	0.00
LABORER: Mason Tender - Brick	$ 10.00	0.00
LABORER: Mason Tender - Cement/Concrete	$ 10.89	0.96
LABORER: Pipelayer	$ 11.00	3.47
LABORER: Roof Tearoff	$ 10.06	0.00
OPERATOR: Backhoe/Excavator/Trackhoe	$ 14.04	1.01
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 13.93	0.00
OPERATOR: Bulldozer	$ 18.29	1.31
OPERATOR: Drill	$ 16.22	0.34
OPERATOR: Forklift	$ 14.83	0.00
OPERATOR: Grader/Blade	$ 10.00	0.00

OPERATOR: Loader	$ 12.87	0.70
OPERATOR: Mechanic	$ 17.00	0.00
OPERATOR: Paver (Asphalt, Aggregate, and Concrete)	$ 16.03	0.00
OPERATOR: Roller	$ 12.70	0.00
PAINTER (Brush, Roller, and Spray)	$ 11.27	0.00
PIPEFITTER	$ 15.22	3.16
ROOFER	$ 11.42	0.00
SHEET METAL WORKER (HVAC Duct Installation Only)	$ 18.40	2.12
SHEET METAL WORKER, Excludes HVAC Duct Installation	$ 21.13	6.53
TILE FINISHER	$ 11.22	0.00
TILE SETTER	$ 12.15	0.00
TRUCK DRIVER: Dump Truck	$ 12.39	1.18
TRUCK DRIVER: Flatbed Truck	$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck	$ 12.50	0.00
TRUCK DRIVER: Water Truck	$ 12.00	4.11

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO

is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

==========

END OF GENERAL DECISION

ATTACHMENT F – BONDS AND INSURANCE REQUIREMENTS

REFERENCE:

Uniform General Conditions, Article 5

ATTACHMENT G – BIDDER'S CHECKLIST

The following information is provided to assist Bidders in preparing and returning a complete Bid Proposal. This list may not be all-inclusive but it provides a list of the basic requirements for what to include with the Bid Proposal. No penalty or other responsibility shall be assigned to TMD for failure of the Bidder to submit a complete Bid Proposal.

This list consists of documents to be returned and other essential information. Reference

____l. Schedule of Values

____2. Historically Underutilized Businesses Subcontracting Plan

____3. Addendum(s)

____4. Hardcopy of Work Breakdown Schedule (MS Project Gantt Chart or Schedule of Values)

____5. CD-ROM MS Project (identify version on face of the CD)

ATTACHMENT H – TMD STANDARD TERMS AND CONDITIONS

ITEMS BELOW APPLY TO AND BECOME PART OF BID.
ANY EXCEPTIONS THERETO MUST BE IN WRITING.

1. BIDDING REQUIREMENTS:

1.1. Bidders must comply with all rules, regulations and statutes relating to purchasing in the State of Texas in addition to the requirements of this form.

1.2. Bids should be submitted on this form. Bidders must price per unit shown. Unit prices shall govern in the event of extension errors. If a price quotation is submitted as part of the bid, the quotation must be referenced on the bid document and signed by the Bidder to establish formal linkage to the bid.

1.3. Bids must be time stamped at Texas Military Department (TMD) Purchasing and Contracts Department on or before the hour and date specified for the bid opening.

1.4. Late and/or unsigned bids will not be considered under any circumstances. Person signing bid must have the authority to bind the firm in a contract.

1.5. Quote FOB destination, freight prepaid and allowed unless otherwise stated within the specifications.

1.6. Bid prices are requested to be firm for TMD acceptance for 30 days from bid opening date. "Discount from list" bids are not acceptable unless requested. Cash discounts are not considered in determining an award. Cash discounts offered will be taken if earned.

1.7. Bidder should enter Texas Identification Number System (TINS) number, full firm name and address of Bidder on the face of this form. Enter in the space provided, if not shown.

1.8. Bid cannot be altered or amended after opening time. Alterations made before opening time should be initialed by Bidder or Bidder's authorized agent. No bid can be withdrawn after opening time without approval by the TMD based on an acceptable written reason.

1.9. Purchases made for State use are exempt from the State Sales tax and Federal Excise tax. Do not include tax in bid. Excise Tax Exemption Certificates are available upon request.

1.10. **AWARD NOTICE:** The State reserves the right to make an award on the basis of low line item bid, low total of line items, or in any other combination that will serve the best interest of the State and to reject any and all bid items at the sole discretion of the State. The State also reserves the right to accept or reject all or any part of any bid, waive minor technicalities and award the bid to best serve the interests of the State. Any contract may also be extended up to three months at the sole discretion of the State.

1.11. Consistent and continued tie bidding could cause rejection of bids by the TMD and/or investigation for antitrust violations.

1.12. Inquiries pertaining to this IFB must include the bid number, class/item codes, and opening date.

1.13. Late, illegible, incomplete, or otherwise non-responsive bids will not be considered.

2. SPECIFICATION:

2.1. Catalogs, brand names or manufacturer's references are descriptive only, and indicate type and quality desired. Bids on brands of like nature and quality will be considered unless advertised under §2155.067, Texas Government Code (Gov't Code). If bidding on other than references, bid should show manufacturer, brand or trade name, and other description of product offered. If other than brand(s) specified is offered, illustrations and complete description of product offered are requested to be made part of the bid. Failure to take exception to specifications or reference data will require Bidder to furnish specified brand names, numbers, etc.

2.2. Unless otherwise specified, items shall be new and unused and of current production.

2.3. All electrical items must meet all applicable Occupational Safety and Health Administration (OSHA) standards and regulations, and bear the appropriate listing from UL, FMRC or NEMA.

2.4. Samples, when requested, must be furnished free of expense to the State. If not destroyed in examination, they will be returned to the Bidder, on request, at Bidder's expense. Each sample should be marked with Bidder's name and address, and bid number. Do not enclose in or attach bid to sample.

2.5. The State will not be bound by any oral statement or representation contrary to the written specifications of this Invitation for Bids (IFB).

2.6. Manufacturer's standard warranty shall apply unless otherwise stated in the IFB.

3. TIE BIDS:

Awards will be made in accordance with 34 TAC Rules 20.36(b)(3) and 20.38 (Preferences).

4. DELIVERY:

4.1. Show number of days required to place material in receiving agency's designated location under normal conditions. Delivery days mean calendar days, unless otherwise specified. Failure to state delivery time obligates Bidder to deliver in 14 calendar days. Unrealistic delivery promises may cause bid to be disregarded.

4.2. If delay is foreseen, Bidder shall give written notice to TMD and the ordering agency. Bidder must keep TMD and ordering agency advised at all times of status of order.

4.3. Default in promised delivery (without accepted reasons) or failure to meet specifications authorizes TMD to purchase the goods or services of this IFB elsewhere and charge any increased costs for the goods or services, including the cost of rebidding, to the Bidder.

4.4. No substitutions permitted without written approval of TMD.

4.5. Delivery shall be made during normal working hours only, unless prior approval has been obtained from ordering agency.

5. INSPECTION AND TESTS:

All goods will be subject to inspection and test by the State. Authorized TMD personnel shall have access to supplier's place of business for the purpose of inspecting merchandise. Tests shall be performed on samples submitted with the bid or on samples taken from regular shipment. All costs shall be borne by the Bidder in the event products tested fail to meet or exceed all conditions and requirements of the specification. Goods delivered and rejected in whole or in part may, at the State's option, be returned to the Bidder or held for disposition at Bidder's expense. Latent defects may result in revocation of acceptance.

6. AWARD OF CONTRACT:

A response to this IFB is an offer to contract based upon the terms, conditions, and specifications contained herein. Bids do not become contracts until they are accepted through an open market purchase order. The contract shall be governed, construed, and interpreted under the laws of the State of Texas. The factors listed in §§2155.074, 2155.144, 2156.007, and 2157.003, Gov't Code, shall also be considered in making an award when specified. Any legal actions must be filed in Travis County, Texas.

7. FRAUD, WASTE, AND ABUSE:

By submitting a response, Bidder represents and warrants that it has read and understood and will comply with TMD's Anti-Fraud Policy, found at: https://www.comptroller.texas.gov/about/policies/ethics.php, as such Policy currently reads and as it is amended throughout the term of the Contract.

8. PAYMENT:

Bidder shall submit 2 copies of an itemized invoice showing the TMD purchase order number on all copies. The State will incur no penalty for late payment if payment is made in thirty (30) or fewer days from receipt of goods or services and an uncontested invoice. Payment shall be made in accordance with Chapter 2251, Gov't Code.

9. PATENTS, TRADEMARKS, OR COPYRIGHTS:

Bidder agrees to defend and indemnify the TMD and the State from claims involving infringement or violation of patents, trademarks, copyrights, trade secrets, or other proprietary rights, arising out of the TMD's or the State's use of any good or service provided by the Bidder as a result of this IFB.

10. BIDDER ASSIGNMENTS:

Bidder hereby assigns to the TMD any and all claims for overcharges associated with this contract arising under the antitrust laws of the United States 15 U.S.C.A. §1, *et seq*., and the antitrust laws of the State of Texas, Tex. Bus. & Comm. Code §15.01, *et seq*.

11. BIDDER AFFIRMATIONS:

Signing this bid with a false statement is a material breach of contract and shall void the submitted bid and any resulting contracts, and the Bidder shall be removed from all bid lists. By signature hereon affixed, the Bidder hereby certifies that:

11.1. The Bidder has not given, offered to give, nor intends to give at any time hereafter any economic opportunity, future employment, gift, loan, gratuity, special discount, trip, favor, or service to a public servant in connection with the submitted bid.

11.2. Pursuant to 15 U.S.C. §1, *et seq*. and Tex. Bus. & Comm. Code §15.01, *et seq*. neither the Bidder nor the firm, corporation, partnership, or institution represented by the Bidder, or anyone acting for such a firm, corporation or institution has violated the antitrust laws of this state, federal antitrust laws, nor communicated directly or indirectly the bid made to any competitor or any other person engaged in such line of business.

11.3. Pursuant to §231.006(d), Texas Family Code, regarding child support, the Bidder certifies that the individual or business entity named in this bid is not ineligible to receive the specified payment and acknowledges that the contract may be terminated and payment may be withheld if this certification is inaccurate. Furthermore, any Bidder subject to §231.006, Gov't Code, must include names and Social Security numbers of each person with at least 25% ownership of the business entity submitting the bid. This information must be provided prior to award. Enter the Name & Social Security Numbers for each person below:

Name:	Social Security Number:
Name:	Social Security Number:
Name:	Social Security Number:

11.4. Under §2155.006, Gov't Code, the Bidder certifies that the individual or business entity named in this bid or any contract resulting from this IFB is not ineligible to receive the specified contract and acknowledges that the contract may be terminated and payment withheld if this certification is inaccurate. §2155.004 prohibits a person or entity from receiving a state contract if they received compensation for participating in preparing the solicitation or specifications for the contract.

11.5. As required by §2252.903, Gov't Code, Bidder agrees that any payments due under a contract resulting from this IFB shall be directly applied towards eliminating any debt or delinquency including, but not limited to, delinquent taxes, delinquent student loan payments, and delinquent child support, until the debt is paid in full. Bidder shall comply with rules adopted by TMD under §§403.055, 403.0551, 2252.903, Gov't Code and other applicable laws and regulations regarding satisfaction of debts or delinquencies to the State of Texas.

11.6. Pursuant to §669.003, Gov't Code, TMD may not enter into a contract with a person who employs a current or former executive head of TMD or any other state agency until four years has passed since that person was the executive head of TMD or any other state agency. By submitting a bid, the Bidder certifies that it does not employ any person who was the executive head of TMD or any other state agency in the past four years. If Bidder does employ a person who was the executive head of TMD or any other state agency, provide the following information:

Name of Former Executive: _____

Name of State Agency: _____

Date of Separation from Agency: _____

Position with Bidder: _____

Date of Employment with Bidder: _____

11.7. Pursuant to §572.069, Gov't Code, Bidder certifies that it has not employed and will not employ a former TMD employee or state officer who participated in a procurement or contract negotiation for TMD involving Bidder within two years after the state officer or employee left state agency employment or service. This certification only applies to former state officers or employees whose state service or employment ceased on or after September 1, 2015.

11.8. In accordance with §2155.4441, Gov't Code, Bidder agrees that during the performance of a contract for services it shall purchase products and materials produced in Texas when they are available at a price and time comparable to products and materials produced outside this state.

11.9. Bidder certifies that the bidding entity and its principals are eligible to participate in this transaction and have not been subjected to suspension, debarment, or similar ineligibility determined by any federal, state or local governmental entity and that Bidder is in compliance with the State of Texas statutes and rules relating to procurement and that Bidder is not listed on the federal government's terrorism watch list as described in Executive Order 13224. Entities ineligible for federal procurement are listed at http://www.sam.gov.

11.10. Sections 2155.006 and 2261.053, Gov't Code, prohibit state agencies from awarding contracts to any person who, in the past five years, has been convicted of violating a federal law or assessed a penalty in connection with a contract involving relief for Hurricane Rita, Hurricane Katrina, or any other disaster, as defined by §418.004, Gov't Code, occurring after September 24, 2005. Under §2155.006, Gov't Code, Bidder certifies that the individual or business entity named in its bid is not ineligible to receive a contract and acknowledges that any contract resulting from this IFB may be terminated and payment withheld if this certification is inaccurate.

11.11. Bidder represents and warrants that payment to the Bidder and the Bidder's receipt of appropriated or other funds under any contract resulting from this IFB are not prohibited by §556.005 or §556.008, Gov't Code, relating to the prohibition of using state funds for lobbying activities.

11.12. Bidder represents and warrants that it has no actual or potential conflicts of interest in providing the requested items to TMD under the IFB and any resulting contract, if any, and that Bidder's provision of the requested items under the IFB and any resulting contract, if any, would not reasonably create an appearance of impropriety.

12. NOTE TO BIDDER:

If Bidder takes any exceptions to any provisions of the IFB, these exceptions must be specifically and clearly identified by section in Bidder's bid in response to the IFB and Bidder's proposed alternative must also be provided in the bid. Bidders cannot take a 'blanket exception' to the entire IFB. If any Bidder takes a 'blanket exception' to the entire IFB or does not provide proposed alternative language, the Bidder's bid may be disqualified from further consideration.

12.1 The State of Texas Purchase Order, and its General Terms and Conditions, shall constitute a contract between Texas Military Department and the selected/awarded vendor.

13. PROTEST PROCEDURES:

Any actual or prospective Bidder who is aggrieved in connection with this IFB, evaluation, or award of any contract resulting from this IFB may formally protest as provided in Comptroller of Public Accounts rules at 34 TAC Rule 20.535.

14. DISPUTE RESOLUTION:

The dispute resolution process provided for in Chapter 2260, Gov't Code must be used by TMD and the Bidder to attempt to resolve any dispute arising under any contract resulting from this IFB.

15. NON-APPROPRIATION OF FUNDS:

Any contract resulting from this IFB is subject to termination or cancellation, without penalty to TMD, either in whole or in part, subject to the availability of state funds. TMD is a state agency whose authority and appropriations are subject to actions of the Texas Legislature. If TMD becomes subject to a legislative change, revocation of statutory authority, or lack of appropriated funds which would render TMD's or Bidder's delivery or performance under the contract impossible or unnecessary, the contract will be terminated or cancelled and be deemed null and void. In the event of a termination or cancellation under this Section, TMD will not be liable to Bidder for any damages, which are caused or associated with such termination, or cancellation and TMD will not be required to give prior notice.

16. TEXAS PUBLIC INFORMATION ACT:

Notwithstanding any provisions of this IFB to the contrary, Bidder understands that TMD will comply with the Texas Public Information Act (Chapter 552, Gov't Code) as interpreted by judicial opinions and opinions of the Attorney General of the State of Texas. Information, documentation, and other material in connection with this solicitation or any resulting contract may be subject to public disclosure pursuant to the Texas Public Information Act. Within three (3) days of receipt, Bidder will refer to TMD any third-party requests, received directly by Bidder, for information to which Bidder has access as a result of or in the course of performance under any contract resulting from this IFB. Any part of the solicitation response that is of a confidential or proprietary nature must be clearly and prominently marked as such by the Bidder.

17. CONFLICT OF INTEREST:

Under §2155.003, Gov't Code, a TMD employee may not have an interest in, or in any manner be connected with a contract or bid for a purchase of goods or services by an agency of the state; or in any manner, including by rebate or gift, accept or receive

from a person to whom a contract may be awarded, directly or indirectly, anything of value or a promise, obligation, or contract for future reward or compensation. Any individual who interacts with public purchasers in any capacity is required to adhere to the guidelines established in Section 1.2 of the State of Texas Procurement Manual, which outlines the ethical standards required of public purchasers, employees, and Bidders who interact with public purchasers in the conduct of state business, and with any opinions of or rules adopted by the Texas Ethics Commission. Entities who are interested in seeking business opportunities with the State must be mindful of these restrictions when interacting with public purchasers of TMD or purchasers of other state agencies.

18. FORCE MAJEURE:

Neither Bidder nor TMD shall be liable to the other for any delay in, or failure of performance, of any requirement included in any contract resulting from this IFB caused by force majeure. The existence of such causes of delay or failure shall extend the period of performance until after the causes of delay or failure have been removed provided the non-performing party exercises all reasonable due diligence to perform. Force majeure is defined as acts of God, war, fires, explosions, hurricanes, floods, failure of transportation, or other causes that are beyond the reasonable control of either party and that by exercise of due foresight such party could not reasonably have been expected to avoid, and which, by the exercise of all reasonable due diligence, such party is unable to overcome. Each party must inform the other in writing, with proof of receipt, within three (3) business days of the existence of such force majeure, or otherwise waive this right as a defense.

19. INDEPENDENT CONTRACTOR:

Bidder is and shall remain an independent contractor in relationship to TMD. TMD shall not be responsible for withholding taxes from payments made under any contract resulting from this IFB. Bidder shall have no claim against TMD for vacation pay, sick leave, retirement benefits, social security, worker's compensation, health or disability benefits, unemployment insurance benefits, or employee benefits of any kind.

20. INDEMNIFICATION AND LIABILITY:

20.1. Acts or Omissions:

(a) Vendor shall indemnify and hold harmless the State of Texas and Customers, AND/OR THEIR OFFICERS, AGENTS, EMPLOYEES, REPRESENTATIVES, CONTRACTORS, ASSIGNEES, AND/OR DESIGNEES FROM ANY AND ALL LIABILITY, ACTIONS, CLAIMS, DEMANDS, OR SUITS, AND ALL RELATED COSTS, ATTORNEY FEES, AND EXPENSES arising out of, or resulting from any acts or omissions of the Vendor or its agents, employees, subcontractors, Order Fulfillers, or suppliers of subcontractors in the execution or performance of the Contract and any Purchase Orders issued under the Contract. THE DEFENSE SHALL BE COORDINATED BY VENDOR WITH THE OFFICE OF THE ATTORNEY GENERAL WHEN TEXAS STATE AGENCIES ARE NAMED DEFENDANTS IN ANY LAWSUIT AND VENDOR MAY NOT AGREE TO ANY SETTLEMENT WITHOUT FIRST OBTAINING THE CONCURRENCE FROM THE OFFICE OF THE ATTORNEY GENERAL. VENDOR AND THE CUSTOMER AGREE TO FURNISH TIMELY WRITTEN NOTICE TO EACH OTHER OF ANY SUCH CLAIM.

(b) This section is not intended to and shall not be construed to require bidder to indemnify or hold harmless the state or Texas Military Department for any claims or liabilities resulting from the negligent acts or omissions of the Texas Military Department or its employees.

20.2 Infringements

a) Vendor shall indemnify and hold harmless the State of Texas and Customers, AND/OR THEIR EMPLOYEES, AGENTS, REPRESENTATIVES, CONTRACTORS, ASSIGNEES, AND/OR DESIGNEES from any and all third-party claims involving infringement of United States patents, copyrights, trade and service marks, and any other intellectual or intangible property rights in connection with the PERFORMANCES OR ACTIONS OF VENDOR PURSUANT TO THIS CONTRACT. VENDOR AND THE CUSTOMER AGREE TO FURNISH TIMELY WRITTEN NOTICE TO EACH OTHER OF ANY SUCH CLAIM. VENDOR SHALL BE LIABLE TO PAY ALL COSTS OF DEFENSE INCLUDING ATTORNEYS' FEES. THE DEFENSE SHALL BE COORDINATED BY VENDOR WITH THE OFFICE OF THE ATTORNEY GENERAL WHEN TEXAS STATE AGENCIES ARE NAMED DEFENDANTS IN ANY LAWSUIT AND VENDOR MAY NOT AGREE TO ANY SETTLEMENT WITHOUT FIRST OBTAINING THE CONCURRENCE FROM THE OFFICE OF THE ATTORNEY GENERAL.

b) Vendor shall have no liability under this section if the alleged infringement is caused in whole or in part by: (i) use of the product or service for a purpose or in a manner for which the product or service was not designed, (ii) any modification made to the product without Vendor's written approval, (iii) any modifications made to the product by the Vendor pursuant to Customer's specific instructions, (iv) any intellectual property right owned by or licensed to Customer, or (v) any use of the product or service by Customer that is not in conformity with the terms of any applicable license agreement.

c) If Vendor becomes aware of an actual or potential claim, or Customer provides Vendor with notice of an actual or potential claim, Vendor may (or in the case of an injunction against Customer, shall), at Vendor's sole option and expense; (i) procure for the Customer the right to continue to use the affected portion of the product or service, or (ii) modify or replace the affected portion of the product or service with functionally equivalent or superior product or service so that Customer's use is non-infringing.

20.3 Taxes/Workers' Compensation/Unemployment Insurance – Including Indemnity

1) VENDOR AGREES AND ACKNOWLEDGES THAT DURING THE EXISTENCE OF THIS CONTRACT, VENDOR SHALL BE ENTIRELY RESPONSIBLE FOR THE LIABILITY AND PAYMENT OF VENDOR'S AND VENDOR'S EMPLOYEES' TAXES OF WHATEVER KIND, ARISING OUT OF THE PERFORMANCES IN THIS CONTRACT. VENDOR AGREES TO COMPLY WITH ALL STATE AND FEDERAL LAWS APPLICABLE TO ANY SUCH PERSONS,

INCLUDING LAWS REGARDING WAGES, TAXES, INSURANCE, AND WORKERS' COMPENSATION. THE CUSTOMER AND/OR THE STATE SHALL NOT BE LIABLE TO THE VENDOR, ITS EMPLOYEES, AGENTS, OR OTHERS FOR THE PAYMENT OF TAXES OR THE PROVISION OF UNEMPLOYMENT INSURANCE AND/ OR WORKERS' COMPENSATION OR ANY BENEFIT AVAILABLE TO A STATE EMPLOYEE OR EMPLOYEE OF ANOTHER GOVERNMENTAL ENTITY CUSTOMER.

2) VENDOR AGREES TO INDEMNIFY AND HOLD HARMLESS CUSTOMERS, THE STATE OF TEXAS AND/OR THEIR EMPLOYEES, AGENTS, REPRESENTATIVES, CONTRACTORS, AND/OR ASSIGNEES FROM ANY AND ALL LIABILITY, ACTIONS, CLAIMS, DEMANDS, OR SUITS, AND ALL RELATED COSTS, ATTORNEYS' FEES, AND EXPENSES, RELATING TO TAX LIABILITY, UNEMPLOYMENT INSURANCE AND/OR WORKERS' COMPENSATION IN ITS PERFORMANCE UNDER THIS CONTRACT. VENDOR SHALL BE LIABLE TO PAY ALL COSTS OF DEFENSE INCLUDING ATTORNEYS' FEES. THE DEFENSE SHALL BE COORDINATED BY VENDOR WITH THE OFFICE OF THE ATTORNEY GENERAL WHEN TEXAS STATE AGENCIES ARE NAMED DEFENDANTS IN ANY LAWSUIT AND VENDOR MAY NOT AGREE TO ANY SETTLEMENT WITHOUT FIRST OBTAINING THE CONCURRENCE FROM THE OFFICE OF THE ATTORNEY GENERAL. VENDOR AND THE CUSTOMER AGREE TO FURNISH TIMELY WRITTEN NOTICE TO EACH OTHER OF ANY SUCH CLAIM.

21. RIGHT TO AUDIT:

In addition to and without limitation on the other audit provisions of this IFB, pursuant to §2262.003, Texas Government Code, the state auditor may conduct an audit or investigation of the Bidder or any other entity or person receiving funds from the state directly under this contract or indirectly through a subcontract under this contract. The acceptance of funds by the Bidder or any other entity or person directly under this contract or indirectly through a subcontract under this contract acts as acceptance of the authority of the state auditor, under the direction of the legislative audit committee, to conduct an audit or investigation in connection with those funds. Under the direction of the legislative audit committee, the Bidder or other entity that is the subject of an audit or investigation by the state auditor must provide the state auditor with access to any information the state auditor considers relevant to the investigation or audit. This IFB or any contract resulting from this IFB may be amended unilaterally by TMD to comply with any rules and procedures of the state auditor in the implementation and enforcement of §2262.003, Texas Government Code. Bidder will ensure that this clause concerning the authority to audit funds received indirectly by subcontractors through the Bidder and the requirement to cooperate is included in any subcontract it awards.

22. NEWS RELEASES, ADVERTISEMENTS AND PUBLICITY:

Bidder must not make any news releases, public announcements, or public disclosures, nor will it have any conversations with representatives of the news media, pertaining to this contract, without the express, prior written approval of TMD, and then only in accordance with explicit written instructions from TMD. Bidder must not use the name of the State of Texas or TMD in any advertisement, promotion or otherwise for any purpose regarding this contract without the express prior written consent of TMD. TMD is not authorized to provide endorsements.

23. INSURANCE REQUIREMENTS

Contractor represents and warrants that it will, within five (5) business days of award provide TMD with current certificates of insurance of the following coverage:

(a) Workers Compensation & Employers Liability: Contractor must maintain Workers' Compensation insurance coverage in accordance with statutory limits.
Workers Compensation: Statutory Limits
Employers Liability: Each Accident $1,000,000
Disease- Each Employee $1,000,000
Disease-Policy Limit $1,000,000
The following website addresses what Texas requires of WC. http://www.tdi.texas.gov/wc/act/index.html. Workers' Compensation Insurance Coverage starts with Chapter 406 of the Labor code.

(b) Commercial General Liability:
Occurrence based:
Bodily Injury and Property Damage each occurrence limit: $1,000,000
Aggregate limit: $2,000,000
Medical Expense each person: $5,000
Personal Injury and Advertising Liability: $1,000,000
Products /Completed Operations Aggregate Limit: $2,000,000
Damage to Premises Rented to You: $50,000

(c) Umbrella/Excess Liability: Contractor may combine its primary and Excess/Umbrella Liability limits to meet the minimum required coverage for any line of coverage; however, if it chooses this option, the coverage will be written at least as broad as those requirements defined above.
Minimum Limit: $1,000,000

Note: The required coverage is to be with companies licensed in the state of Texas, with an "A" rating from A.M. Best, and authorized to provide the corresponding coverage.

24. U.S. DEPARTMENT OF HOMELAND SECURITY'S E-VERIFY SYSTEM:

By entering into this Contract, the Contractor certifies and ensures that it utilizes and will continue to utilize, for the term of this Contract, the U.S. Department of Homeland Security's E-Verify system to determine the eligibility of:

1. All persons employed to perform duties within Texas, during the term of the Contract; and

2. All persons (including subcontractors) assigned by the Bidder to perform work pursuant to the Contract, within the United States of America.

The Contractor shall provide, upon request of TMD, an electronic or hardcopy screenshot of the confirmation or tentative non-confirmation screen containing the E-Verify case verification number for attachment to the Form I-9 for the three most recent hires that match the criteria above, by the Contractor, and Contractor's subcontractors, as proof that this provision is being followed.

If this certification is falsely made, the Contract may be immediately terminated, at the discretion of the state and at no fault to the state, with no prior notification. The Contractor shall also be responsible for the costs of any re-solicitation that the state must undertake to replace the terminated Contract.

25. DISCLOSURE OF POTENTIAL CONFLICTS OF INTEREST; CERTAIN CONTRACT PROHIBITED:

Pursuant to §2261.252, Gov't Code, the Department may not enter into a contract for the purchase of goods or services with a private vendor if certain positions within the agency including the Adjutant General, Executive Director, General Counsel or the Procurement Director or their covered family members have a financial interest in the vendor. Any contract found to violate Government Code 2261.252 is void.

26. TECHNOLOGY ACCESS CLAUSE

The Vendor expressly acknowledges that state funds may not be expended in connection with the purchase of an automated information system unless that system meets certain statutory requirements relating to accessibility by persons with visual impairments. Accordingly, the Vendor represents and warrants to the Texas Military Department that the technology provided to the Texas Military Department for purchase is capable either by virtue of features included within the technology or because it is readily adaptable by use with other technology, of:

(a) Providing equivalent access for effective use by both visual and non-visual means;

(b) presenting information, including prompts used for interactive communications, in formats intended for non-visual use; and

(c) being integrated into networks for obtaining, retrieving, and disseminating information used by individuals who are not blind or visually impaired.

(d) For purposes of this paragraph, the phrase "equivalent access" means a substantially similar ability to communicate with or make use of the technology, either directly by features incorporated within the technology or by other reasonable means such as assistive devices or services which would constitute reasonable accommodations under the Americans with Disabilities Act or similar state or federal laws. Examples of methods by which equivalent access may be provided include, but are not limited to, keyboard alternatives to mouse commands and other means of navigation graphical displays, and customizable display appearance."

27. CANCELLATION

Unless otherwise specified in the solicitation, Texas Military Department may cancel the purchase order without penalty, either in whole or in part for any reason.

28. CONSTRUCTION

The invalidity or unenforceability of any provision of the contract shall not affect the validity or enforceability of any other provision. Neither party may assign the contract without the prior written consent of the other party. Any amendment or modification will be effective only if in writing and signed by Texas Military Department.

29. DISCRETIONARY EXTENSION

(a) Contracts for services, whose original period were for one year or longer, may be extended for up to ninety (90) days beyond the normal expiration date of the contract, under substantially the same terms and conditions, provided the vendor/contractor and the Texas Military Department mutually agree to extension and pricing during the extension period.

(b) In compliance with the provisions of Texas Government Code Sections 2155.074, 2155.076, 2156.007, 2157.003, 2157.125 and TAC Section 20.36, information obtained from the CPA's Vendor Performance Tracking System may be used in evaluating responses to solicitations for goods and services to determine the best value for the state.

(c) The Texas Military Department reserves the right NOT to consider a response from a bidder whose same, or similar, goods or services to the Texas Military Department have been documented as unsatisfactory in providing the same or similar goods or services.

30. ABANDONMENT OR DEFAULT

If Bidder defaults on this Contract, Texas Military Department reserves the right to cancel this Contract without notice and either re-solicit or re-award the Contract to the next best responsive and responsible Bidder. The defaulting Bidder will not be considered in the re-solicitation and may not be considered in future solicitations for the same type of work, unless the specification or scope of work significantly changed. The period of suspension will be determined by the agency based on the seriousness of the default.

31. ASSIGNMENTS

Without the prior written consent of Texas Military Department, Bidder may not assign this Contract, in whole or in part, and may not assign any right or duty required under it.

32. FRANCHISE TAX

Bidder hereby certifies that Bidder is not currently delinquent in the payment of any franchise tax owed to the State of Texas under Chapter §171, Tax Code. Making a false statement as to corporate tax status is a material breach of contract.

ATTACHMENT I – UNIFORM GENERAL AND SUPPLEMENTAL CONDITIONS

Texas Military Department



2015
Uniform General Conditions

Uniform General Conditions for Construction Contracts

Table of Contents

Article I. Definitions 5

Article 2. Wage Rates and Other Laws Governing Construction 9

Article 3. General Responsibilities of Owner and Contractor. 12

Article 4. Historically Underutilized Business (HUB) Subcontracting Plan 20

Article 5. Bonds and Insurance 22

Article 6. Construction Documents, Coordination Documents, and Record Documents 29

Article 7. Construction Safety 31

Article 8. Quality Control 33

Article 9. Construction Schedules 39

Article I0. Payments 44

Article 11. Changes 49

Article 12. Project Completion and Acceptance 53

Article 13. Warranty and Guarantee 58

Article 14. Suspension and Termination 60

Article 15. Dispute Resolution 63

Article 16. Miscellaneous 64

Article 1. Definitions

Unless the context clearly requires another meaning, the following terms have the meaning assigned herein.

1.1 *Addendum/Addenda* means formally issued written or graphic modifications and/or interpretations of the Construction Documents that may add to, delete from, clarify or correct the description and/or scope of the Work. Addenda are issued during the bidding phase of the project.

1.2 *Application for Payment* means Contractor's monthly partial invoice for payment that includes any portion of the Work that has been completed for which an invoice has not been submitted and performed in accordance with the requirements of the Contract Documents. The Application for Payment accurately rflects the progress of the Work, is itemized based on the Schedule of Values, bears the notarized signature of Contractor, and shall not include subcontracted items for which Contractor does not intend to pay.

1.3 *Application for Final Payment* means Contractor's final invoice for payment that includes any portion of the Work that has been completed for which an invoice has not been submitted, amounts owing to adjustments to the final Contract Sum resulting from approved change orders, and release ofremaining Contractor's retainage.

1.4 *Architect/Engineer (AIE)* means a person registered as an architect pursuant to Tex. Occ. Code Ann., Ch. 1051, as a landscape architect pursuant to Tex. Occ. Code Ann., Ch. 1052, a person licensed as a professional engineer pursuant Tex. Occ. Code Ann., Ch. 1001, and/or a firm employed by Owner or Design-Build Contractor to provide professional architectural or engineering services and to exercise overall responsibility for the design of a Project or a significant portion thereof, and to perform the contract administration responsibilities set forth in the Contract.

1.5 *Authority Having Jurisdiction* means a federal, state, local, or other regional department, or an individual such as a fire marshal, building official, electrical inspector, utility provider or other individual having statutory authority.

1.6 *Baseline Schedule* means the initial time schedule prepared by Contractor for Owner's information and acceptance that conveys Contractor's and Subcontractors' activities (including coordination and review activities required in the Contract Documents to be performed by A/E and ODR), durations, and sequence of work related to the entire Project to the extent required by the Contract Documents. The schedule clearly demonstrates the critical path of activities, durations and necessary predecessor conditions that drive the end date of the schedule. The Baseline Schedule shall not exceed the time limit current under the Contract Documents.

1.7 *Certificate of Final Completion* means the certificate issued by *AIE* that documents, to the best of A/E's knowledge and understanding, Contractor's completion of all

Contractor's Punchlist items and pre-final Punchlist items, final cleanup and Contractor's provision of Record Documents, operations and maintenance manuals, and all other closeout documents required by the Contract Documents.

1.8 *Certificate of Substantial Completion* means the certificate executed by the A/E, ODR and Contractor that documents to the best of A/E's and ODR's knowledge and understanding, Contractor's sufficient completion of the work in accordance with the Contract, so as to be operational and fit for the use intended.

1.9 *Change Order* means a written modification of the Contract between Owner and Contractor, signed by Owner, Contractor, and A/E.

1.10 *Close-out Documents* mean the product brochures, submittals, product/equipment maintenance and operations instructions, manuals, and other documents/warranties, record documents, affidavit of payment, release of lien and claim, and as may be further defined, identified, and required by the Contract Documents.

1.11 *Contract* means the entire agreement between Owner and Contractor, including all of the Contract Documents.

1.12 *Contract Date* is the date when the agreement between Owner and Contractor becomes effective.

1.13 *Contract Documents* mean those documents identified as a component of the agreement (Contract) between Owner and Contractor. These may include, but are not limited to, Drawings; Specifications; General, Supplementary General, and Special Conditions; and all pre-bid and/or pre-proposal addenda.

1.14 *Contract Sum* means the total compensation payable to Contractor for completion of the Work in accordance with the terms of the Contract.

1.15 *Contract Time* means the period between the start date identified in the Notice to Proceed with construction and the Substantial Completion date identified in the Notice to Proceed or as subsequently amended by a Change Order.

1.16 *Contractor* means the individual, corporation, limited liability company, partnership, firm, or other entity contracted to perform the Work, regardless of the type of construction contract used, so that the term as used herein includes a Construction Manager-at-Risk or a Design-Build firm as well as a general or prime Contractor. The Contract Documents refer to Contractor as if singular in number.

1.17 *Construction Documents* mean the Drawings, Specifications, and other documents issued to build the Project. Construction Documents become part of the Contract Documents when listed in the Contract or any Change Order.

1.18 *Construction Manager-at-Risk*, in accordance with Tex. Gov't Code, Ch. 2166, means a sole proprietorship, partnership, corporation, or other legal entity that assumes the risk for construction, rehabilitation, alteration, or repair of a facility at the

contracted price as a general contractor and provides consultation to Owner regarding construction during and after the design of the facility.

1.19 *Date of Commencement* means the date designated m the Notice to Proceed for Contractor to commence the Work.

1.20 *Day* means a calendar day unless otherwise specifically stipulated.

1.21 *Design-Build* means a project delivery method in which the detailed design and subsequent construction is provided through a single contract with a Design-Build firm; a team, partnership, or legal entity that includes design professionals and a builder. The Design-Build Project delivery shall be implemented in accordance with Tex. Gov't Code § 2166.2531.

1.22 *Drawings* mean that product of A/E which graphically depicts the Work.

1.23 *Final Completion* means the date determined and certified by *AIE* and Owner on which the Work is fully and satisfactorily complete in accordance with the Contract.

1.24 *Final Payment* means the last and final monetary compensation made to Contractor for any portion of the Work that has been completed and accepted for which payment has not been made, amounts owing to adjustments to the final Contract Sum resulting from approved change orders, and release of Contractor's retainage.

1.25 *Historically Underutilized Business (HUB)* pursuant to Tex. Gov't Code, Ch. 2161, means a business that is at least 51% owned by an Asian Pacific American, a Black American, a Hispanic American, a Native American and/or an American Woman; is an entity with its principal place of business in Texas; and has an owner residing in Texas with proportionate interest that actively participates in the control, operations, and management of the entity's affairs.

1.26 *Notice to Proceed* means written document informing Contractor of the dates beginning Work and the dates anticipated for Substantial Completion.

1.27 *Open Item List* means a list of work activities, Punchlist items, changes or other issues that are not expected by Owner and Contractor to be complete prior to Substantial Completion.

1.28 *Owner* means the State of Texas, and any agency of the State of Texas, acting through the responsible entity of the State of Texas identified in the Contract as Owner.

1.29 *Owner 's Designated Representative (ODR)* means the individual assigned by Owner to act on its behalf and to undertake certain activities as specifically outlined in the Contract. ODR is the only party authorized to direct changes to the scope, cost, or time of the Contract.

1.30 *Project* means all activities necessary for realization of the Work. This includes design, contract award(s), execution of the Work itself, and fulfillment of all Contract and warranty obligations.

1.31 *Progress Assessment Report (PAR)* means the monthly compliance report to Owner verifying compliance with the HUB subcontracting plan (HSP).

1.32 *Proposed Change Order (PCO)* means a document that informs Contractor of a proposed change in the Work and appropriately describes or otherwise documents such change including Contractor's response of pricing for the proposed change.

1.33 *Punchlist* means a list of items of Work to be completed or corrected by Contractor after Substantial Completion. Punchlists indicate items to be finished, remaining Work to be performed, or Work that does not meet quality or quantity requirements as required in the Contract Documents.

1.34 *Record Documents* mean the drawing set, Specifications, and other materials maintained by Contractor that documents all addenda, Architect's Supplemental Instructions, Change Orders and postings and markings that record the as-constructed conditions of the Work and all changes made during construction.

1.35 *Request for Information (RFI)* means a written request by Contractor directed to A/E or ODR for a clarification of the information provided in the Contract Documents or for direction concerning information necessary to perform the Work that may be omitted from the Contract Documents.

1.36 *Samples* mean representative physical examples of materials, equipment, or workmanship used to confirm compliance with requirements and/or to establish standards for use in execution of the Work.

1.37 *Schedule of Values* means the detailed breakdown of the cost of the materials, labor, and equipment necessary to accomplish the Work as described in the Contract Documents, submitted by Contractor for approval by Owner and A/E.

1.38 *Shop Drawings* mean the drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data prepared by Contractor or its agents which detail a portion of the Work.

1.39 *Site* means the geographical area of the location of the Work.

1.40 *Special Conditions* mean the documents containing terms and conditions which may be unique to the Project. Special Conditions are a part of the Contract Documents and have precedence over the Uniform General Conditions and Supplementary General Conditions.

1.41 *Specifications* mean the written product of A/E that establishes the quality and/or performance of products utilized in the Work and processes to be used, including testing and verification for producing the Work.

1.42 *Subcontractor* means a business entity that enters into an agreement with Contractor to perform part of the Work or to provide services, materials, or equipment for use in the Work.

1.43 *Submittal Register* means a list provided by Contractor of all items to be furnished for review and approval by *NE* and Owner and as identified in the Contract Documents including anticipated sequence and submittal dates.

1.44 *Substantial Completion* means the date determined and certified by Contractor, *NE,* and Owner when the Work, or a designated portion thereof, is sufficiently complete, in accordance with the Contract, so as to be operational and fit for the use intended.

1.45 *Supplementary General Conditions* mean procedures and requirements that modify the Uniform General Conditions. Supplementary General Conditions, when used, have precedence over the Uniform General Conditions.

1.46 *Unit Price Work* means the Work, or a portion of the Work, paid for based on incremental units of measurement.

1.47 *Unilateral Change Order (ULCO)* means a Change Order issued by Owner without the complete agreement of Contractor, as to cost and/or time.

1.48 *Work* means the administration, procurement, materials, equipment, construction and all services necessary for Contractor, and/or its agents, to fulfill Contractor's obligations under the Contract.

1.49 *Work Progress Schedule* means the continually updated time schedule prepared and monitored by Contractor that accurately indicates all necessary appropriate revisions as required by the conditions of the Work and the Project while maintaining a concise comparison to the Baseline Schedule.

Article 2. Wage Rates and Other Laws Governing Construction

2.1 Environmental Regulations. Contractor shall conduct activities in compliance with applicable laws and regulations and other requirements of the Contract relating to the environment and its protection at all times. Unless otherwise specifically determined, Owner is responsible for obtaining and maintaining permits related to stormwater run-off. Contractor shall conduct operations consistent with stormwater run-off permit conditions. Contractor is responsible for all items it brings to the Site, including hazardous materials, and all such items brought to the Site by its Subcontractors and suppliers, or by other entities subject to direction of Contractor. Contractor shall not incorporate hazardous materials into the Work without prior approval of Owner, and shall provide an affidavit attesting to such in association with request for Substantial Completion inspection.

2.2 Wage Rates. Contractor shall not pay less than the wage scale of the various classes of labor as shown on the prevailing wage schedule provided by Owner in the bid or proposal specifications. The specified wage rates are minimum rates only. Owner is

not bound to pay any claims for additional compensation made by any Contractor because the Contractor pays wages in excess of the applicable minimum rate contained in the Contract. The prevailing wage schedule is not a representation that qualified labor adequate to perform the Work is available locally at the prevailing wage rates.

2.2.1 Notification to Workers. Contractor shall post the prevailing wage schedule in a place conspicuous to all workers on the Project Site When requested by Owner, Contractor shall furnish evidence of compliance with the Texas Prevailing Wage Law and the addresses of all workers.

2.2.1.I Pursuant to Tex. Gov't Code § 2258.024, Contractor shall keep, on site, true and accurate records showing the name and occupation of each worker employed by the Contractor or subcontractors and the actual per diem wages paid to each worker. The record shall be open to inspection by the ODR and their agents at all reasonable hours for the duration of the contract.

2.2.1.2 With each application for progress payment, Contractor shall make available upon request certified payroll records, including from subcontractors of any tier level, on Form WH-347 as promulgated by the U.S. Department of Labor, as may be revised from time to time and in unlocked and unprotected Excel format, along with copies of any and all Contract Documents between Contractor and any Subcontractors. Pursuant to Tex. Penal Code §§ 37.02 and 37.IO, Employees of Contractor and subcontractors, including all tier levels, shall be subject to prosecution for submitting certified payroll records that contain materially false information.

2.2.1.3 The prevailing wage schedule is determined by Owner in compliance with Tex. Gov't Code, Ch. 2258. Should Contractor at any time become aware that a particular skill or trade not reflected on Owner's prevailing wage schedule will be or is being employed in the Work, whether by Contractor or by Subcontractor, Contractor shall promptly inform ODR of the proposed wage to be paid for the skill along with a justification for same and ODR shall promptly concur with or reject the proposed wage and classification.

2.2.1.4 Contractor is responsible for determining the most appropriate wage for a particular skill in relation to similar skills or trades identified on the prevailing wage schedule. In no case, shall any worker be paid less than the wage indicated for laborers.

2.2.1.5 Pursuant to Tex. Labor Code § 214.008, Misclassification of Workers; Penalty. The Owner requires Contractor and all subcontractors properly classify individuals as Employees or Independent Contractors.

2.2.2 Penalty for Violation. Contractor, and any Subcontractor, will pay to the State a penalty of sixty dollars ($60) for each worker employed for each day, or portion thereof, that the worker is paid less than the wage rates stipulated in the prevailing wage schedule

2.2.3 Complaints of Violations.

2.2.3.1 Owner's Determination of Good Cause. Upon receipt of information concerning a violation, Owner will conduct an investigation in accordance with Tex. Gov't Code, Ch. 2258 and make an initial determination as to whether good cause exists that a violation occurred. Upon making a good cause finding, Owner will retain the foll amounts claimed by the claimant or claimants as the difference between wages paid and wages due under the prevailing wage schedule and any supplements thereto, together with the applicable penalties in accordance with Tex. Gov't Code § 2258.023, such amounts being subtracted from successive progress payments pending a final decision on the violation.

2.2.3.2 No Extension of Time. If Owner's determination proves valid that good cause existed to believe a violation had occurred, Contractor is not entitled to an extension of time for any delay arising directly or indirectly from the arbitration procedures.

2.2.3.3 Cooperation with Owner's Investigation. Contractor shall cooperate with Owner during any investigations hereunder. Such cooperation shall include, but not necessarily be limited to, timely providing the information and/or documentation requested by Owner, which may include certified payroll records on Form WH-347 as promulgated by the U.S. Department of Labor, as may be revised from time to time and in unlocked and unprotected Excel format; and copies of any and all Contract Documents between Contractor and any Subcontractors.

2.2.3.4 Notification to Owner. In the event Contractor or Subcontractor elect to appeal an initial determination made pursuant to Paragraph 2.2.3.1, the Contractor and/or Subcontractor, as applicable, shall deliver notice thereof to Owner.

2.3 Venue for Suits. The venue for any suit arising from the Contract will be in a court of competent jurisdiction in Travis County, Texas, or as may otherwise be designated in the Supplementary General Conditions.

2.4 Licensing of Trades. Contractor shall comply with all applicable provisions of State law related to license requirements for skilled tradesmen, contractors, suppliers and or laborers, as necessary to accomplish the Work. In the event Contractor, or one of its Subcontractors, loses its license during the term of performance of the Contract, Contractor shall promptly hire or contract with a licensed provider of the service at no additional cost to Owner.

2.5 Royalties, Patents, and Copyrights. Contractor shall pay all royalties and license fees, defend suits or claims for infringement of copyrights and patent rights, and shall hold Owner harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by Owner or A/E. However, if Contractor has reason to believe that the required design, process, or product is an infringement of a copyright or a patent, Contractor shall be responsible for such loss unless such information is promptly furnished to *AJE.*

2.6 State Sales and Use Taxes. Owner qualifies for exemption from certain State and local sales and use taxes pursuant to the provisions of Tex. Tax Code, Ch. 151. Upon request from Contractor, Owner shall furnish evidence of tax exempt status. Contractor may claim exemption from payment of certain applicable State taxes by complying with such procedures as prescribed by the State Comptroller of Public Accounts. Owner acknowledges not all items qualify for exemption. Owner is not obligated to reimburse Contractor for taxes paid on items that qualify for tax exemption.

Article 3. General Responsibilities of Owner and Contractor

3.1 Owner's General Responsibilities. Owner is the entity identified as such in the Contract and referred to throughout the Contract Documents as if singular in number.

3.1.1 Preconstruction Conference. Prior to, or concurrent with, the issuance of Notice to Proceed with construction, a conference will be convened for attendance by Owner, Contractor, A/E and appropriate Subcontractors. The purpose of the conference is to establish a working understanding among the parties as to the Work, the operational conditions at the Project Site, and general administration of the Project. Topics include communications, schedules, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, maintaining required records and all other matters of importance to the administration of the Project and effective communications between the Project team members.

3.1.2 Owner's Designated Representative. Prior to the start of construction, Owner will identify Owner's Designated Representative (ODR), who has the express authority to act and bind Owner to the extent and for the purposes described in the various Articles of the Contract, including responsibilities for general administration of the Contract.

3.1.2.l Unless otherwise specifically defined elsewhere in the Contract Documents, ODR is the single point of contact between Owner and Contractor. Notice to ODR, unless otherwise noted, constitutes notice to Owner under the Contract.

3.1.2.2 All directives on behalf of Owner will be conveyed to Contractor and A/E by ODR in writing.

3.1.2.3 Owner will furnish or cause to be furnished, free of charge, the number of complete sets of the Drawings, Specifications, and addenda as provided in the Supplementary General Conditions or Special Conditions.

3.1.2.4 The ODR will establish the protocol for planning, scheduling and documenting progress meetings with provisions for absence of various project team members that have a key role in these duties.

3.1.3 Owner Supplied Materials and Information.

3.1.3.l Owner will furnish to Contractor those surveys describing the physical characteristics, legal description, limitations of the Site, Site utility locations, and other information used in the preparation of the Contract Documents.

3.1.3.2 Owner will provide information, equipment, or services under Owner's control to Contractor with reasonable promptness.

3.1.4 Availability of Lands. Owner will furnish, as indicated in the Contract, all required rights to use the lands upon which the Work occurs. This includes rights-of-way and easements for access and such other lands that are designated for use by Contractor. Contractor shall comply with all Owner identified encumbrances or restrictions specifically related to use of lands so furnished. Owner will obtain and pay for easements for permanent structures or permanent changes in existing facilities,

3.1.5 Limitation on Owner's Duties.

3.1.5.1 Owner will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, technologies, sequences or procedures of construction or the safety precautions and programs incident thereto. Owner is not responsible for any failure of Contractor to comply with laws and regulations applicable to the Work. Owner is not responsible for the failure of Contractor to perform or furnish the Work in accordance with the Contract Documents. Except as provided in Section 2.5, Owner is not responsible for the acts or omissions of Contractor, or any of its Subcontractors, suppliers or of any other person or organization performing or furnishing any of the Work on behalf of Contractor.

3.1.5.2 Owner will not take any action in contravention of a design decision made by *AIE* in preparation of the Contract Documents, when such actions are in conflict with statutes under which *AIE* is licensed for the protection of the public health and safety.

3.2 Role of Architect/Engineer. Unless specified otherwise in the Contract between Owner and Contractor, *AIE* shall provide general administration services for Owner during the construction phase of the project. Written correspondence, requests for information, and Shop Drawings/submittals shall be directed to *AIE* for action. *AIE* has the authority to act on behalf of Owner to the extent provided in the Contract Documents, unless otherwise modified by written instrument, which will be furnished to Contractor by ODR, upon request.

3.2.1 Site Visits.

3.2.1.1 *AIE* will make visits to the Site at intervals as provided in the A/E's Contract with Owner, to observe the progress and the quality of the various aspects of Contractor's executed Work and report findings to Owner.

3.2.1.2 A/E has the authority to interpret Contract Documents and inspect the Work for compliance and conformance with the Contract. Except as referenced in Paragraph 3.1.5.2, Owner retains the sole authority to accept or reject Work and issue direction for correction, removal, or replacement of Work.

3.2.2 Clarifications and Interpretations. It may be determined that clarifications or interpretations of the Contract Documents are necessary. Upon direction by ODR, such clarifications or interpretations will be provided by A/E consistent with the intent of the Contract Documents. A/E will issue these clarifications with reasonable promptness to Contractor as A/E's supplemental instruction ("ASI") or similar instrument. If Contractor believes that such clarification or interpretation justifies an adjustment in the Contract Sum or the Contract Time, Contractor shall so notify Owner in accordance with the provisions of Article 11.

3.2.3 Limitations on Architect/Engineer Authority. A/E is not responsible for:

3.2.3.1 Contractor's means, methods, techniques, .sequences, procedures, safety, or programs incident to the Project, nor will *AIE* supervise, direct, control or have authority over the same;

3.2.3.2 The failure of Contractor to comply with laws and regulations applicable to the furnishing or performing the Work;

3.2.3.3 Contractor's failure to perform or furnish the Work in accordance with the Contract Documents; or

3.2.3.4 Acts or omissions of Contractor, or of any other person or organization performing or furnishing any of the Work.

3.3 Contractor' s G en er a 1 R esp on sib ilities. Contractor is solely responsible for implementing the Work in full compliance with all applicable laws and the Contract Documents and shall supervise and direct the Work using the best skill and attention

to assure that each element of the Work conforms to the Contract requirements. Contractor is solely responsible for all construction means, methods, techniques, safety, sequences, coordination, procedures and protection of the installed work as part of the contract until substantial completion of the project. Contractor remains responsible for the care and protection of materials and Work in the areas where punch list items are completed until Final Completion.

3.3.1 Project Administration. Contractor shall provide Project administration for *all* Subcontractors, vendors, suppliers, and others involved in implementing the Work and shall coordinate administration efforts with those of A/E and ODR in accordance with these general conditions and other provisions of the Contract, and as outlined in the preconstruction conference. Contractor's Project Administration includes periodic daily reporting on weather, work progress, labor, materials, equipment, obstructions to prosecution of the work, accidents and injuries in accordance with the Contract and transmitted no less frequently than on a weekly basis.

3.3.2 Contractor's Management Personnel. Contractor shall employ a competent person or persons who will be present at the Project Site during the progress of the Work to supervise or oversee the work. The competent persons are subject to the approval of ODR. Contractor shall not change approved staff during the course of the project without the written approval of ODR unless the staff member leaves the employment of Contractor. Contractor shall provide additional quality control, safety and other staff as stated in the Supplementary General Conditions.

3.3.3 Labor. Contractor shall provide competent, suitably qualified personnel to survey, lay-out, and construct the Work as required by the Contract Documents and maintain good discipline and order at the Site at all times.

3.3.4 Services, Materials, and Equipment. Unless otherwise specified, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities, incidentals, and services necessary for the construction, performance, testing, start-up, inspection and completion of the Work.

3.3.5 Contractor General Responsibility. For Owner furnished equipment or material that will be in the care, custody, and control of Contractor, Contractor is responsible for damage or loss. Owner shall deliver to Contractor a complete list and respective values of such materials or equipment and make an equitable adjustment to the contract amount for any increase in cost of Builder's Risk insurance.

3.3.6 Non-Compliant Work. Should A/E and/or ODR identify Work as non-compliant with the Contract Documents, A/E and/or ODR shall communicate the finding to Contractor, and Contractor shall correct such Work at no additional cost to the Owner. The approval of Work by either A/E or

ODR does not relieve Contractor from the obligation to comply with all requirements of the Contract Documents.

3.3.7 Subcontractors. Contractor shall not employ any Subcontractor, supplier or other person or organization, whether initially or as a substitute, against whom Owner shall have reasonable objection. Owner will communicate such objections in writing within ten (10) days ofreceipt of Contractor's intent to use such Subcontractor, supplier, or other person or organization. Contractor is not required to employ any Subcontractor, supplier or other person or organization to furnish any of the work to whom Contractor has reasonable objection. Contractor shall not substitute Subcontractors without the acceptance of Owner. Pursuant to Tex. Gov't Code § 2269.256(b), if the Contractor reviews, evaluates and recommends that the Owner accept a bid or proposal from a Subcontractor . but the Owner requires another bid or proposal to be accepted, Owner shall compensate the Contractor by a change in price, time or guaranteed maximum cost for any additional cost or risk the Contractor will incur because of Owner's requirement to select another bid or proposal rather than the one recommended.

3.3.7.1 All Subcontracts and supply contracts shall be consistent with and bind the Subcontractors and suppliers to the terms and conditions of the Contract Documents including provisions of the Contract between Contractor and Owner.

3.3.7.2 Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with Contractor. Require all Subcontractors, suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with Owner only through Contractor. Contractor shall furnish to Owner a copy, at Owner's request, of each first-tier subcontract promptly after its execution. Contractor agrees that Owner has no obligation to review or approve the content of such contracts and that providing Owner such copies in no way relieves Contractor of any of the terms and conditions of the Contract, including, without limitation, any provisions of the Contract which require the Subcontractor to be bound to Contractor in the same manner in which Contractor is bound to Owner.

3.3.8 Continuing the Work. Contractor shall carry on the Work and adhere to the progress schedule during all disputes, disagreements, or alternative resolution processes with Owner. Contractor shall not delay or postpone any Work because of pending unresolved disputes, disagreements or alternative resolution processes, except as Owner and Contractor may agree in writing.

3.3.9 Cleaning. Contractor shall at all times, keep the Site and the Work clean and free from accumulation of waste materials or rubbish caused by the construction activities under the Contract. Contractor shall ensure that the entire Project is thoroughly cleaned prior to requesting Substantial Completion inspection and, again, upon completion of the Project prior to the final inspection.

3.3.l0 Acts and Omissions of Contractor, its Subcontractors, and Emvlovees. Contractor shall be responsible for acts and omissions of his employees and all its Subcontractors, their agents and employees. Owner may, in writing, require Contractor to remove from the Project any of Contractor's or its Subcontractor's employees whom ODR finds to be careless, incompetent, unsafe, uncooperative, disruptive, or otherwise objectionable.

3.3.I I Acts or Omissions. Contractor shall indemnify and hold harmless the State of Texas and Customers, AND/OR THEIR OFFICERS, AGENTS, EMPLOYEES, REPRESENTATIVES, CONTRACTORS, ASSIGNEES, AND/OR DESIGNEES FROM ANY AND ALL LIABILITY, ACTIONS, CLAIMS, DEMANDS, OR SUITS, AND ALL RELATED COSTS, ATTORNEY FEES, AND EXPENSES arising out of, or resulting from any acts or omissions of Contractor or its agents, employees, subcontractors, Order Fulfillers, or suppliers of subcontractors in the execution or performance of the Contract and any Purchase Orders issued under the Contract. THE DEFENSE SHALL BE COORDINATED BY CONTRACTOR WITH THE OFFICE OF THE ATTORNEY GENERAL WHEN TEXAS STATE AGENCIES ARE NAMED DEFENDANTS IN ANY LAWSUIT AND CONTRACTOR MAY NOT AGREE TO ANY SETTLEMENT WITHOUT FIRST OBTAINING THE CONCURRENCE FROM THE OFFICE OF THE ATTORNEY GENERAL. CONTRACTOR AND OWNER AGREE TO FURNISH TIMELY WRITTEN NOTICE TO EACH OTHER OF ANY SUCH CLAIM.

3.3.12 Infringements.

3.3.12.1 Contractor shall indemnify and hold harmless the State of Texas and Customers, AND/OR THEIR EMPLOYEES, AGENTS, REPRESENTATIVES, CONTRACTORS, ASSIGNEES, AND/OR DESIGNEES from any and all third party claims involving infringement of United States patents, copyrights, trade and service marks, and any other intellectual or intangible property rights in connection with the PERFORMANCES OR ACTIONS OF CONTRACTOR PURSUANT TO THIS CONTRACT. CONTRACTOR AND THE CUSTOMER AGREE TO FURNISH TIMELY WRITTEN NOTICE TO EACH OTHER OF ANY SUCH CLAIM. CONTRACTOR SHALL BE LIABLE TO PAY ALL COSTS OF DEFENSE INCLUDING ATTORNEYS' FEES. THE DEFENSE SHALL BE COORDINATED BY CONTRACTOR WITH THE OFFICE OF THE ATTORNEY GENERAL WHEN TEXAS STATE AGENCIES ARE NAMED DEFENDANTS IN

ANY LAWSUIT AND CONTRACTOR MAY NOT AGREE TO ANY SETTLEMENT WITHOUT FIRST OBTAINING THE CONCURRENCE FROM THE OFFICE OF THE ATTORNEY GENERAL.

3.3.12.2 Contractor shall have no liability under this section if the alleged infringement is caused in whole or in part by: (i) use of the product or service for a purpose or in a manner for which the product or service was not designed, (ii) any modification made to the product without Contractor's written approval, (iii) any modifications made to the product by Contractor pursuant to Customer's specific instructions, (iv) any intellectual property right owned by or licensed to Customer, or (v) any use of the product or service by Customer that is not in conformity with the terms of any applicable license agreement.

3.3.12.3 If Contractor becomes aware of an actual or potential claim, or Customer provides Contractor with notice of an actual or potential claim, Contractor may (or in the case of an injunction against Customer, shall), at Contractor's sole option and expense; (i) procure for the Customer the right to continue to use the affected portion of the product or service, or (ii) modify or replace the affected portion of the product or service with functionally equivalent or superior product or service so that Customer's use is non-infringing.

3.3.12.4 Taxes/Workers' Compensation/Unemployment Insurance-Including Indemnity.

3.3.12.4.1 CONTRACTOR AGREES AND ACKNOWLEDGES THAT DURING THE EXISTENCE OF THIS CONTRACT, CONTRACTOR SHALL BE ENTIRELY RESPONSIBLE FOR THE LIABILITY AND PAYMENT OF CONTRACTOR'S AND CONTRACTOR'S EMPLOYEES' TAXES OF WHATEVER KIND, ARISING OUT OF THE PERFORMANCES IN THIS CONTRACT. CONTRACTOR AGREES TO COMPLY WITH ALL STATE AND FEDERAL LAWS APPLICABLE TO ANY SUCH PERSONS, INCLUDING LAWS REGARDING WAGES, TAXES, INSURANCE, AND WORKERS' COMPENSATION. THE CUSTOMER AND/OR THE STATE SHALL NOT BE LIABLE TO CONTRACTOR, ITS EMPLOYEES, AGENTS, OR OTHERS FOR THE PAYMENT OF TAXES OR THE PROVISION OF UNEMPLOYMENT INSURANCE AND/OR WORKERS' COMPENSATION OR ANY BENEFIT

AVAILABLE TO A STATE EMPLOYEE OR EMPLOYEE OF ANOTHER GOVERNMENTAL ENTITY CUSTOMER.

3.3.12.4.l CONTRACTOR AGREES TO INDEMNIFY AND HOLD HARMLESS OWNER, THE STATE OF TEXAS AND/OR THEIR EMPLOYEES, AGENTS, REPRESENTATIVES, CONTRACTORS, AND/OR ASSIGNEES FROM ANY AND ALL LIABILITY, ACTIONS, CLAIMS, DEMANDS, OR SUITS, AND ALL RELATED COSTS, ATTORNEYS' FEES, AND EXPENSES, RELATING TO TAX LIABILITY, UNEMPLOYMENT INSURANCE AND/OR WORKERS' COMPENSATION IN ITS PERFORMANCE UNDER THIS CONTRACT. CONTRACTOR SHALL BE LIABLE TO PAY ALL COSTS OF DEFENSE INCLUDING ATTORNEYS' FEES. THE DEFENSE SHALL BE COORDINATED BY CONTRACTOR WITH THE OFFICE OF THE ATTORNEY GENERAL WHEN TEXAS STATE AGENCIES ARE NAMED DEFENDANTS IN ANY LAWSUIT AND VENDOR MAY NOT AGREE TO ANY SETTLEMENT WITHOUT FIRST OBTAINING THE CONCURRENCE FROM THE OFFICE OF THE ATTORNEY GENERAL. CONTRACTOR AND OWNER AGREE TO FURNISH TIMELY WRITTEN NOTICE TO EACH OTHER OF ANY SUCH CLAIM.

3.3.12.5 The provisions of this indemnification are solely for the benefit of the parties hereto and not intended to create or grant any rights, contractual or otherwise, to any other person or entity.

3.3.12.6 Contractor shall promptly advise Owner in writing of any claim or demand against Owner or against Contractor which involves Owner and known to Contractor and related to or arising out of Contractor's activities under this Contract.

3.3.13 Ancillary Areas. Operate and maintain operations and associated storage areas at the site of the Work in accordance with the following:

3.3.13.l Confine all Contractor operations, including storage of materials and employee parking upon the Site of Work, to areas designated by Owner.

3.3.13.2 Contractor may erect, at its own expense, temporary buildings that will remain its property. Remove such buildings and associated utility service lines upon completion of the Work, unless Contractor requests and Owner provides written consent that it may abandon such buildings and utilities in place.

3.3.13.3 Use only established roadways or construct and use such temporary roadways as may be authorized by Owner. Do not allow load limits of vehicles to exceed the limits prescribed by appropriate regulations or law. Provide protection to road surfaces, curbs, sidewalks, trees, shrubbery, sprinkler systems, drainage structures and other like existing improvements to prevent damage and repair any damage thereto at the expense of Contractor.

3.3.13.4 Owner may restrict Contractor's entry to the Site to specifically assigned entrances and routes.

3.3.14 Separate Contracts. Owner reserves the right to award other contracts in connection with other portions of the Project under these same or substantially similar contract conditions, including those portions related to insurance and waiver of subrogation. Owner reserves the right to perform operations related to the Project with Owner's own forces.

3.3.15 Under a system of separate contracts, the conditions described herein continue to apply except as may be amended by change order.

3.3.16 Contractor shall cooperate with other contractors or forces employed on the Project by Owner, including providing access to Site and Project information as requested.

3.3.17 Owner shall be reimbursed by Contractor for costs incurred by Owner which are payable to a separate contractor because of delays, improperly timed activities, or defective construction by Contractor. Owner will equitably adjust the Contract by Change Order for costs incurred by Contractor because of delays, improperly timed activities, damage to the Work or defective construction by a separate contractor.

Article 4. Historically Underutilized Business (HUB) Subcontracting Plan

4.1 General Description. The purpose of the Historically Underutilized Business (HUB) program is to promote equal business opportunities for economically disadvantaged persons (as defined by Tex. Gov't Code, Ch. 2161) to contract with the State of Texas in accordance with the goals specified in the State of Texas Disparity Study. The HUB program annual procurement utilization goals are defined in 34 T.A.C. § 20.13(b).

4.1.1 State agencies are required by statute to make a good faith effort to assist HUBs in participating in contract awards issued by the State. 34 T.A.C. §

20.13(b) outlines the State's policy to encourage the utilization of HUBs in State contracting opportunities through race, ethnic and gender neutral means.

4.1.2 A Contractor who contracts with the State in an amount of $100,000 or greater is required to make a good faith effort to award subcontracts to HUBs in accordance with 34 T.A.C. § 20.14(a)(2)(A) by submitting a HUB subcontracting plan within twenty-four (24) hours after the bid or response is due and complying with the HUB subcontracting plan after it is accepted by Owner and during the term of the Contract.

4.2 Compliance with Approved HUB Subcontracting Plan. Contractor, having been awarded this Contract in part by complying with the HUB program statute and rules, hereby covenants to continue to comply with the HUB program as follows:

4.2.l Prior to adding or substituting a Subcontractor, promptly notify Owner in the , event a change is required for any reason to the accepted HUB subcontracting plan.

4.2.2 Conduct the good-faith effort activities required and provide Owner with necessary documentation to justify approval of a change to the approved HUB subcontracting plan.

4.2.3 Cooperate in the execution of a Change Order or such other approval of the change in the HUB subcontracting plans as Contractor and Owner may agree to.

4.2.4 Maintain and make available to Owner upon request business records documenting compliance with the accepted HUB subcontracting plan.

4.2.5 Upon receipt of payment for performance of Work, submit to Owner a compliance report, in the format required by Owner that demonstrates Contractor's performance of the HUB subcontracting plan.

4.2.5.l Progress Assessment Report (PAR): monthly compliance reports to Owner (contracting agency), verifying their compliance with the HUB subcontracting plan, including the use/expenditures they have made to Subcontractors. (The PAR is available in the Index Forms Library on the Facilities Design & Construction page of the Texas Facilities Commission website.

4.2.6 Promptly and accurately explain and provide supplemental information to Owner to assist in Owner's investigation of Contractor's good-faith effort to fulfill the HUB subcontracting plan and the requirements under 34 T.A.C. § 20.14(a)(l).

4.3 Failure to Demonstrate Good-Faith Effort. Upon a determination by Owner that Contractor has failed to demonstrate a good-faith effort to fulfill the HUB subcontracting plan or any Contract covenant detailed above, Owner may, in addition to all other remedies available to it, report the failure to perform to the Comptroller of

Public Accounts, Texas Procurement and Support Services Division, Historically Underutilized Business Program and may bar Contractor from future contracting opportunities with Owner.

Article 5. Bonds and Insurance

5.I Construction Bonds. Contractor is required to tender to Owner, prior to commencing the Work, performance and payment bonds, as required by Tex. Gov't Code, Ch. 2253. On Construction Manager-at-Risk and Design-Build Projects the Owner shall require a security bond, as described in Subsection 5.1.2 below.

5.1.1 Bond Requirements. Each bond shall be executed by a corporate surety or sureties authorized to do business in the State of Texas and acceptable to Owner, on Owner's form, and in compliance with the relevant provisions of the Texas Insurance Code. If any bond is for more than ten (10) percent of the surety's capital and surplus, Owner may require certification that the company has reinsured the excess portion with one or more reinsurers authorized to do business in the State. A reinsurer may not reinsure for more than ten (I0) percent of its capital and surplus. If a surety upon a bond loses its authority to do business in the State, Contractor shall, within thirty (30) days after such loss, furnish a replacement bond at no added cost to Owner.

5.I.I .I A Performance bond is required if the Contract Sum is in excess of $100,000. The performance bond is solely for the protection of Owner. The performance bond is to be for the Contract Sum to guarantee the faithful performance of the Work in accordance with the Contract Documents. The form of the bond shall be approved by the Office of the Attorney General of Texas. The performance bond shall be effective through Contractor's warranty period.

5.1.1.2 A Payment bond is required if the Contract price is in excess of $25,000. The payment bond is to be for the Contract Sum and is payable to Owner solely for the protection and use of payment bond beneficiaries. The form of the bond shall be approved by the Office of the Attorney General of Texas.

5.1.2 Security Bond. The security bond provides protection to Owner if Contractor presents an acceptable guaranteed maximum price ("GMP") to Owner and I) fails to execute the GMP; or 2) fails to deliver the required payment and performance bonds within the time period stated below.

5.1.3 When Bonds Are Due.

5.1.3.1 Security bonds are due within ten (10) days of signing a Construction Manager-at-Risk or Design-Build Contract.

5.1.3.2 Payment and performance bonds are due within ten (10) days of Contractor's receipt of a fully executed GMP on a Construction Manager-at-Risk project or the Contract Sum for a Design-Build project, or within ten (10) days of Contractor's receipt of a fully executed Contract on competitively bid or competitive sealed proposal projects.

5.1.4 Power of Attorney. Each bond shall be accompanied by a valid power of attorney (issued by the surety company and attached, signed and sealed with the corporate embossed seal, to the bond) authorizing the attorney-in-fact who signs the bond to commit the company to the terms of the bond, and stating any limit in the amount for which the attorney can issue a single bond.

5.1.5 Bond Indemnification. The process of requiring and accepting bonds and making claims there under shall be conducted in compliance with Tex. Gov't Code, Ch. 2253. IF FOR ANY REASON A STATUTORY PAYMENT OR PERFORMANCE BOND IS NOT HONORED BY THE SURETY, CONTRACTOR SHALL FULLY INDEMNIFY AND HOLD OWNER HARMLESS OF AND FROM ANY COSTS, LOSSES, OBLIGATIONS OR LIABILITIES IT INCURS AS A RESULT.

5.1.6 Furnishing Bond Information. Owner shall furnish certified copies of the payment bond and the related Contract to any qualified person seeking copies who complies with Tex. Gov't Code § 2253.026.

5.1.7 Claims on Payment Bonds. Claims on payment bonds must be sent directly to Contractor and his surety in accordance with Tex. Gov't Code § 2253.041. All payment bond claimants are cautioned that no lien exists on the funds unpaid to Contractor on such Contract, and that reli.ance on notices sent to Owner may result in loss of their rights against Contractor and/or his surety. Owner is not responsible in any manner to a claimant for collection of unpaid bills, and accepts no such responsibility because of any representation by any agent or employee.

5.1.8 Payment Claims when Payment Bond not Reguired. The rights of Subcontractors regarding paymenf are governed by Tex. Prop. Code §§ 53.231 – 53.239 when the value of the Contract between Owner and Contractor is less than $25,000.00. These provisions set out the requirements for filing a valid lien on funds unpaid to Contractor as of the time of filing the claim, actions necessary to release the lien and satisfaction of such claim.

5.1.9 Sureties. A surety shall be listed on the US Department of the Treasury's Listing of Approved Sureties maintained by the Bureau of Financial Management Service (FMS), www.fms.treas.gov/c570, stating companies holding Certificates of Authority as acceptable sureties on Federal bonds and acceptable reinsuring companies (FMS Circular 570).

5.2 Insurance Requirements. Contractor shall carry insurance in the types and amounts indicated in this Article for the duration of the Contract. The insurance shall be evidenced by delivery to Owner of certificates of insurance executed by the insurer or its authorized agent stating coverages, limits, expiration dates and compliance with all applicable required provisions. Upon request, Owner, and/or its agents, shall be entitled to receive without expense, copies of the policies and all endorsements. Contractor shall update all expired policies prior to submission for monthly payment. Failure to update policies shall be reason for withholding of payment until renewal is provided to Owner.

5.2.1 Contractor shall provide and maintain all insurance coverage with the minimum amounts described below until the end of the warranty period unless otherwise stated in Supplementary General Conditions or Special Conditions. Failure to maintain insurance coverage, as required, is grounds for suspension of Work for cause pursuant to Article 14.

5.2.2 Contractor shall deliver to Owner true and complete copies of certificates and corresponding policy endorsements prior to the issuance of any Notice to Proceed.

5.2.3 Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

5.2.4 The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.2.5 The insurance coverage and limits established herein shall not be interpreted as any representation or warranty that the insurance coverage and limits necessarily will be adequate to protect Contractor.

5.2.6 Coverage shall be written on an occurrence basis by companies authorized and admitted to do business in the State of Texas and rated A or better by AM. Best Company or similar rating company or otherwise acceptable to Owner.

5.2.2.1 Insurance Coverage Required.

5.2.2.1.1 Workers' Compensation. Insurance with limits as required by the Texas Workers' Compensation Act, with the policy endorsed to provide a waiver of subrogation in favor of Owner, employer's liability insurance of not less than:

$1,000,000 each accident;

$1,000,000 disease each employee; and

$1,000,000 disease policy limit.

5.2.2.1.2 Commercial General Liability Insurance. Including premises, operations, independent · contractor's liability, products and completed operations and contractual liability, covering, but not limited to, the liability assumed under the indemnification provisions of this Contract, fully insuring Contractor's liability for bodily injury (including death) and property damage with a minimum limit of:

$1,000,000 per occurrence;

$2,000,000 general aggregate;

$5,000 Medical Expense each person;

$1,000,000 Personal Injury and Advertising Liability;

$2,000,000 products and completed operations aggregate;

$50,000 Damage to Premises Rented to You;

and Coverage shall be on an "occurrence" basis.

The policy shall include coverage extended to apply to completed operations and explosion, collapse, and underground hazards. The policy shall include endorsement CG2503 Amendment of Aggregate Limits of Insurance (per Project) or its equivalent.

If the Work involves any activities within fifty (50) feet of any railroad, railroad protective insurance as may be required by the affected railroad, written for not less than the limits required by such railroad.

5.2.2.1.3 Asbestos Abatement Liability Insurance, including coverage for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos containing materials. *This requirement applies if the Work or the Project includes asbestos containing materials.

The combined single limit for bodily injury and property damage will be a minimum of $1,000,000 per occurrence.

*Specific requirement for claims-made form: Required period of coverage will be determined by the following formula: continuous coverage for life of the Contract, plus one (1) year (to provide coverage for the warranty period), and an extended discovery period for a minimum of five (5) years which shall begin at the end of the warranty period.

Employer's liability limits for asbestos abatement will be:

$500,000 each accident;

$500,000 disease each employee; and

$500,000 disease policy limit.

If this Contract is for asbestos abatement only, the Special Form builder's risk or Special Form installation floater (e) is not required.

5.2.2.1.4 Comprehensive Automobile Liability Insurance, covering owned, hired, and non-owned vehicles, with a minimum combined single limit for bodily injury (including death) and property damage of $1,000,000 per accident. No aggregate shall be permitted for this type of coverage.

Such insurance is to include coverage for loading and unloading hazards.

5.2.2.1.5 Special Form Builder's Risk Insurance, if applicable (or Special Form installation floater for instances in which the project involves solely the installation of material and/or equipment). Coverage shall be Special Form, including, but not limited to, fire, extended coverage, vandalism and malicious mischief, theft and, if applicable, flood, earth movement and named storm. Builder's risk and installation floater limits shall be equal to 100 percent of the Contract Sum plus, if any, existing property and Owner-furnished equipment specified by Owner. The policy shall be written jointly in the names of Owner and Contractor. Subcontractors shall be named as additional insureds. The policy shall have endorsements as follows:

5.2.2.1.5.1 This insurance shall be specific as to coverage and not contributing insurance with any permanent insurance maintained on the property.

5.2.2.1.5.2 This insurance shall not contain an occupancy clause suspending or reducing coverage should Owner partially occupy the Site and before the parties have determined Substantial Completion.

5.2.2.1.5.3 Loss, if any, shall be adjusted with and made payable to Owner as trustee for the insureds as their interests may appear. Owner shall be named as loss payee.

5.2.2.1.5.4 For renovation projects or projects that involve portions of Work contained within an existing structure, refer to Supplementary General and Special Conditions for possible additional builder's risk msurance requirements.

5.2.2.1.5.5 For Owner furnished equipment or materials that will be in care, custody or control of Contractor, Contractor will be responsible for damage and loss.

5.2.2.1.5.6 For those properties located within a Tier 1 or 2 windstorm area, named storm coverage must be provided with limits specified by Owner.

5.2.2.1.5.7 For those properties located in flood prone areas, flood insurance coverage must be provided with limits specified by Owner.

5.2.2.1.5.8 Builder's risk insurance policy shall remain in effect until Substantial Completion.

5.2.2.1.6 "Umbrella" Liability Insurance. Contractor shall obtain, pay for and maintain umbrella liability insurance during the Contract term, insuring Contractor for an amount of not less than amount specified in the Supplementary General Conditions or Special Conditions that provides coverage at least as broad as and applies in excess and follows form of the primary liability coverages required hereinabove. The policy shall provide "drop down" coverage where underlying primary insurance coverage limits are insufficient or exhausted.

5.2.3 Policies must include the following clauses, as applicable:

5.2.3.1 This insurance shall not be canceled, materially changed, or non-renewed except after thirty (30) days written notice has been given to Owner.

5.2.3.2 It is agreed that Contractor's insurance shall be deemed primary with respect to any insurance or self insurance carried by Owner for liability arising out of operations under the Contract with Owner.

5.2.3.3 Owner, its officials, directors, employees, representatives, and volunteers are added as additional insureds as respects operations and activities of, or on behalf of the named insured performed under Contract with Owner. The additional insured status must cover completed operations as well. This is not applicable to workers' compensation policies.

5.2.3.4 A waiver of subrogation in favor of Owner shall be provided in all policies.

5.2.4 Without limiting any of the other obligations or liabilities of Contractor, Contractor shall require each Subcontractor performing work under the Contract, at Subcontractor's own expense, to maintain during the term of the Contract, the same stipulated minimum insurance including the required provisions and additional policy conditions as shown above. As an alternative, Contractor may include its Subcontractors as additional insureds on its own coverage as prescribed under these requirements. Contractor's certificate of insurance shall note in such event that Subcontractors are included as additional insureds and that Contractor agrees to provide workers' compensation for Subcontractors and their employees. Contractor shall obtain and monitor the certificates of insurance from each Subcontractor in order to assure compliance with the insurance requirements. Contractor must retain the certificates of insurance for the duration of the Contract plus five (5) years and shall have the responsibility of enforcing these insurance requirements among its Subcontractors. Owner shall be entitled, upon request and without expense, to receive copies of these certificates.

5.2.5 Workers' compensation insurance coverage must be provided for all workers at all tier levels and meet the statutory requirements of Tex. Lab. Code § 401.011(44) and specific to constmction projects for public entities as required by Tex. Lab. Code § 406.096.

Article 6. Construction Documents, Coordination Documents, and Record Documents

6.1 Drawings and Specifications.

6.1.1 Copies Furnished. Contractor will be furnished, free of charge, the number of complete sets of the Drawings, Specifications, and Addenda as provided in the Supplementary General Conditions or Special Conditions. Additional complete sets of Drawings and Specifications, if requested, will be furnished at reproduction cost to the entity requesting such additional sets. Electronic copies of such documents will be provided to Contractor without charge.

6.1.2 Ownership of Drawings and Specifications. All Drawings, Specifications and copies thereof furnished by A/E are to remain A/E's property. These documents are not to be used on any other project, and with the exception of the Contract record set and electronic versions needed for warranty operations, are to be returned to the A/E, upon request, following completion of the Work.

6.1.3 Interrelation of Documents. The Contract Documents as referenced in the Contract between Owner and Contractor are complimentary, and what is required by one shall be as binding as if required by all.

6.1.4 Resolution of Conflicts in Documents. Where conflicts may exist within the Contract Documents, the documents shall govern in the following order: (a) Change Orders, addenda, and written amendments to the Contract; (b) the Contract; (c) Drawings; (d) Specifications (but Specifications shall control over Drawings as to quality of materials and workmanship); and (e) other Contract Documents. Among categories of documents having the same order of precedence, the term or provision that includes the latest date shall control and more specific requirements shall govern over general requirements. Contractor shall notify A/E and ODR for resolution of the issue prior to executing the Work in question.

6.1.5 Contractor's Dutv to Review Contract Documents. In order to facilitate its responsibilities for completion of the Work in accordance with and as reasonably inferable from the Contract Documents, prior to commencing the Work, Contractor shall examine and compare the Contract Documents, information furnished by Owner, relevant field measurements made by Contractor and any visible or reasonably anticipated conditions at the Site affecting the Work. This duty extends throughout the construction phase prior to commencing each particular work activity and/or system installation.

6.1.6 Discrepancies and Omissions in Drawings and Specifications.

6.1.6.l Promptly report to ODR and to *AIE* the discovery of any apparent error, omission or inconsistency in the Contract Documents prior to execution of the Work

6.1.6.2 It is recognized that Contractor is not acting in the capacity of a licensed design professional, unless it is performing as a Design-Build firm.

6.1.6.3 It is further recognized that Contractor's examination of Contract Documents is to facilitate construction and does not create an affirmative responsibility to detect errors, om1ss10ns or inconsistencies or to ascertain compliance with applicable laws, building codes or regulations, unless it is performing as a Design-Build firm or a Construction Manager-at-Risk

6.1.6.4 When performing as a Design-Build firm, Contractor has sole responsibility for discrepancies, errors, and omissions in the Drawings and Specifications.

6.1.6.5 When performing as a Construction Manager-at-Risk, Contractor has a shared responsibility with A/E for discovery and resolution of discrepancies, errors, and omissions in the Contract Documents. In such case, Contractor's responsibility pertains to review, coordination, and recommendation of resolution strategies within budget constraints.

6.1.6.6 Contractor has no liability for errors, omissions, or inconsistencies unless Contractor knowingly failed to report a recognized problem to Owner or the Work is executed under a Design-Build or Construction Manager-at-Risk Contract as outlined above. Should Contractor fail to perform the examination and reporting obligations of these provisions, Contractor is responsible for avoidable costs and direct and/or consequential damages.

6.2 Requirements for Record Documents. Contractor shall:

6.2.l Maintain at the Site one copy of all Drawings, Specifications, addenda, approved submittals, Contract modifications, and all Project correspondence. Keep current and maintain Drawings and Specifications in good order with postings and markings to record actual conditions of Work and show and reference all changes made during construction. Provide Owner and A/E access to these documents.

6.2.2 Maintain the Record Documents including Drawings, Specifications and other materials which reflect the actual field conditions and representations of the Work performed, whether it be directed by addendum, Change Order or otherwise. Make available all records prescribed herein for reference and examination by Owner and its representatives and agents.

6.2.3 Update the Record Documents at least monthly prior to submission of periodic partial pay estimates. Failure to maintain current Record Documents constitutes cause for denial of a progress payment otherwise due.

6.2.4 Prior to requesting Substantial Completion inspection Contractor shall furnish a copy of its marked-up Record Documents and a preliminary copy of each instructional manual, maintenance and operating manual, parts catalog, wiring diagrams, spare parts, specified written warranties and like publications, or parts for all installed equipment, systems, and like items and as described in the Contract Documents. (Unexecuted samples of the aforementioned documentation may be reviewed by ODR when the absence of substantial completion transactions preclude execution; however, Contractor remains obligated to provide fully executed copies of such materials prior to final payment.)

6.2.5 Once determined acceptable by ODR with input from *AIE,* provide one (1) reproducible copy and one (1) electronic media copy of all Record Documents, unless otherwise required by the Supplementary General Conditions or Special Conditions.

6.2.6 Contractor shall be responsible for updating the Record Documents for all Contractor initiated documents and changes to the Contract Documents due to coordination and actual field conditions, including RFIs.

6.2.7 A/E shall be responsible for updating the Record Documents for any addenda, Change Orders, A/E supplemental instructions and any other alterations to the Contract Documents generated by *AIE* or Owner.

Article 7. Construction Safety

7.1 General. It is the duty and responsibility of Contractor and all of its Subcontractors to be familiar with, enforce and comply with all requirements of Public Law No. 91- 596, 29 U.S.C. § 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto. Contractor shall prepare a safety plan specific to the Project and submit it to ODR and A/E prior to commencing Work. In addition, Contractor and all of its Subcontractors shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property to protect them from damage, injury or loss and erect and maintain all necessary safeguards for such safety and protection.

7.2 Notices. Contractor shall provide notices as follows:

7.2.1 Notify owners of adjacent property including those that own or operate utility services and/or underground facilities, and utility owners, when prosecution of the Work may affect them or their facilities, and cooperate with them in the protection, removal, relocation and replacement, and access to their facilities and/or utilities.

7.2.2 Coordinate the exchange of material safety data sheets (MSDSs) or other hazard communication information required to be made available to or exchanged between or among employers at the site in connection with laws and regulations. Maintain a complete file of MSDSs for all materials in use on site throughout the construction phase and make such file available to Owner and its agents as requested.

7.3 Emergencies. In any emergency affecting the safety of persons or property, Contractor shall act to minimize, mitigate, and prevent threatened damage, injury or loss.

7.3.1 Have authorized agents of Contractor respond immediately upon call at any time of day or night when circumstances warrant the presence of Contractor to protect the Work or adjacent property from damage or to take such action pertaining to the Work as may be necessary to provide for the safety of the public.

7.3.2 Give ODR and *NE* prompt notice of all such events.

7.3.3 If Contractor believes that any changes in the Work or variations from Contract Documents have been caused by its emergency response, promptly notify Owner within seventy-two (72) hours of the emergency response event.

7.3.4 Should Contractor fail to respond, Owner is authorized to direct other forces to take action as necessary and Owner may deduct any cost of remedial action from funds otherwise due Contractor.

7.4 Injuries. In the event of an incident or accident involving outside medical care for an individual on or near the Work, Contractor shall notify ODR and other parties as may be directed promptly, but no later than twenty-four (24) hours after Contractor learns that an event required medical care.

7.4.1 Record the location of the event and the circumstances surrounding it, by using photography or other means, and gather witness statements and other documentation which describes the event.

7.4.2 Supply ODR and *NE* with an incident report no later than thirty-six (36) hours after the occurrence of the event. In the event of a catastrophic incident (one (1) fatality or three (3) workers hospitalized), barricade and leave intact the scene of the incident until all investigations are complete. A full set of incident investigation documents, including facts, finding of cause, and remedial plans shall be provided within one (1) week after occurrence, unless otherwise directed by legal counsel. Contractor shall provide ODR with

written notification within one week of such catastrophic event if legal counsel delays submission of full report.

7.5 Environmental Safetv. Upon encountering any previously unknown potentially hazardous material, or other materials potentially contaminated by hazardous material, Contractor shall immediately stop work activities impacted by the discovery, secure the affected area, and notify ODR immediately.

7.5.1 Bind all Subcontractors to the same duty.

7.5.2 Upon receiving such notice, ODR will promptly engage qualified experts to make such investigations and conduct such tests as may be reasonably necessary to determine the existence or extent of any environmental hazard. Upon completion of this investigation, ODR will issue a written report to Contractor identifying the material(s) found and indicate any necessary steps to be taken to treat, handle, transport or dispose of the material.

7.5.3 Owner may hire third-party Contractors to perform any or all such steps.

7.5.4 Should compliance with ODR's instructions result in an increase in Contractor's cost of performance, or delay the Work, Owner will make an equitable adjustment to the Contract Sum and/or the time of completion, and modify the Contract in writing accordingly.

7.6 Trenching Plan. When the project requires excavation which either exceeds a depth of four (4) feet, or results in any worker's upper body being positioned below grade level, Contractor is required to submit a trenching plan to ODR prior to commencing trenching operations unless an engineered plan is part of the Contract Documents. The plan is required to be prepared and sealed by a professional engineer registered in the State of Texas, and hired or employed by Contractor or Subcontractor to perform the work. Said engineer caunot be anyone who is otherwise either directly or indirectly engaged on this project.

Article 8. Quality Control

8.1 Materials & Workmanship. Contractor shall execute Work in a good and workmanlike matter in accordance with the Contract Documents. Contractor shall develop and provide a quality control plan specific to this Project and acceptable to Owner. Where Contract Documents do not specify quality standards, complete and construct all Work in compliance with generally accepted construction industry standards. Unless otherwise specified, incorporate all new materials and equipment into the Work under the Contract.

8.2 Testing.

8.2.1 Owner is responsible for coordinating and paying for routine and special tests required to confirm compliance with quality and performance requirements, except as stated below or otherwise required by the Contract Documents. Contractor shall provide the following testing:

8.2.1.1 Any test of basic material or fabricated equipment included as part of a submittal for a required item in order to establish compliance with the Contract Documents.

8.2.1.2 Any test of basic material or fabricated equipment offered as a substitute for a specified item on which a test may be required in order to establish compliance with the Contract Documents.

8.2.1.3 Preliminary, start-up, pre-functional and operational testing of building equipment and systems as necessary to confirm operational compliance with requirements of the Contract Documents.

8.2.1.4 All subsequent tests on original or replaced materials conducted as a result of prior testing failure.

8.2.2 All testing shall be performed in accordance with standard test procedures by an accredited laboratory, or special consultant as appropriate, acceptable to Owner. Results of all tests shall be provided promptly to ODR, A/E, and Contractor.

8.2.3 Non-Compliance (Test Results). Should any of the tests indicate that a material and/or system does not comply with the Contract requirements, the burden of proofremains with Contractor, subject to:

8.2.3.l Contractor selection and submission of the laboratory for Owner acceptance.

8.2.3.2 Acceptance by Owner of the quality and nature of tests.

8.2.3.3 All tests taken in the presence of A/E and/or ODR, or their representatives.

8.2.3.4 If tests confirm that the material/systems comply with Contract Documents, Owner will pay the cost of the test.

8.2.3.5 If tests reveal noncompliance, Contractor will pay those laboratory fees and costs of that particular test and all future tests, of that failing Work, necessary to eventually confirm compliance with Contract Documents.

8.2.3.6 Proof of noncompliance with the Contract Documents will make Contractor liable for any corrective action which ODR determines appropriate, including complete removal and replacement of non-compliant work or material.

8.2.4 Notice of Testing. Contractor shall give ODR and *AIE* timely notice of its readiness and the date arranged so ODR and A/E may observe such inspection, testing, or approval.

8.2.5 Test Samples. Contractor is responsible for providing Samples of sufficient size for test purposes and for coordinating such tests with their Work Progress Schedule to avoid delay.

8.2.6 Covering Up Work. If Contractor covers up any Work without providing Owner an opportunity to inspect, Contractor shall, if requested by ODR, uncover and recover the work at Contractor's expense.

8.3 Submittals.

8.3.1 Contractor's Submittals. Contractor shall submit with reasonable promptness consistent with the Project schedule and in orderly sequence all Shop Drawings, Samples, or other information required by the Contract Documents, or subsequently required by Change Order. Prior to submitting, Contractor shall review each submittal for general compliance with Contract Documents and approve submittals for review by A/E and Owner by an approval stamp affixed to each copy. Submittal data presented without Contractor's stamp will be returned without review or comment, and any delay resulting from failure is Contractor's responsibility.

8.3.1.1 Contractor shall within twenty-one (21) days of the effective date of the Notice To Proceed with construction, submit to ODR and A/E, a submittal schedule/register, organized by specification section, listing all items to be furnished for review and approval by *AIE* and Owner. The list shall include Shop Drawings, manufacturer's literature, certificates of compliance, materials Samples, materials colors, guarantees, and all other items identified throughout the Specifications.

8.3.1.2 Contractor shall indicate the type of item, Contract requirements reference, and Contractor's scheduled dates for submitting the item along with the requested dates for approval answers from A/E and Owner. The submittal register shall indicate the projected dates for procurement of all included items and shall be updated at least monthly with actual approval and procurement dates. Contractor's Submittal Register must be reasonable in terms of the review time for complex submittals. Contractor's submittal schedule must be consistent with the Work Progress Schedule and identify critical submittals. Show and allow a minimum of fifteen (15) calendar days duration after receipt by A/E and ODR for review and approval. If resubmittal required, allow a minimum of an additional fifteen (15) calendar days for review. Submit the updated Submittal Register with each request for progress payment. Owner may establish routine review procedures and schedules for submittals at the preconstruction conference and/or elsewhere in the Contract Documents. If Contractor fails to update and provide the Submittal Register as required, Owner may, after seven (7) days notice to Contractor withhold a reasonable sum of money that would otherwise be due Contractor.

8.3.1.3 Contractor shall coordinate the Submittal Register with the Work Progress Schedule. Do not schedule Work requiring a submittal to begin prior to scheduling review and approval of the related submittal. Revise and/or update both schedules monthly to ensure consistency and current project data. Provide to ODR the updated Submittal Register and schedule with each application for progress payment. Refer to requirements for the Work Progress Schedule for inclusion of procurement activities therein. Regardless, the Submittal Register shall identify dates submitted and returned and shall be used to confirm status and disposition of particular items submitted, including approval or other action taken and other information not conveniently tracked through the Work Progress Schedule.

8.3.1.4 By submitting Shop Drawings, Samples or other required information, Contractor represents that it has determined and verified all applicable field measurements, field construction criteria, materials, catalog numbers and similar data to the extent possible from existing conditions and design information provided by A/E prior to fabrication; and has checked and coordinated each Shop Drawing and Sample with the requirements of the Work and the Contract Documents.

8.3.2 Review of Submittals. A/E and ODR review is only for conformance with the design concept and the information provided in the Contract Documents. Responses to submittals will be in writing. The approval of a separate item does not indicate approval of an assembly in which the item functions. The approval of a submittal does not relieve Contractor of responsibility for any deviation from the requirements of the Contract unless Contractor informs A/E and ODR of such deviation in a clear, conspicuous, and written manner on the submittal transmittal and at the time of submission, and obtains Owner's written specific approval of the particular deviation.

8.3.3 Correction and Resubmission. Contractor shall make any corrections required to a submittal and resubmit the required number of corrected copies promptly so as to avoid delay, until submittal approval. Direct attention in writing to *AIE* and ODR, when applicable, to any new revisions other than the corrections requested on previous submissions.

8.3.4 Limits on Shop Drawing Review. Contractor shall not commence any Work requiring a submittal until review of the submittal under Subsection 8.3.2. Construct all such work in accordance with reviewed submittals. Comments incorporated as part of the review in Subsection 8.3.2 of Shop Drawings and Samples is not authorization to Contractor to perform extra work or changed work unless authorized through a Change Order. A/E's and ODR's review, if any, does not relieve Contractor from responsibility for defects in the Work resulting from errors or omissions of any kind on the submittal, regardless of any approval action. A/E or ODR shall not make formal changes to the Contract Documents via the submittal process. Changes

to the Construction Documents shall be accomplished via Section 3.2.2 and Article 11 Changes.

8.3.5 No Substitutions Without Approval. ODR and *AIE* may receive and consider Contractor's request for substitution when Contractor agrees to reimburse Owner for review costs and satisfies the requirements of this section. If Contractor does not satisfy these conditions, ODR and A/E will return the request without action except to record noncompliance with these requirements. Owner will not consider the request if Contractor cannot provide the product or method because of failure to pursue the Work promptly or coordinate activities properly. Contractor's request for a substitution may be considered by ODR and A/E when:

8.3.5.1 The Contract Documents do not require extensive revisions; and

8.3.5.2 Proposed changes are in keeping with the general intent of the Contract Documents and the design intent of A/E and do not result in an increase in cost to Owner; and

8.3.5.3 The request is timely, fully documented, properly submitted and one or more of the following apply:

8.3.5.3.1 Contractor cannot provide the specified product, assembly or method of construction within the Contract Time;

8.3.5.3.2 The request directly relates to an "or-equal" clause or similar language in the Contract Documents;

8.3.5.3.3 The request directly relates to a "product design standard" or "performance standard" clause in the Contract Documents;

8.3.5.3.4 The requested substitution offers Owner a substantial advantage in cost, time, energy conservation or other considerations, after deducting additional responsibilities Owner must assume;

8.3.5.3.5 The specified product or method of construction cannot receive necessary approval by an authority having jurisdiction, and ODR can approve the requested substitution;

8.3.5.3.6 Contractor cannot provide the specified product, assembly or method of construction in a manner that is compatible with other materials and where Contractor certifies that the substitution will overcome the incompatibility;

8.3.5.3.7 Contractor cannot coordinate the specified product, assembly or method of construction with other materials and where Contractor certifies they can coordinate the proposed substitution; or

8.3.5.3.8 The specified product, assembly or method of construction cannot provide a warranty required by the Contract Documents and where Contractor certifies that the proposed substitution provides the required warranty.

8.3.5.3.9 The manufacture of the specified product has been removed from production due to cancellation or obsolescence.

8.3.6 Unauthorized Substitutions at Contractor's Risk. Contractor is financially responsible for any additional costs or delays resulting from unauthorized substitution of materials, equipment or fixtures other than those specified. Contractor shall reimburse Owner for any increased design or contract administration costs resulting from such unauthorized substitutions.

8.4 Field Mock-up.

8.4.1 Mock-ups shall be constructed prior to commencement of a specified scope of work to confirm acceptable workmanship.

8.4.1.1 As a minimum, field mock-ups shall be constructed for roofing systems, exterior veneer / finish systems, glazing systems, and any other Work requiring a mock-up as identified throughout the Contract Documents. Mock-ups for systems not part of the Project scope shall not be required.

8.4.1.2 Mock-ups may be incorporated into the Work if allowed by the Contract Documents and if acceptable to ODR. If mock-ups are freestanding, they shall remain in place until otherwise directed by Owner.

8.4.1.3 Contractor shall include field mock-ups in their Work Progress Schedule and shall notify ODR and A/E of readiness for review sufficiently in advance to coordinate review without delay.

8.5 Inspection During Construction.

8.5.1 Contractor shall provide sufficient, safe, and proper facilities, including equipment as necessary for safe access, at all reasonable times for observation and/or inspection of the Work by Owner and its agents. "Reasonable times" of inspection allow for sufficient monitoring of the quality of materials and installation without substantially impeding the progress of the Work.

8.5.2 Contractor shall not cover up any Work with finishing materials or other building components prior to providing Owner and its agents an opportunity to perform an inspection of the Work.

8.5.2.1 Should corrections of the Work be required for approval, Contractor shall not cover-up corrected Work until Owner indicates approval.

8.5.2.2 Contractor shall provide notification of at least five (5) working days or otherwise as mutually agreed, to ODR of the anticipated need for a cover-up inspection. Should ODR fail to make the necessary inspection within the agreed period, Contractor may proceed with cover-up Work, but is not relieved of responsibility for Work to comply with requirements of the Contract Documents.

Article 9. Construction Schedules

9.1 Contract Time. **TIME IS AN ESSENTIAL ELEMENT OF THE CONTRACT.** The Contract Time is the time between the dates indicated in the Notice to Proceed for commencement of the Work and for achieving Substantial Completion. The Contract Time can be modified only by Change Order. Failure to achieve Substantial Completion within the Contract Time as otherwise agreed to in writing will cause damage to Owner and may subject Contractor to liquidated damages as provided in the Contract Documents. If Contractor fails to achieve Final Completion within thirty (30) calendar days after Substantial Completion or a mutually agreed upon longer period of time between Contractor and Owner, Contractor shall be responsible for Owner's additional inspection, project management, and maintenance cost to the extent caused by Contractor's failure to achieve Final Completion.

9.2 Notice to Proceed. Owner will issue a Notice to Proceed which shall state the dates for beginning Work and for achieving Substantial Completion of the Work.

9.3 Work Progress Schedule. Refer to Supplementary General Conditions or Special Conditions for additional schedule requirements. Unless indicated otherwise in those documents, Contractor shall submit their initial Work Progress Schedule for the Work in relation to the entire Project not later than twenty-one (21) days after the effective date of the Notice to Proceed to ODR and A/E. Unless otherwise indicated in the Contract Documents, the Work Progress Schedule shall be computerized Critical Path Method (CPM) with fully editable logic. This initial schedule shall indicate the dates for starting and completing the various aspects required to complete the Work, including mobilization, procurement, installation, testing, inspection, delivery of Close-out Documents and acceptance of all the Work of the Contract. When acceptable to Owner, the initially accepted schedule shall be the Baseline Schedule for comparison to actual conditions throughout the Contract duration.

9.3.1 Schedule Requirements. Contractor shall submit electronic and paper copy of the initial Work Progress Schedule reflecting accurate and reliable representations of the plarmed progress of the Work, the Work to date if any, and of Contractor's actual plans for its completion. Contractor shall organize

and provide adequate detail so the schedule is capable of measuring and forecasting the effect of delaying events on completed and uncompleted activities.

9.3.1.1 Contractor shall resubmit initial schedule as required to address review comments from A/E and ODR until such schedule is accepted as the Baseline Schedule.

9.3.1.2 Submittal of a schedule, schedule rev1s10n or schedule update constitutes Contractor's representation to Owner of the accurate depiction of all progress to date and that Contractor will follow the schedule as submitted in performing the Work.

9.3.2 Schedule Updates. Contractor shall update the Work Progress Schedule and the Submittal Register monthly, as a minimum, to reflect progress to date and current plans for completing the Work, while maintaining original schedule as Baseline Schedule and submit paper and electronic copies of the update to A/E and ODR as directed, but as a minimum with each request for payment. Owner has no duty to make progress payments unless accompanied by the updated Work Progress Schedule. Show the anticipated date of completion reflecting all extensions of time granted through Change Order as of the date of the update. Contractor may revise the Work Progress Schedule when in Contractor's judgment it becomes necessary for the management of the Work. Contractor shall identify all proposed changes to schedule logic to Owner and to A/E via an executive summary accompanying the updated schedule for review prior to final implementation of revisions into a revised Baseline Schedule. Schedule changes that materially impact Owner's operations shall be communicated promptly to ODR and shall not be incorporated into the revised Baseline Schedule without ODR's consent.

9.3.3 The Work Progress Schedule is for Contractor's use in managing the Work and submittal of the schedule, and successive updates or revisions, is for the information of Owner and to demonstrate that Contractor has complied with requirements for planning the Work. Owner's acceptance of a schedule, schedule update or revision constitutes Owner's agreement to coordinate its own activities with Contractor's activities as shown on the schedule.

9.3.3.l Acceptance of the Work Progress Schedule, or update and/or revision thereto does not indicate any approval of Contractor's proposed sequences and duration.

9.3.3.2 Acceptance of a Work Progress Schedule update or revision indicating early or late completion does not constitute Owner's consent, alter the terms of the Contract, or waive either Contractor's responsibility for timely completion or Owner's right to damages for Contractor's failure to do so.

9.3.3.3 Contractor's scheduled dates for completion of any activity or the entire Work do not constitute a change in terms of the Contract.

Change Orders are the only method of modifying the Substantial Completion Date(s) and Contract Time.

9.4 Ownership of Float. Unless indicated otherwise in the Contract Documents, Contractor shall develop its schedule, pricing, and execution plan to provide a minimum of ten (10) percent total float at acceptance of the Baseline Schedule. Float time contained in the Work Progress Schedule is not for the exclusive benefit of Contractor or Owner, but belongs to the Project and may be consumed by either party as needed on a first-used basis.

9.5 Completion of Work. Contractor is accountable for completing the Work within the Contract Time stated in the Contract, or as otherwise amended by Change Order.

9.5.I If, in the judgment of Owner, the work is behind schedule and the rate of placement of work is inadequate to regain scheduled progress to insure timely completion of the entire work or a separable portion thereof, Contractor, when so informed by Owner, shall immediately take action to increase the rate of work placement by:

9.5.I .I An increase in working forces.

9.5.1.2 An increase in equipment or tools.

9.5.1.3 An increase in hours of work or number of shifts.

9.5.1.4 Expedite delivery of materials.

9.5.1.5 Other action proposed if acceptable to Owner.

9.5.2 Within ten (10) days after such notice from ODR, Contractor shall notify ODR in writing of the specific measures taken and/or planned to increase the rate of progress. Contactor shall include an estimate as to the date of scheduled progress recovery and an updated Work Progress Schedule illustrating Contractor's plan for achieving timely completion of the Project. Should ODR deem the plan of action inadequate, Contractor shall take additional steps or make adjustments as necessary to its plan of action tmtil it meets with ODR's approval.

9.6 Modification of the Contract Time.

9.6.1 Delays and extension of time as hereinafter described are valid only if executed in accordance with provisions set forth in Article 11.

9.6.2 When a delay defined herein as excusable prevents Contractor from completing the Work within the Contract Time, Contractor is entitled to an extension of time. Owner will make an equitable adjustment and extend the number of days lost because of excusable delay or Weather Days, as measured by Contractor's progress schedule. All extensions of time will be granted in calendar days. In no event, however, will an extension of time be granted for

delays that merely extend the duration of non-critical activities, or which only consume float without delaying the project Substantial Completion date(s).

9.6.2.1 A "Weather Day" is a day on which Contractor's current schedule indicates Work is to be done, and on which inclement weather and/or related site conditions prevent Contractor from performing seven (7) continuous hours of Work on the critical path between the hours of 7:00 a.m. and 6:00 p.m. Weather days are excusable delays. When weather conditions at the site prevent work from proceeding, Contractor shall immediately notify ODR for confirmation of the conditions. At the end of each calendar month, submit to ODR and A/E a list of Weather Days occurring in that month along with documentation of the impact on critical activities. Based on confirmation by ODR, any time extension granted will be issued by Change Order. If Contractor and Owner cannot agree on the time extension, Owner may issue a ULCO for fair and reasonable time extension.

9.6.2.2 Excusable Delay. Contractor is entitled to an equitable adjustment of the Contract Time, issued via change order, for delays caused by the following:

9.6.2.2.1 Errors, omissions and imperfections in design, which A/E corrects by means of changes in the Drawings and Specifications.

9.6.2.2.2 Unanticipated physical conditions at the Site, which A/E corrects by means of changes to the Drawings and Specifications or for which ODR directs changes in the Work identified in the Contract Documents.

9.6.2.2.3 Failure of Owner to have secured property, right-of-way or easements necessary for Work to begin or progress.

9.6.2.2.4 Changes in the Work that effect activities identified in Contractor's schedule as "critical" to completion of the entire Work, if such changes are ordered by ODR or recommended by A/E and ordered by ODR.

9.6.2.2.5 Suspension of Work for unexpected natural events, Force Majeure (sometimes called "acts of God"), civil unrest, strikes or other events which are not within the reasonable control of Contractor.

9.6.2.2.6 Suspension of Work for convenience of ODR, which prevents Contractor from completing the Work within the Contract Time.

9.6.2.2.7 Administrative delays caused by activities or approval requirements related to au Authority Having Jurisdiction.

9.6.3 Contractor's relief in the event of such delays is the time impact to the critical path as determined by analysis of Contractor's schedule. In the event that Contractor incurs additional direct costs because of the excusable delays other than described in Subparagraph 9.6.2.2.4 and within the reasonable control of Owner, the Contract price and Contract Time are to be equitably adjusted by Owner pursuant to the provisions of Article 11.

9.7 No Damages for Delay. Contractor has no claim for monetary damages for delay or hindrances to the work from any cause, including without limitation any act or omission of Owner.

9.8 Concurrent Delay. When the completion of the Work is simultaneously delayed by an excusable delay and a delay arising from a cause not designated as excusable, Contractor may not be entitled to a time extension for the period of concurrent delay.

9.9 Other Time Extension Requests. Time extensions requested in association with changes to the Work directed or requested by Owner shall be included with Contractor's proposed costs for such change. Time extensions requested for inclement weather are covered by Paragraph 9.6.2.1 above. If Contractor believes that the completion of the Work is delayed by a circumstance other than for changes directed to the Work or weather, they shall give ODR written notice, stating the nature of the delay and the activities potentially affected, within five (5) days after the onset of the event or circtimstance giving rise to the excusable delay. Contractor shall provide sufficient written evidence to document the delay. In the case of a continuing cause of delay, only one claim is necessary. State claims for extensions of time in numbers of whole or half days.

9.9.1 Within ten (!0) days after the cessation of the delay, Contractor shall formalize its request for extension of time in writing to include a full analysis of the schedule impact of the delay and substantiation of the excusable nature of the delay. All changes to the Contract Time or made as a result of such claims is by Chauge Order, as set forth in Article 11.

9.9.2 No extension of time releases Contractor or the Surety furnishing a performance or payment bond from any obligations under the Contract or such a bond. Those obligations remain in full force until the discharge of the Contract.

9.9.3 Contents of Time Extension Requests. Contractor shall provide with each Time Extension Request a quantitative demonstration of the impact of the delay on project completion time, based on the Work Progress Schedule. Contractor shall include with Time Extension Requests a reasonably detailed narrative setting forth:

9.9.3.1 The nature of the delay and its cause; the basis of Contractor's claim of entitlement to a time extension.

9.9.3.2 Documentation of the actual impacts of the claimed delay on the critical path indicated in Contractor's Work Progress Schedule, and any concurrent delays.

9.9.3.3 Description and documentation of steps taken by Contractor to mitigate the effect of the claimed delay, including, when appropriate, the modification of the Work Progress Schedule.

9.9.4 Owner's Response. Owner will respond to the Time Extension Request by providing to Contractor written notice of the number of days granted, if any, and giving its reason if this number differs from the number of days requested by Contractor.

9.9.4.1 Owner will not grant time extensions for delays that do not affect the Contract Substantial Completion date.

9.9.4.2 Owner will respond to each properly submitted Time Extension Request within fifteen (15) days following receipt. If Owner cannot reasonably make a determination about Contractor's entitlement to a time extension within that time, Owner will notify Contractor in writing. Unless otherwise agreed by Contractor, Owner has no more than fifteen (15) additional days to prepare a final response. If Owner fails to respond within forty-five (45) days from the date the Time Extension Request is received, Contractor is entitled to a time extension in the amount requested.

9.10 Failure to Complete Work Within the Contract Time. **TIME IS AN ESSENTIAL ELEMENT OF THE CONTRACT.** Contractor's failure to substantially complete the Work within the Contract Time or to achieve Substantial Completion as required will cause damage to Owner. These damages shall be liquidated by agreement of Contractor and Owner, in the amount per day as set forth in the Contract Documents.

9.11 Liguidated Damages. Owner may collect liquidated damages due from Contractor directly or indirectly by reducing the Contract Sum in the amount ofliquidated damages stated in the Supplementary General Conditions or Special Conditions.

Article 10. Payments

I0.1 Schedule of Values. Contractor shall submit to ODR and A/E for acceptance a Schedule of Values accurately itemizing material and labor for the various classifications of the Work based on the organization of the specification sections and of sufficient detail acceptable to ODR. The accepted Schedule of Values will be the basis for the progress payments under the Contract.

I0.1.1 No progress payments will be made prior to receipt and acceptance of the Schedule of Values, provided iu such detail as required by ODR, and submitted not less than twenty-one (21) days prior to the first request for payment. The Schedule of Values shall follow the order of trade divisions of the Specifications and include itemized costs for general conditions, costs for preparing close out documents, fees, contingencies, and Owner cash allowances, if applicable, so that the sum of the items will equal the Contract price. As appropriate, assign each item labor and/or material values, the subtotal thereof equaling the value of the work in place when complete.

10.1.1.1 Owner requires that the Work items be inclusive of the cost of the Work items only. Any contract markups for overhead and profit, general conditions, etc., shall be contained within separate line items for those specific purposes which shall be divided into at least two (2) lines, one (I) for labor and one (I) for materials.

I0.1.2 Contractor shall retain a copy of all worksheets used in preparation of its bid or proposal, supported by a notarized statement that the worksheets are true and complete copies of the documents used to prepare the bid or proposal. Make the worksheets available to ODR at the time of Contract execution. Thereafter Contractor shall grant Owner during normal business hours access to said copy of worksheets at any time during the period commencing upon execution of the Contract and ending one year after final payment.

10.2. Progress Payments. Contractor will receive periodic progress payments for Work performed, materials in place, suitably stored on Site, or as otherwise agreed to by Owner and Contractor. Payment is not due until receipt by ODR or his designee of a correct and complete Pay Application in electronic and/or hard copy format as set forth in Supplementary General Conditions, Special Conditions, and certified by A/E. Progress payments are made provisionally and do not constitute acceptance of work not in accordance with the Contract Documents. Owner will not process progress payment applications for Change Order Work until all parties execute the Change Order.

10.2.1 Preliminary Pay Worksheet. Once each month that a progress payment is to be requested, the Contractor shall submit to *AIE* and ODR a complete, clean copy of a preliminary pay worksheet or preliminary pay application, to include the following:

10.2.1.l Contractor's estimate of the amount of Work performed, labor furnished and materials incorporated into the Work, using the established Schedule of Values;

10.2.1.2 An updated Work Progress Schedule including the executive summary and all required schedule reports;

I0.2.1.3 HUB subcontracting plan Progress Assessment Report as required in Paragraph 4.2.5.l;

10.2.1.4 Such additional documentation as Owner may require as set forth in the Supplementary General Conditions or elsewhere in the Contract Documents; and

10.2.1.5 Construction payment affidavit.

10.2.2 Contractor's Application for Payment. As soon as practicable, but in no event later than seven (7) days after receipt of the preliminary pay worksheet, A/E and ODR will meet with Contractor to review the preliminary pay worksheet and to observe the condition of the Work. Based on this review, ODR and A/E may require modifications to the preliminary pay worksheet prior to the submittal of an Application for Payment, and will promptly notify Contractor of revisions necessary for approval. As soon as practicable, Contractor shall submit its Application for Payment on the appropriate and completed form, reflecting the required modifications to the Schedule of Values required by A/E and/or ODR. Attach all additional documentation required by ODR and/or A/E, as well as an affidavit affirming that all payrolls, bills for labor, materials, equipment, subcontracted work and other indebtedness connected with Contractor's Application for Payment are paid or will be paid within the time specified in Tex. Gov't Code, Ch. 2251. No Application for Payment is complete unless it fully reflects all required modifications, and attaches all required documentation including Contractor's affidavit.

10.2.3 Certification by Architect/Engineer. Within five (5) days or earlier following A/E's receipt of Contractor's formal Application for Payment, *AIE* will review the Application for Payment for completeness, and forward it to ODR. A/E will certify that the application is complete and payable, or that it is incomplete, stating in particular what is missing. If the Application for Payment is incomplete, Contractor shall make the required corrections and resubmit the Application for Payment for processing.

10.3 Owner's Dutv to Pay. Owner has no duty to pay the Contractor except on receipt by ODR of: 1) a complete Application for Payment certified by A/E; 2) Contractor's updated Work Progress Schedule; and 3) confirmation that Contractor's record documentation at the Site is kept current.

10.3.l Payment for stored materials and/or equipment confirmed by Owner and A/E to be on-site or otherwise properly stored is limited to eighty-five (85) percent of the invoice price or eighty-five (85) percent of the scheduled value for the materials or equipment, whichever is less.

10.3.2 Retainage. Owner will withhold from each progress payment, as retainage, five (5) percent of the total earned amount, the amount authorized by law, or as otherwise set forth in the Supplementary General Conditions or Special Conditions. Retainage is managed in conformance with Tex. Gov't Code, Ch. 2252, Subch. B.

10.3.2.1 Contractor shall provide written consent of its surety for any request for reduction or release of retainage.

10.3.2.2 At least sixty-five (65) percent of the Contract, or such other discrete Work phase as set forth in Subsection 12.1.6 or Work package delineated in the Contract Documents, must be completed before Owner can consider a retainage reduction or release.

10.3.2.3 Contractor shall not withhold retainage from their Subcontractors and suppliers in amounts that are any percentage greater than that withheld in its Contract with Owner under this subsection, unless otherwise acceptable to Owner.

10.3.3 Price Reduction to Cover Loss. Owner may reduce any Application for Payment, prior to payment to the extent necessary to protect Owner from loss on account of actions of Contractor including, but not limited to, the following:

10.3.3.1 Defective or incomplete Work not remedied;

10.3.3.2 Damage to Work of a separate Contractor;

10.3.3.3 Failure to maintain scheduled progress or reasonable evidence that the Work will not be completed within the Contract Time;

10.3.3.4 Persistent failure to carry out the Work in accordance with the Contract Documents;

10.3.3.5 Reasonable evidence that the Work cannot be completed for the unpaid portion of the Contract Sum;

10.3.3.6 Assessment of fines for violations of prevailing wage rate law; or

10.3.3.7 Failure to include the appropriate amount of retainage for that periodic progress payment.

10.3.4 Title to all material and Work covered by progress payments transfers to Owner upon payment.

10.3.4.1 Transfer of title to Owner does not relieve Contractor and its Subcontractors of the sole responsibility for the care and protection of materials and Work upon which payments have been made until substantial completion, responsibility for the care and protection of materials and Work in areas where punch list items are completed until final completion or the restoration of any damaged Work, or waive the right of Owner to require the fulfillment of all the terms of the Contract.

10.4 Progress Payments. Progress payments to Contractor do not release Contractor or its surety from any obligations under the Contract.

10.4.1 Upon Owner's request, Contractor shall furnish manifest proof of the status of Subcontractor's accounts in a form acceptable to Owner.

10.4.2 Pay estimate certificates must be signed by a corporate officer or a representative duly authorized by Contractor.

10.4.3 Provide copies of bills of lading, invoices, delivery receipts or other evidence of the location and value of such materials in requesting payment for materials.

10.4.4 For purposes of Tex. Gov't Code § 2251.021(a)(2), the date the performance of servrce 1s complete is the date when ODR approves the Application for Payment.

10.5 Off-Site Storage. With prior approval by Owner and in the event Contractor elects to store materials at an off-site location, abide by the following conditions, unless otherwise agreed to in writing by Owner.

10.5.1 Store materials in a commercial warehouse meeting the criteria stated below.

10.5.2 Provide insurance coverage adequate not only to cover materials while in storage, but also in transit from the off-site storage areas to the Project Site. Copies of duly authenticated certificates of insurance, made out to insure the State agency which is signatory to the Contract, must be filed with Owner's representative.

10.5.3 Inspection by Owner's representative is allowed at any time. Owner's inspectors must be satisfied with the security, control, maintenance, and preservation measures.

10.5.4 Materials for this Project are physically separated and marked for the Project in a sectioned-off area. Only materials which have been approved through the submittal process are to be considered for payment.

10.5.5 Owner reserves the right to reject materials at any time prior to final acceptance of the complete Contract if they do not meet Contract requirements regardless of any previous progress payment made.

10.5.6 With each monthly payment estimate, submit a report to ODR and A/E listing the quantities of materials already paid for and still stored in the off-site location.

10.5.7 Make warehouse records, receipts and invoices available to Owner's representatives, upon request, to verify the quantities and their disposition.

10.5.8 In the event of Contract termination or default by Contractor, the items in storage off-site, upon which payment has been made, will be promptly turned over to Owner or Owner's agents at a location near the jobsite as directed by ODR. The full provisions of performance and payment bonds on this Project cover the materials off-site in every respect as though they were stored on the Project Site.

10.6 Time for Payment by Contractor Pursuant to Tex. Gov't Code § 2251.022.

I0.6.1 Contractor who receives a payment from a governmental entity shall pay Subcontractor the appropriate share of the payment not later than the tenth (!0th) day after the date Contractor receives the payment.

I0.6.2 The appropriate share is overdue on the eleventh (11th) day after the date Contractor receives the payment.

Article 11. Changes

11.1 Change Orders. A Change Order issued after execution of the Contract is a written order to Contractor, signed by ODR, Contractor, and A/E, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time can only be changed by Change Order. A Change Order signed by Contractor indicates his agreement therewith, including the adjustment in the Contract Sum and/or the Contract Time. ODR may issue a written authorization for Contractor to proceed with Work of a Change Order in advance of final execution by all parties in accordance with Section I1.9.

11.l.1 Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, and the Contract Sum and the Contract Time will be adjusted accordingly. All such changes inthe Work shall be authorized by Change Order or ULCO, and shall be performed under the applicable conditions of the Contract Documents. If such changes cause an increase or decrease in Contractor's cost of, or time required for, performance of the Contract, an equitable adjustment shall be made and confirmed in writing in a Change Order or a ULCO.

11.1.2 It is recognized by the parties hereto and agreed by them that the Specifications and Drawings may not be complete or free from errors, omissions and imperfections or that they may require changes or additions in order for the Work to be completed to the satisfaction of Owner .and that, accordingly, it is the express intention of the parties, notwithstanding any other provisions in this Contract, that any errors, omissions or imperfections in such Specifications and Drawings, or any changes in or additions to same or to the Work ordered by Owner and any resulting delays in the Work or increases in Contractor's costs and expenses arising out of such errors, shall not constitute or give rise to any claim, demand or cause of action of any nature whatsoever in favor of Contractor, whether for breach of Contract, or otherwise; provided, however, that Owner shall be liable to Contractor for the

sum stated to be due Contractor in any Change Order approved and signed by both parties, it being agreed hereby that such sum, together with any extension of time contained in said Change Order, shall constitute full compensation to Contractor for all costs, expenses and damages to Contractor, as permitted under Tex. Gov't Code, Ch. 2260.

11.1.3 Procedures for administration of Change Orders shall be established by Owner and stated in Supplementary General Conditions, Special Conditions, or elsewhere in the Contract Documents.

11.1.4 No verbal order, verbal statement, or verbal direction of Owner or his duly appointed representative shall be treated as a change under this article or entitle Contractor to an adjustment.

11.1.5 Contractor agrees that Owner or any of its duly authorized representatives shall have access and the right to examine any directly pertinent books, documents, papers, and records of Contractor. Further, Contractor agrees to include in all its subcontracts a provision to the effect that Subcontractor agrees that Owner or any of its duly authorized representatives shall have access to and the right to examine any directly pertinent books, documents, papers and records of such Subcontractor relating to any claim arising from the Contract, whether or not the Subcontractor is a party to the claim. The period of access and examination described herein which relates to appeals under the Disputes article of the Contract, litigation, or the settlement of claims arising out of the performance of the Contract shall continue until final disposition of such claims, appeals or litigation.

11.2 Unit Prices. If unit prices are stated in the Contract Documents or subsequently agreed upon, and if the quantities originally contemplated are so changed in a Proposed Change Order that application of the agreed unit prices to the quantities of work proposed will cause substantial inequity to Owner or Contractor, the applicable unit prices shall be equitably adjusted as provided in the Supplementary General Conditions or Special Conditions or as agreed to by the parties and incorporated into a Change Order.

11.3 Claims for Additional Costs.

11.3.1 If Contractor wishes to make a claim for an increase in the Contract Sum not related to a requested change, they shall give Owner and A/E written notice thereof within twenty-one (21) days after the occurrence of the event giving rise to such claim, but, in any case before proceeding to execute the Work considered to be additional cost or time, except in an emergency endangering life or property in which case Contractor shall act in accordance with Subsection 7.2.1. No such claim shall be valid unless so made. If Owner and Contractor cannot agree on the amount of the adjustment in the Contract Sum, it shall be determined as set forth under Article 15. Any change in the Contract Sum resulting from such claim shall be authorized by a Change Order or a ULCO.

11.3.2 If Contractor claims that additional cost is involved because of, but not limited to, 1) any written interpretation of the Contract Documents, 2) any order by Owner to stop the Work pursuant to Article 14 where Contractor was not at fault, or 3) any written order for a minor change in the Work issued pursuant to Section 11.4, Contractor shall make such claim as provided in Subsection 11.3.1.

11.3.3 Should Contractor or his Subcontractors fail to call attention of *AIE* to discrepancies or omissions in the Contract Documents, but claim additional costs for corrective Work after Contract award, Owner may assume intent to circumvent competitive bidding for necessary corrective Work. In such case, Owner may choose to let a separate Contract for the corrective Work, or issue a ULCO to require performance by Contractor. Claims for time extensions or for extra cost resulting from delayed notice of patent Contract Document discrepancies or omissions will not be considered by Owner.

11.4 Minor Changes. A/E, with concurrence of ODR, will have authority to order minor changes in the Work not involving an adjustment in the Contract Sum or an extension of the Contract Time. Such changes shall be effected by written order which Contractor shall carry out promptly and record on as-built record documents.

11.5 Concealed Site Conditions. Contractor is responsible for visiting the Site and being familiar with local conditions such as the location, accessibility, and general character of the Site and/or building. If, in the performance of the Contract, subsurface, latent, or concealed conditions at the Site are found to be materially different from the information included in the Contract Documents, or if unknown conditions of an unusual nature are disclosed differing materially from the conditions usually inherent in Work of the character shown and specified, ODR and A/E shall be notified in writing of such conditions before they are further disturbed or subsequent related work proceeds. Upon such notice, or upon its own observation of such conditions, A/E, with the approval of ODR, will promptly make such changes in the Drawings and Specifications as they deem necessary to conform to the different conditions, and any increase or decrease in the cost of the Work, or in the time within which the Work is to be completed, resulting from such changes will be adjusted by Change Order, subject to the prior approval of ODR.

11.6 Extension of Time. All changes to the Contract Time shall be made as a consequence of requests as required under Section 9.6, and as documented by Change Order as provided under Section 11.1.

11.7 Administration of Change Order Requests. All changes in the Contract shall be administered in accordance with procedures approved by Owner, and when required, make use of such electronic information management system(s) as Owner may employ.

11.7.1 Routine changes in the construction Contract shall be formally initiated by A/E by means of a PCO form detailing requirements of the proposed change for pricing by Contractor. This action may be preceded by communications

between Contractor, *AIE* and ODR concerning the need and nature of the change, but such communications shall not constitute a basis for beginning the proposed Work by Contractor. Except for emergency conditions described below, approval of Contractor's cost proposal by A/E and ODR will be required for authorization to proceed with the Work being changed. Owner will not be responsible for the cost of Work changed without prior approval and Contractor may be required to remove Work so installed.

11.7.2 All proposed costs for change order Work must be supported by itemized accounting of material, equipment and associated itemized installation costs in sufficient detail, following the outline and organization of the establish Schedule of Values, to permit analysis by A/E and ODR using current estimating guides and/or practices. Photocopies of Subcontractor and vendor proposals shall be furnished unless specifically waived by ODR. Contractor shall provide written response to a change request within twenty-one (21) days ofreceipt.

11.7.3 Any unexpected circumstance which necessitates an immediate change in order to avoid a delay in progress of the Work may be expedited by verbal communication and authorization between Contractor and Owner, with written confirmation following within twenty-four (24) hours. A limited scope not-to-exceed estimate of cost and time will be requested prior to authorizing Work to proceed. Should the estimate be impractical for any reason, ODR may authorize the use of detailed cost records of such work to establish and confirm the actual costs and time for documentation in a formal Change Order.

11.7.4 Emergency changes to save life or property may be initiated by Contractor alone (see Section 7.3) with the claimed cost and/or time of such work to be fully documented as to necessity and detail of the reported costs and/or time.

11.7.5 The method of incorporating approved Change Orders into the parameters of the accepted Schedule of Values must be coordinated and administered in a manner acceptable to ODR.

11.8 Pricing Change Order Work. The amounts that Contractor and/or its Subcontractor adds to a Change Order for profit and overhead will also be considered by Owner before approval is given. The amounts established hereinafter are the maximums that are acceptab1e to Owner.

11.8.l For Work performed by its forces, Contractor will be allowed their actual costs for materials, the total amount of wages (including benefits) paid for labor, plus the total cost of State and Federal payroll taxes and of worker's compensation and comprehensive general liability insurance, plus additional bond and builders risk insurance cost if the change results in an increase in the premium paid by Contractor. To the total of the above costs, Contractor will be allowed to add a percentage as noted below to cover overhead and profit combined. Allowable percentages for overhead and profit on any specific change shall not exceed fifteen (15) percent for the first $10,000 of

value for self-performed work or portion thereof, ten (10) percent for the second $10,000 of value for self-performed work or portion thereof and seven and a half (7.5) percent for any value of the self-performed work that exceeds $20,000.

11.8.2 For subcontracted Work each affected Subcontractor shall figure its costs, overhead and profit as described above for Contractor's Work, all Subcontractor costs shall be combined, and to that total Subcontractor cost Contractor will be allowed to add a maximum mark-up of ten (10) percent for the first $10,000 of subcontracted Work value or portion thereof, seven and half (7.5) percent for the second $10,000 of subcontracted Work value or portion thereof, and five (5) percent for any value of the subcontracted Work exceeding $20,000.

11.8.3 On changes involving both additions and deletions, percentages for overhead and profit will be allowed only on the net addition. Owner does not accept and will not pay for additional Contract cost identified as indirect or consequential damages.

11.8.4 For Contracts based on a Guaranteed Maximum Price (GMP), the Construction Manager-at-Risk or Design Builder shall NOT be entitled to a percentage mark-up on any Change Order Work unless the Change Order increases the Guaranteed Maximum Price.

11.9 Unilateral Change Order (ULCO). Owner may issue a written ULCO directing a change in the Work prior to reaching agreement with Contractor on the adjustment, if any, in the Contract price and/or the Contract Time.

11.9.1 Owner and Contractor shall negotiate for appropriate adjustments, as applicable, to the Contract Sum or the Contract Time arising out of a ULCO. As the changed Work is performed, Contractor shall submit its costs for such Work with its Application for Payment beginning with the next Application for Payment within thirty (30) days of the issuance of the ULCO. The Parties reserve their rights as to the disputed amount, subject to Article 15.

11.10 Final Resolution of Changes. Upon execution of a Change Order and /or a ULCO by Owner, Contractor and A/E, all costs and time issues regarding that change are final and not subject to additive adjustments.

Article 12. Project Completion and Acceptance

12.l Closing Inspections.

12.1.1 Substantial Completion Inspection. When Contractor considers the entire Work or part thereof Substantially Complete, it shall notify ODR in writing that the Work will be ready for Substantial Completion inspection on a specific date. Contractor shall include with this notice Contractor's Punchlist to indicate that it has previously inspected all the Work associated with the request for inspection, noting items it has corrected and included all remaining

work items with date scheduled for completion or correction prior to final inspection. The failure to include any items on this list does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents. If any of the items on this list prevents the Project from being used as intended, Contractor shall not request a Substantial Completion Inspection. Owner and its representatives will review the list of items and schedule the requested inspection, or inform Contractor in writing that such an inspection is premature because the Work is not sufficiently advanced or conditions are not as represented on Contractor's list.

12.1.1.1 Prior to the Substantial Completion inspection, Contractor shall furnish a copy of its marked-up Record Documents and a preliminary copy of each instructional manual, maintenance and operating manual, parts catalog, wiring diagrams, spare parts, specified written warranties, and like publications or parts for all installed equipment, systems, and like items as described in the Contract Documents. Delivery of these items is a prerequisite for requesting the Substantial Completion inspection.

12.1.1.2 On the date requested by Contractor, or as mutually agreed upon pending the status of the Open Items List, A/E, ODR, Contractor, and other Owner representatives as determined by Owner will jointly attend the Substantial Completion inspection, which shall be conducted by ODR or their delegate. If ODR determines that the Work is Substantially Complete, ODR will issue a Certificate of Substantial Completion to be signed by A/E, Owner, and Contractor establishing the date of Substantial Completion and identifying responsibilities for security, maintenance, insurance and utilities. *AIE* will provide with this certificate a consolidated list of Punchlist items (the pre-final Punchlist including all items noted by the various inspecting parties) for completion prior to final inspection. This list may include items in addition to those on Contractor's Punchlist, which the inspection team deems necessary to correct or complete prior to final inspection. The failure to include any items on this list does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents. If Owner occupies the Project upon determination. of Substantial Completion, Contractor shall complete all corrective Work at the convenience of Owner, without disruption to Owner's use of the Project for its intended purposes.

12.1.2 Final Inspection. Contractor shall complete the list of items identified on the pre-final Punchlist prior to requesting a final inspection. Unless otherwise specified, or otherwise agreed in writing by the parties as documented on the Certificate of Substantial Completion, Contractor shall complete and/or correct all Work within thirty (30) days of the Substantial Completion date. Upon completion of the pre-final Punchlist work, Contractor shall give written notice to ODR and A/E that the Work will be ready for final inspection on a specific date. Contractor shall accompany this notice

with a copy of the updated pre-final Punchlist indicating resolution of all items. On the date specified or as soon thereafter as is practicable, ODR, *AIE* and Contractor will inspect the Work. A/E will submit to Contractor a final Punchlist of open items that the inspection team requires corrected or completed before final acceptance of the Work.

12.1.2.1 Correct or complete all items on the final Punchlist before requesting Final Payment. Unless otherwise agreed to in writing by the parties, complete this work within seven (7) days of receiving the final Punchlist. Upon completion of the final Punchlist, notify A/E and ODR in writing stating the disposition of each final Punchlist item. *AIE,* Owner, and Contractor shall promptly inspect the completed items. When the final Punchlist is complete, and the Contract is fully satisfied according to the Contract Documents ODR will issue a certificate establishing the date of Final Completion. Completion of all Work is a condition precedent to Contractor's right to receive Final Payment.

12.1.3 Annotation. Any Certificate issued under this Article may be annotated to indicate that it is not applicable to specified portions of the Work, or that it is subject to any limitation as determined by Owner.

12.1.4 Purpose of Inspection. Inspection is for determining the completion of the Work, and does not relieve Contractor of its overall responsibility for completing the Work in a good and competent fashion, in compliance with the Contract. Work accepted with incomplete Punchlist items or failure of Owner or other parties to identify Work that does not comply with the Contract Documents or is defective in operation or workmanship does not constitute a waiver of Owner's rights under the Contract or relieve Contractor of its responsibility for performance or warranties.

12.1.5 Additional Inspections.

12.1.5.l If Owner's inspection team determines that the Work is not substantially complete at the Substantial Completion inspection, ODR or A/E will give Contractor written notice listing cause(s) of the rejection. Contractor will set a time for completion of incomplete or defective work acceptable to ODR. Contractor shall complete or correct all work so designated prior to requesting a second Substantial Completion inspection.

12.1.5.2 If Owner's inspection team determines that the Work is not complete at the final inspection, ODR or *AIE* will give Contractor written notice listing the cause(s) of the rejection. Contractor will set a time for completion of incomplete or defective work acceptable to ODR. Contractor shall complete or correct all Work so designated prior to again requesting a final inspection.

12.1.5.3 The Contract contemplates three (3) comprehensive inspections: the Substantial Completion inspection, the Final Completion inspection, and the inspection of completed final Punchlist items. The cost to Owner of additional inspections resulting from the Work not being ready for one or more of these inspections is the responsibility of Contractor. Owner may issue a ULCO deducting these costs from Final Payment. Upon Contractor's written request, Owner will furnish documentation of any costs so deducted. Work added to the Contract by Change Order after Substantial Completion inspection is not corrective Work for purposes of determining timely completion, or assessing the cost of additional inspections.

12.1.6 Phased Completion. The Contract may provide, or Project conditions may warrant, as determined by ODR, that designated elements or parts of the Work be completed in phases. Where phased completion is required or specifically agreed to by the parties, the provisions of the Contract related to closing inspections, occupancy, and acceptance apply independently to each designated element or part of the Work. For all other purposes, unless otherwise agreed by the parties in writing, Substantial Completion of the Work as a whole is the date on which the last element or part of the Work completed receives a Substantial Completion certificate.

Final Completion of the Work as a whole is the date on which the last element or part of the Work completed receives a Final Completion certificate.

12.2 Owner's Right of Occupancy. Owner may occupy or use all or any portion of the Work following Substantial Completion, or at any earlier stage of completion. Should Owner wish to use or occupy the Work, or part thereof, prior to Substantial Completion, ODR will notify Contractor in writing and identify responsibilities for security, maintenance, insurance and utilities. Work performed on the premises by third parties on Owner's behalf does not constitute occupation or use of the Work by Owner for purposes of this Article. All Work performed by Contractor after occupancy, whether in part or in whole, shall be at the convenience of Owner so as to not disrupt Owner's use of, or access to occupied areas of the Project.

12.3 Acceptance and Payment

12.3.l Request for Final Payment. Following the certified completion of all work, including all final Punchlist items, cleanup, and the delivery of record documents, Contractor shall submit a certified Application for Final Payment and include all sums held as retainage and forward to *AIE* and ODR for review and approval.

12.3.2 Final Payment Documentation. Contractor shall submit, prior to or with the Application for Final Payment, final copies of all close out documents, maintenance and operating instructions, guarantees and warranties, certificates, Record Documents and all other items required by the Contract.

Contractor shall submit evidence of return of access keys and cards, evidence of delivery to Owner of attic stock, spare parts, and other specified materials. Contractor shall submit consent of surety to Final Payment form and an affidavit that all payrolls, bills for materials and equipment, subcontracted work and other indebtedness connected with the Work, except as specifically noted, are paid, will be paid, after payment from Owner or otherwise satisfied within the period of time required by Tex. Gov't Code, Ch. 2251. Contractor shall furnish documentation establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of claims and liens arising out of the Contract. Contractor may not subsequently submit a claim on behalf of Subcontractor or vendor unless Contractor's affidavit notes that claim as an exception.

12.3.3 Architect/Engineer Approval. A/E will review a submitted Application for Final Payment promptly but in no event later than ten (!0) days after its receipt. Prior to the expiration of this deadline, A/E will either: I) return the Application for Final Payment to Contractor with corrections for action and resubmission; or 2) accept it, note their approval, and send to Owner.

12.3.4 Offsets and Deductions. Owner may deduct from the Final Payment all sums due from Contractor. If the Certificate of Final Completion notes any Work remaining, incomplete, or defects not remedied, Owner may deduct the cost of remedying such deficiencies from the Final Payment. On such deductions, Owner will identify each deduction, the amount, and the explanation of the deduction on or by the twenty-first (21st) day after Owner's receipt of an approved Application for Final Payment. Such offsets and deductions shall be incorporated via a final Change Order, including a ULCO as may be applicable.

12.3.5 Final Payment Due. Final Payment is due and payable by Owner, subject to all allowable offsets and deductions, on the thirtieth (30th) day following Owner's approval of the Application for Payment. If Contractor disputes any amount deducted by Owner, Contractor shall give notice of the dispute on or before the thirtieth (30th) day following receipt of Final Payment. Failure to do so will bar any subsequent claim for payment of amounts deducted.

12.3.6 Effect of Final Payment. Final Payment constitutes a waiver of all claims by Owner, relating to the condition of the Work except those arising from:

12.3.6.1 Faulty or defective Work appearing after Substantial Completion (latent defects);

12.3.6.2 Failure of the Work to comply with the requirements of the Contract Documents;

12.3.6.3 Terms of any warranties required by the Contract, or implied by law; or

12.3.6.4 Claims arising from personal injury or property damage to third parties.

12.3.7 Waiver of Claims. Final payment constitutes a waiver of all claims and liens by Contractor except those specifically identified in writing and submitted to ODR prior to the application for Final Payment.

12.3.8 Effect on Warranty. Regardless of approval and issuance of Final Payment, the Contract is not deemed fully performed by Contractor and closed until the expiration of all warranty periods. Issuance of Final Payment does not alter Contractor's contractual obligations during the warranty period.

Article 13. Warranty and Guarantee

13.1 Contractor's General Warranty and Guarantee. Contractor warrants to Owner that all Work is executed in accordance with the Contract, complete in all parts and in accordance with approved practices and customs, and of the required finish and workmanship. Contractor further warrants that unless otherwise specified, all materials and equipment incorporated in the Work under the Contract are new. Owner may, at its option, agree in writing to waive any failure of the Work to conform to the Contract, and to accept a reduction in the Contract price for the cost of repair or diminution in value of the Work by reason of such defect. Absent such a written agreement, Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute and is not waived by any inspection or observation by Owner, *AIE* or others, by making any progress payment or final payment, by the use or occupancy of the Work or any portion thereof by Owner, at any time, or by any repair or correction of such defect made by Owner.

13.2 Warranty Period. Except as may be otherwise specified or agreed, Contractor shall repair all defects in materials, equipment, or workmanship appearing within one year from the date of Substantial Completion of the Work. If Substantial Completion occurs by phase, then the warranty period for that particular Work begins on the date of such occurrence, or as otherwise stipulated on the Certificate of Substantial Completion for the particular Work.

13.3 Limits on Warranty. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

13.3.1 Modification or improper maintenance or operation by persons other than Contractor, Subcontractors, or any other individual or entity for whom Contractor is not responsible, unless Owner is compelled to undertake maintenance or operation due to the neglect of Contractor.

13.3.2 Normal wear and tear under normal usage after acceptance of the Work by Owner.

13.4 Events Not Affecting Warranty. Contractor's obligation to perform and complete the Work in a good and workmanlike manner in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of defective Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

13.4.1 Observations by Owner and/or A/E;

13.4.2 Recommendation to pay any progress or final payment by A/E;

13.4.3 The issuance of a certificate of Substantial Completion or any payment by Owner to Contractor under the Contract Documents;

13.4.4 Use or occupancy of the Work or any part thereof by Owner;

13.4.5 Any acceptance by Owner or any failure to do so;

13.4.6 Any review of a Shop Drawing or sample submittal; or

13.4.7 Any inspection, test or approval by others.

13.5 Separate Warranties. If a particular piece of equipment or component of the Work for which the Contract requires a separate warranty is placed in continuous service before Substantial Completion, the warranty period for that equipment or component will not begin until Substantial Completion, regardless of any warranty agreements in place between suppliers and/or Subcontractors and Contractor. ODR will certify the date of service commencement in the Substantial Completion certificate.

13.5.l In addition to Contractor's warranty and duty to repair, Contractor expressly assumes all warranty obligations required under the Contract for specific building components, systems and equipment.

13.5.2 Contractor may satisfy any such obligation by obtaining and assigning to Owner a complying warranty from a manufacturer, supplier, or Subcontractor. Where an assigned warranty is tendered and accepted by Owner which does not fully comply with the requirements of the Contract, Contractor remains liable to Owner on all elements of the required warranty not provided by the assigned warranty.

13.6 Correction of Defects. Upon receipt of written notice from Owner, or any agent of Owner designated as responsible for management of the warranty period, of the discovery of a defect, Contractor shall promptly remedy the defect(s), and provide written notice to Owner and designated agent indicating action taken. In case of emergency where delay would cause serious risk of loss or damage to Owner, or if Contractor fails to remedy within thirty (30) days, or within another period agreed to in writing, Owner may correct the defect and be reimbursed the cost of remedying the defect from Contractor or its surety.

13.7 Certification of No Asbestos Containing Materials or Work. Contractor shall ensure compliance with the Asbestos Hazard Emergency Response Act (AHERA- 40 C.F.R § 763-99(7)) from all Subcontractors and materials suppliers, and shall provide a notarized certification to Owner that all equipment and materials used in fulfillment of their Contract responsibilities are non-Asbestos Containing Building Materials (ACBM). This certification must be provided no later than Contractor's application for Final Payment.

Article 14. Suspension and Termination

14.1 Suspension of Work for Cause. Owner may, at any time without prior notice, suspend all or any part of the Work, if after reasonable observation and/or investigation, Owner determines it is necessary to do so to prevent or correct any condition of the Work, which constitutes an immediate safety hazard, or which may reasonably be expected to impair the integrity, usefulness or longevity of the Work when completed.

14.1.1 Owner will give Contractor a written notice of suspension for cause, setting forth the reason for the suspension and identifying the Work suspended. Upon receipt of such notice, Contractor shall immediately stop the Work so identified. As soon as practicable following the issuance of such a notice, Owner will initiate and complete a further investigation of the circumstances giving rise to the suspension, and issue a written determination of the findings.

14.1.2 If it is confirmed that the cause was within the control of Contractor, Contractor will not be entitled to an extension of time or any compensation for delay resulting from the suspension. If the cause is determined not to have been within the control of Contractor, and the suspension has prevented Contractor from completing the Work within the Contract Time, the suspension is an excusable delay and a time extension will be granted through a Change Order.

14.1.3 Suspension of Work under this provision will be no longer than is reasonably necessary to remedy the conditions giving rise to the suspension.

14.2 Suspension of Work for Owner's Convenience. Upon seven (7) days written notice to Contractor, Owner may at any time without breach of the Contract suspend all or any portion of the Work for a period of up to thirty (30) days for its own convenience. Owner will give Contractor a written notice of suspension for convenience, which sets forth the nmnber of suspension days for which the Work, or any portion of it, and the date on which the suspension of Work will cease. When such a suspension prevents Contractor from completing the Work within the Contract Time, it is an excusable delay. A notice of suspension for convenience may be modified by Owner at any time on seven (7) days written notice to Contractor. If Owner suspends the Work for its convenience for more than sixty (60) consecutive days, Contractor may elect to terminate the Contract pursuant to the provisions of the Contract.

14.3 Termination by Owner for Cause.

14.3.1 Upon written notice to Contractor and its surety, Owner may, without prejudice to any right or remedy, terminate the Contract and take possession of the Site and of all materials, equipment, tools, construction equipment, and machinery thereon owned by Contractor under any of the following circumstances:

14.3.1.1 Persistent or repeated failure or refusal, except during complete or partial suspensions of work authorized under the Contract, to supply enough properly skilled workmen or proper materials;

14.3.1.2 Persistent disregard of laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, including ODR;

14.3.1.3 Persistent failure to prosecute the Work in accordance with the Contract, and to ensure its completion within the time, or any approved extension thereof, specified in the Contract;

14.3.1.4 Failure to remedy defective work condemned by ODR;

14.3.1.5 Failure to pay Subcontractors, laborers, and material suppliers pursuant to Tex. Gov'!Code, Ch. 2251;

14.3.1.6 Persistent endangerment to the safety of labor or of the Work;

14.3.1.7 Failure to supply or maintain statutory bonds or to maintain required insurance, pursuant to the Contract;

14.3.1.8 Any material breach of the Contract; or

14.3.1.9 Contractor's insolvency, bankruptcy, or demonstrated financial inability to perform the Work.

14.3.2 Failure by Owner to exercise the right to terminate in any instance is not a waiver of the right to do so in any other instance.

14.3.3 Should Owner decide to terminate the Contract under the provisions of Section 14.3, it will provide to Contractor and its surety thirty (30) days prior written notice.

14.3.4 Should Contractor or its surety, after having received notice of termination, demonstrate to the satisfaction of Owner that Contractor or its surety are proceeding to correct such default with diligence and promptness, upon which the notice of termination was based, the notice of termination may be rescinded in writing by Owner. If so rescinded, the Work may continue without an extension of time.

14.3.5 If Contractor or its surety fails, after written notice from Owner to commence and continue correction of such default with diligence and promptness to the satisfaction of Owner within thirty (30) days following receipt of notice, Owner may arrange for completion of the Work and deduct the cost of completion from the unpaid Contract Sum.

14.3.5.1 This amount includes the cost of additional Owner costs such as A/E services, other consultants, and contract administration.

14.3.5.2 Owner will make no further payment to Contractor or its surety unless the costs to complete the Work are less than the Contract balance, then the difference shall be paid to Contractor or its surety. If such costs exceed the unpaid balance, Contractor or its surety will pay the difference to Owner.

14.3.5.3 This obligation for payment survives the termination of the Contract.

14.3.5.4 Owner reserves the right in termination for cause to take assignment of all the Contracts between Contractor and its Subcontractors, vendors, and suppliers. ODR will promptly notify Contractor of the contracts Owner elects to assume. Upon receipt of such notice, Contractor shall promptly take all steps necessary to effect such assignment.

14.4 Conversion to Termination for Convenience. In the event that any termination of Contractor for cause under Section 14.3 is later determined to have been improper, the termination shall automatically convert to a termination for convenience under Section 14.5 and Contractor's recovery for termination shall be strictly limited to the payments allowable under Section 14.5.

14.5 Termination for Convenience of Owner. Owner reserves the right, without breach, to terminate the Contract prior to, or during the performance of the Work, for any reason. Upon such an occurrence, the following shall apply:

14.5.l Owner will immediately notify Contractor and A/E in writing, specifying the reason for and the effective date of the Contract termination. Such notice may also contain instructions necessary for the protection, storage or decommissioning of incomplete work or systems, and for safety.

14.5.2 Upon receipt of the notice of termination, Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due at that point in the Contract:

14.5.2.1 Stop all work.

14.5.2.2 Place no further subcontracts or orders for materials or services.

14.5.2.3 Terminate all subcontracts for convenience.

14.5.2.4 Cancel all materials and equipment orders as applicable.

14.5.2.5 Take action that is necessary to protect and preserve all property related to the Contract which is in the possession of Contractor.

14.5.3 When the Contract is terminated for Owner's convenience, Contractor may recover from Owner payment for all Work executed. Contractor may not claim lost profits on other work or lost business opportunities.

14.6 Termination By Contractor. If the Work is stopped for a period of ninety (90) days under an order of any court or other public authority having jurisdiction, or as a result of an act of government, such as a declaration of a national emergency making materials unavailable, through no act or fault of Contractor or Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with Contractor, then Contractor may, upon thirty (30) additional days written notice to ODR, terminate the Contract and recover from Owner payment for all Work executed, but not lost profits on other work or lost business opportunities. If the cause of the Work stoppage is removed prior to the end of the thirty (30) day notice period, Contractor may not terminate the Contract.

14.7 Settlement on Termination. When the Contract is terminated for any reason, at any time prior to one hundred eighty (180) days after the effective date of termination, Contractor shall submit a final termination settlement proposal to Owner based upon recoverable costs as provided under the Contract. If Contractor fails to submit the proposal within the time allowed, Owner may determine the amount due to Contractor because of the termination and pay the determined amount to Contractor.

Article 15. Dispute Resolution

15.l Unresolved Contractor Disputes. The dispute resolution process provided for in Tex. Gov't Code, Ch. 2260 or Tex. Civ. Prac. & Rem. Code, Ch. 114, shall be used by Contractor to attempt to resolve any claim for breach of Contract made by Contractor that is not resolved under procedures described throughout the Uniform General Conditions, Supplementary Conditions, or Special Conditions of the Contract.

15.2 Alternative Dispute Resolution Process. Owner may establish a dispute resolution process to be utilized in advance of that outlined in Tex. Gov't Code, Ch. 2260 or Tex. Civ. Prac. & Rem. Code, Ch. 114.

15.3 Nothing herein shall hinder, prevent, or be construed as a waiver of Owner's right to seek redress on any disputed matter in a court of competent jurisdiction.

15.4 Nothing herein shall waive or be construed as a waiver of the State's sovereign immunity.

Article 16. Miscellaneous

16.1 Supplementary General and Special Conditions. When the Work contemplated by Owner is of such a character that the foregoing Uniform General Conditions of the Contract cannot adequately cover necessary and additional contractual relationships, the Contract may include Supplementary General and Special Conditions as described below:

16.1.1 Supplementary General Conditions may describe the standard procedures and requirements of contract administration followed by a contracting agency of the State. Supplementary General Conditions may expand upon matters covered by the Uniform General Conditions, where necessary, provided the expansion does not weaken the character or intent of the Uniform General Conditions. Supplementary General Conditions are of such a character that it is to be anticipated that a contracting agency of the State will normally use the same, or similar, conditions to supplement each of its several projects.

16.1.2 Special Conditions shall relate to a particular Project and be unique to that Project but shall not weaken the character or intent of the Uniform General Conditions.

16.2 Federally Funded Projects. On Federally funded projects, Owner may waive, suspend or modify any Article in these Uniform General Conditions which conflicts with any Federal statue, rule, regulation or procedure, where such waiver, suspension or modification is essential to receipt by Owner of such Federal funds for the Project. In the case of any Project wholly financed by Federal funds, any standards required by the enabling Federal statute, or any Federal rules, regulations or procedures adopted pursuant thereto, shall be controlling.

16.3 Internet-based Project Management Systems. At its option, Owner may administer its design and construction management through an Internet-based management system. In such cases, Contractor shall conduct communication through this media and perform all Project related functions utilizing this database system. This includes correspondence, subrnittals, Requests for Information, vouchers or payment requests and processing, amendment, Change Orders and other administrative activities.

16.3.l Accessibility and Administration.

16.3.1.1 When used, Owner will make the software accessible via the Internet to all Project team members.

16.3.1.2 Owner shall administer the software.

16.3.2 Training. When used, Owner shall provide training to the Project team members.

16.4 Administrative Inspections and Audits. Contractor agrees that all relevant records related to this Contract or any work product under this Contract, including practices of its Subcontractors, shall be subject, at any reasonable time, to inspection, examination, review, audit, and copying at any office or location of Contractor where such records

may be fonnd, with or without notice by the Texas State Auditor's Office ("SAO"), the contracting agency or its contracted examiners, or the Office of the Texas Attorney General, and with regard to any federal funding, the relevant federal agency, the Comptroller General, the General Accounting Office, the Office of the Inspector General, or any of their authorized representatives. All Subcontracts shall reflect the requirements of this section. In addition, pursuant to Tex. Gov't Code§ 2262.003 the SAO may conduct an audit or investigation of any entity receiving funds nnder this Contract, including ·direct payments to Contractor and indirect payments nnder a Subcontract to this Contract; acceptance of such monies acts as acceptance of SAO authority, nnder legislative audit committee direction, to audit and investigate related to those fnnds and the entity subject to the audit or investigation must provide SAO with access to any information SAO considers relevant to the scope of the audit or investigation.

End of Uniform General Conditions

Supplemental Conditions to Uniform General Conditions for Construction Contracts

GENERAL INFORMATION

The State of Texas is responsible for the design and construction of Army National Guard Facilities on property owned, leased, or licensed by the State from the Federal government, as may be required for the training and support of the State's Army National Guard ("TXARNG"). The National Guard Bureau ("NGB") has programs which provide Federal funding assistance to the State in support of its responsibilities in these areas: the Military Construction Army National Guard ("MCARNG"), Operations and Maintenance (O&M); Environmental, JSIIDS, Telecommunications and Automated Target Systems. Under these programs, design and construction requirements for the TXARNG are accomplished by State contracts executed by a State Contracting Officer ("SCO") in conformance with State law, and other clauses required by the Federal government, and within limits of funding authorized by the U.S. Congress. These Supplementary General Conditions incorporate Federal requirements into this contract and are to be read in conjunction with the Uniform General Conditions.

ARTICLE 1. Definitions

Owner. The State's responsible instrumentality is the Texas Military Department (TMD), acting through the State Contracting Officer (SCO).

Owner's Designated Representative (ODR). The terms "Owner's Designated Representative, Project Officer, and Inspector" refer to authorized owner's representatives; however, they do not have authority to settle disputes or obligate the State. Any reference made regarding the authority to execute contracts and bind the agency refers to the Office of the Executive Director's (OED) ODR.

State Contracting Officer (SCO). A person duly appointed in accordance with the laws and regulations of the State of Texas, with the authority to enter into and administer contracts on behalf of the State.

United States Property and Fiscal Officer (USPFO). A commissioned officer of the National Guard of Texas who has been ordered to active duty by the President to receipt and account for all funds and property of the United States in the possession of the Texas National Guard.

National Guard Bureau (NGB). NGB is a Joint Bureau of the Department of the Army and the Department of the Air Force, headed by a chief who is the advisor to the Army Chief of Staff and the Air Force Chief of Staff on National Guard matters. The National Guard Bureau is the channel of communication between the departments concerned and the several States, Territories, Puerto Rico, and the District of Columbia, on all matters pertaining to the National Guard, the Army National Guard of the United States, an.d the Air National Guard of the United States (10 U.S.C. 3040).

Chief National Guard Bureau (CNGB). The Chief, NGB, means the head of the National Guard Bureau or their designee.

Certificate of Substantial Completion. TMD does not issue a Certificate of Final Completion but instead issues a Certificate of Substantial Completion and then a Final Payment.

Milestones. A work breakdown schedule with a cost associated to each task associated with each item on the schedule.

Record Documents. The drawing set, Specifications, and other materials maintained by Contractor that documents all addenda, Architect's Supplemental Instructions, Change Orders and postings and markings that record the as-constructed conditions of the Work and all changes and discoveries made during construction.

Named Storm. A storm, cyclone, typhoon, atmospheric disturbance, depression, or other weather phenomena designated by the U.S. National Weather Service and/or the U.S. National Hurricane Center where a number or name has been applied.

ARTICLE 2. Wage Rate and Other Laws Governing Construction

Environmental Standards.

By signing this agreement or accepting funds under this agreement, the contractor assures that they will:

a. Comply with applicable prvisions of the Clean Air Act (42 U.S.C. 7401, et. Seq.) and Clean Water Act (33 U.S.C. 251, et.seq.), as implemented by Executive Order II 738 (3 CFR, 1971-1975 Comp. P. 799) and Environmental Protection Agency (EPA) rules at 40 CFR Part 15. In accordance with the EPA rules, the recipient further agrees that it will:

   (!) Not use any facility on the EPA's List of Violating Facilities in performing any award that is nonexempt under 40 CFR 15.5, as long as the facility remains on the list.

   (2) Notify the awarding agency if it intends to use a facility in performing this award that is on the List of Violating Facilities or that the recipient knows has been recommended to be placed on the List of Violating Facilities.

b. Identify to the awarding agency any impact this award may have on:

   (1) The quality of the human environment, and provide help the agency may need to comply with the National Environmental Policy Act (NEPA, at 42 U.S.C. 4321, et. seq.) and to prepare Environmental Impact Statements or other required environmental documentation. In such cases, the recipient agrees to take no action that will have an adverse environmental impact (e.g., physical disturbance of a site such as breaking of ground) until the agency provides written notification of compliance with the enviroumental impact analysis process.

   (2) Flood-prone areas, and provide help the agency may need to comply with the National Flood Insurance Act of 1968 and Flood Disaster Protection Act of 1973 (42 U.S.C. 4001, et. seq.), which require flood insurance, when available, for federally assisted construction or acquisition in flood-prone areas.

(3) Coastal zones, and provide help the agency may need to comply with the Coastal Zone Management Act of 1972 (16 U.S.C. 1451, et. seq.), concerning protection of U.S. coastal resources.

(4) Coastal barriers, and provide help the agency need to comply with the Coastal Barriers Resource Act (16 U.S.C. 3501 et. seq.), concerning preservation of barrier resources.

(5) Any existing or proposed component of the National Wild and Scenic Rivers System, and provide help the agency may need to comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271 et. seq.).

(6) Underground sources of drinking water in areas that have an aquifer that is the sole or principal drinking water source, and provide help the agency may need to comply with the Safe Drinking Water Act (42 U.S.C. 300h-3).

c. Prepare and submit all necessary documentation on the Owner's behalf with a copy to Owner.

Non-discrimination.

By signing this agreement or accepting funds under this agreement, the contractor assures that he/she will comply with applicable provisions of the following, national policies prohibiting discrimination:

(1) On the basis ofrace, color, or national origin, in Title VII of the Civil Rights Act of 1964 (42 U.S.C. 2000d et.seq.), as implemented by DOD regulations 32 CFR Part 195,

(2) On the basis of race, color, religion, sex, or national origin, in Executive Order 11246 (3 CFR, 1964-1965 Comp. P. 339), as implemented by Department of Labor regulations issued thereunder (41 CFR Part 60),

(3) On the basis of handicap, in Section 504 of the Rehabilitation Act of 11973 (29 U.S.C. 794) as implemented by Department of Justice regulations at 28 CFR part 41 and DOD Regulations at 32 CFR Part 56; and,

(4) On the basis of Age, in the Age Discrimination Act of 1975 (42 U.S.C.6101 et.seq.) as implemented by Department of Health and Human Services regulations at 45 CFR Part 90.

Drug-Free Work Place.

a. The contractor agrees that he/she will comply with the provisions of the Drug-Free Work Place Act of 1988 (Public Law 100-690, Title V, Subtitle D; 41 U.S.C. 701 et.seq.) and maintain a drug free workplace.

b. Government-Wide Requirements for Drug-Free Workplace (Grants), issued by the Office of Management and Budget and the Department of Defense (41 USC 702) to implement provisions of the Drng-Free Work Place Act of 1988, incorporated by reference and the contactor agrees to comply with provisions thereof, including amendments that may hereafter be issued.

Lobbving.

The contractor agrees that it will not expend any funds appropriated by Congress to pay any person for influencing or attempting to influence an officer or employee of any agency, or a member of Congress in connection with any of the following covered Federal actions:

(1) The awarding of any Federal contract;

(2) The making of any Federal Grant;

(3) The making of any Federal loan;

(4) The entering into of any cooperative agreement; and

(5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

New Restrictions on Lobbying, issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 28) to implement provisions of Section 319 of Public Law 102-121 (31 U.S. 1352) is incorporated by reference and the contractor agrees to comply with provisions thereof, including amendments that may hereafter be issued.

Debarment and Suspension.

a. The contractor shall not make any award or permit any award (sub-grant or contract) at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Order 12549, "Debarment and Suspension".

b. Government-Wide Debarment and Suspension (Non-procurement), issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 25) to implement the provisions of Executive Order 12549, "Debarment and Suspension" is incorporated by reference and the contractor/vendor covenants and agrees to comply with all the provisions thereof, including any amendments to the Final Rule that may hereafter be issued.

Preference for U.S. Flag Carriers.

Travel support by U. S. Government funds under this agreement shall use U.S. flag air carriers (air carriers holding certificates under 49 U.S.C. 41102) for international air transportation of people and property to the extent that such service is available, in accordance with the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 40118) and the interpretative

guidelines issued by the Comptroller General of the United States in the March 31, 1981, amendment to Comptroller General Decision Bl38942.

Davis-Bacon Act.

When required by Federal assistance program legislation, such as the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, environmental remediation construction will have the provisions of the Davis-Bacon Act (40 U.S.C. 276a, as supplemented by Department of Labor regulation (29 CFR Parts 1, 3, and 5), inserted in construction contracts over $2,000. that are awarded by states and state contractors and subcontractors.

a. The contractor agrees that it will comply with the Davis-Bacon Act (40 U.S.C. 276a to a-7) as supplemented by U.S. Department of Labor regulations (29 CFR Part 5). All rulings and interpretations of the Davis-Bacon Acts contained in 29 CFR Part 5 are incorporated by reference in this agreement. As applied to this agreement, the Davis-Bacon Act (40 U.S.C. 276a-276a-7) provides that contracts in excess of $2,000.00 to which the Federal Government provides assistance funding for construction, alteration, or. repair (including painting and decorating) or public buildings or public works within the United States, shall contain a provision that no laborer or mechanic employed directly upon the site of the work shall receive less that the prevailing wage rates as determined by the U.S. Secretary of Labor.

b. Questions regarding prevailing wage rates and classifications shall be directed to the Department of Labor (DOL) at [Insert Phone Number] or by visiting https://www.dol.gov/.

Contract Work Hours and Safety Standards Act.

The contractor covenants and agrees that it will comply with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-330), as supplemented by Department of Labor regulations (29 CFR Part 5). As applied to this contract, the Contract Work Hours and Safety Standards Act specifies that no laborer or mechanic doing any part of the work contemplated by this contract shall be required or permitted to work more than 40 hours in any work week unless paid for all additional hours at no less than one and one-half (1-1/2) times the basic rate of pay.

Equal Employment Opportunity.

This clause applies to contracts awarded in excess of $10,000.00 by grantees and their contractors or sub-grantees.

The contractor covenants and agrees to comply with Executive Order 11246 of September 24, 1965, entitled " Equal Employment Opportunity", as amended by Executive Order 11375 of October 13, 1967 and as supplemented in Department of Labor regulations (41 CPR 60).

Buy American Act.

The contractor covenants and agrees that he/she will not expend any funds appropriated by Congress without complying with the Buy American Act (41 U.S.C. 10). The Buy American Act gives

preference to domestic end products arid domestic construction material. In addition, the Memorandum of Understanding between the United States of America and the European Economic Community (EEC) on Government Procurement, and the North American Free Trade Agreement (NAFTA), provide the EEC and NAFTA end products and construction materials are exempted from application of the Buy American Act.

Copeland "Anti-Kickback" Act.

The contractor covenants agrees that he/she will comply with the Copeland "Anti- Kickback" Act (18 U.S.C. 874) as supplemented in Department of Labor regulations (29 CFR Part 3). As applied to this contract, the Copeland "Anti-Kickback" Act makes it unlawful to induce, by force, intimidation, threat of procuring dismissal from employment, or otherwise, any person employed in the construction or repair of public buildings or public works, financed in whole or in part by the United States, to give up any part of the compensation to which that person is entitled under a contract of employment.

Relocation and Real Property Acguisition.

The contractor covenants and assures that it will comply with 49 CFR Part 24, which implements the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. Section 4601 et seq.) and Provides for fair and equitable treatment of persons displaced by Federally assisted programs or persons whose property is acquired as a result of such programs.

Hatch Act.

The contractor covenants and agrees to comply with the Hatch Act (5 U.S.C. 1501 - 1508 and 7324 – 7326), as implemented by the Office of Personnel Management at 5 CFR Part 151, which limits political activity of employees or officers of State or local governments whose employment is connected to the activity financed in whole or part with Federal funds.

Licensing of Trades.

TMD requires skilled tradesmen licensed by the State carry a physical copy of said license with them at all times on the work site and produce it upon request.

National Historic Preservation.

This clause applies to any construction, acquisition, modernization, or other activity that may impact a historic property.

The contractor covenants and agrees to identify to the awarding agency any property listed or eligible for listing on the National Register of Historic Places that will be affected by this award, and to provide any heþ the awarding agency may need, with respect to this award, to comply with Section 106 of the National Historic Preservation Act of 1966 (16 UJ.S.C. 470, et seq.), as implemented by the Advisory Council on Historic Preservation regulations at 36 CFR Part 800 and Executive Order 11593 (3 CFR, 1971-1975 Comp., p. 559).

Energy Conservation.

The Contractor shall comply with mandatory standards and policies relating to energy efficiency which are contained in the State Energy Conservation Plan issued in compliance with the Energy Policy and Conser¥ation Act (P.L. 94-163, 89 Stat. 871).

Access to and Maintenance of Records.

The State, NGB, the Comptroller General of the United States, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the Contractor which are directly pertinent to this contract, for the purpose of making audit, examination, or reproduction, until three (3) years after final payment, final contract termination settlement, and all other pending matters are closed. The Contractor will include this requirement in all first-tier subcontracts.

Child Support.

According to the Texas Family Code, a child support obligor who is more than 30 days delinquent in paying child support and a business entity in which the obligor is a sole proprietor, partner, shareholder, or owner with an ownership interest of at least 25%, is not eligible to receive payments from state funds under a contract to provide property, materials, or services, or state-funded grants or loans. Under Section 231.006, Family Code, the contractor certifies that the individual or business entity named in this contract is not ineligible to receive the specified payment and acknowledges that this contract may be terminated and payment withheld if this certification if inaccurate.

State Audit.

The state auditor and the office may conduct a review, audit, or investigation of any entity receiving funds from the state directly under the contract or indirectly through a subcontract under this contract. Acceptance of funds directly under the contract or indirectly through a subcontract under the contract acts as acceptance of the authority of the state auditor and the office, to conduct an audit or investigation in connection with those funds. The contractor shall make all information related to the contract available for inspection during regular working hours upon the request for such review, investigation, or audit.

Royalties, Patents and Copyrights.

Any intellectual property created under the contract shall be property of TMD.

Officials not to Benefit.

No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this contract or to any benefit arising from it, in accordance with 42 U.S.C. 22.

Cargo Preference.

(Any contract under which international air travel may be supported by U. S. Government funds.)

The contractor covenants and agrees that it will comply with the Cargo Preference Act of 1954 (46 USC 1241), as implemented by the Department of Transportation regulations at 46 CPR 381.7, which require that at least 50 percent of equipment, materials or commodities procured or otherwise obtained with U.S. Government funds under this Grant, and which may be transported by ocean vessel, shall be transported on privately owned U.S. flag commercial vessels, if available.

ARTICLE 3. General Responsibilities of Owner and Contractor

Operations and Storage Areas.

a. All operations of the contractor (including storage of materials) on State premises shall be confined to areas authorized or approved by the Owner. The contractor shall hold and save the State, its officers, and agents, free and harmless from liability of any nature occasioned by his operations.

b. Temporary buildings (storage sheds, shop, offices, etc.) may be erected by the Contractor with the approval of the Owner, at no cost .to the State. Such temporary buildings and utilities shall remain the property of the Contractor and shall be removed by him at his expense upon the completion of the work. With the written consent of the Owner, such buildings and utilities may be abandoned and need not be removed.

c. The Contractor shall use only established roadways authorized for use by the Owner. When materials are transported in the prosecution of the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal State, or local law or regulation. When it is necessary to cross curbing or sidewalks, the Contractor shall provide protection against damage and any damaged roads curbing or sidewalks shall be repaired by or at the expense of the Contractor.

Solid Waste.

When disposal or diversion of solid waste from landfill are required, the reporting requirements will be explained and specified in the Scope of Work.

Compliance with State, Federal and Municipal Codes.

The contractor shall abide by all state, federal, applicable municipal codes, laws, statutes, regulations, standards and requirements; whether specifically set out in this contract or not. The listing of specific regulatory requirements is merely to abide by the standards required by the Texas National Guard's oversight authorities and is not intended or meant to imply that the contractor may disregard any federal, state, or city employment law standard, safety standard or requirement, building code standard or environmental regulations not specifically referred to. Any failure to specifically refer to any such standard does not diminish nor relinquish the duty and obligation of the contractor to abide by all regulatory provisions applicable to the construction site and job.

Preservation and Protection of Existing Improvements.

a. The contractor shall preserve and protect all existing vegetation such as trees, shrubs, and grass, on or adjacent to the site of work which is not to be removed and which does not unreasonably interfere with the construction work. Care will be taken in removing trees authorized for removal to avoid damage to vegetation to remain in place. Any limbs or branches or trees broken during such operations, or by the careless operation of equipment, or by workmen, hall be trimmed with a clean cut and painted with an approved tree-pruning compound as directed by the owner.

b. The contractor shall protect from damage all existing improvements or utilities at or near the site of the work, the location of which is made known to him, and shall repair or restore any damage to such facilities resulting from failure to comply with the requirements of this contract, or the failure to exercise reasonable care in the performance of the work. If the contractor fails or refuses to repair any such damage promptly, the owner may have the necessary work performed and charge the cost thereof to the contractor.

Owner Supplied Materials and Information.

a. Owner will furnish five (5) sets of complete plans at no expense to Contractor.

b. Owner may provide to Contractor, upon request, surveys describing the physical characteristics, legal description, limitations of the Site, Site utility locations, and other information used in the preparation of the Contract Documents.

c. Any correspondence, requests for information, and show drawings/submittals shall be directed to the A/E for action and will include the ODR.

Contractor's Management Personnel.

Contractor's Management Personnel and Contractor's Competent Person must not perform any work while supervising or overseeing the work, quality control and safety; and must be present while work is in progress.

ARTICLE 5. Bonds and Insurance Requirements

Workers' Compensation Insurance Coverage.

A. Definitions:

(!) Certificate of coverage ("certificate") – A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory worker's compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.

(2) Duration of the project – includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the government entity.

(3) Persons providing services on the project ("subcontractor" in Section 406.096) -includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

B. The contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of the Texas Labor Code, Section 401.011(44) for all employees of the contractor providing services on the project, for the duration of the project.

C. The contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

D. If the coverage period shown on the contractor's current certificate of coverage ends during the duration of the project, the contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.

E. The contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

(1) A certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project; and

(2) No later than seven (7) days after receipt by the contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

F. The contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.

G. The contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

H. The contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

I. The contractor shall contractually require each person with whom it contracts to provide services on a project to:

(1) Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of the Texas Labor Code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project;

(2) Provide to the contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project;

(3) Provide the contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

(4) Obtain from each other person with whom it contracts, and provide to the contractor:

a. A certificate of coverage, prior to the other person beginning work on the project; and

b. A new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

(5) Retain all required certificates of coverage on file for the duration of the project and for year thereafter; Notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and

(6) Contractually require each person with whom it contracts, to perform

as required by paragraphs through (7), with the certificates of coverage to be provided to the person for whom they are providing services.

J. By signing this contract or providing or causing to be provided a certificate of coverage, the contractor is representing to the governmental entity that all employees of the contractor who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on property reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of self-insured, with the Commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

K. The contractor's failure to comply with any of these provisions is a breach of contract by the contractor which entitles the governmental entity to declare the contract void if the contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

ARTICLE 6. Construction Documents, Coordination Documents, and Record Documents

Resolution of Conflicts in Documents.

In the event of a conflict in the Contract documents, the documents shall govern in the following order: (a) Owner/Contractor Agreement; (b) Change Orders, addenda, and written amendments to the Contract; (c) Drawings; (d) Specifications (but Specifications shall control over Drawings as to quality of materials and workmanship); (e) Solicitation; (f) Supplemental General Conditions; and (g) Uniform General Condition's.

Requirements for Record Documents.

a. At least 14 days prior to requesting Substantial Completion inspection Contractor shall furnish a copy of its marked-up Record Documents and a preliminary copy of each instructional manual, maintenance and operating manual, parts catalog, wiring diagrams, spare parts, specified written warranties and like publications, or parts for all installed equipment, systems, and like items and as described in the Contract Documents.

b. Contractor shall be responsible for updating the Record Documents for all Contractor initiated documents and changes to the Contract Documents due to coordination and actual field conditions, including RFis.

c. Contractor shall be responsible for updating the Record Documents for any addenda, Change Orders, A/E supplemental instructions and any other alterations to the Contract Documents generated by A/E or Owner.

ARTICLE 7. Construction Safety

Before commencing any trench excavation which will exceed a depth of five feet, the contractor shall provide to the owner a copy of any geo-technical investigation used for preparation of detailed drawings and specifications regarding the safety systems to be utilized. Such drawings and specifications shall include a certification from a registered professional engineer indicating full compliance with the OSHA regulations referenced herein.

ARTICLE 8. Quality Control

The General Contractor at their expense will hire a third party inspector qualified in construction and certified in code and general compliance with project plans/specifications, whom will verify in writing the milestone and/or phase completion. The inspector will inspect and certify that milestone and/or phases, meet building code and project plans/specifications. The third party inspector must be approved by TMD prior to any inspections being performed.

Submittals.

Contractor shall, within twenty-one (21) days of the Notice of Award, proceed with construction, submit to ODR and A/E, a submittal schedule/register, organized by specification section, listing all items to be furnished for review and approval by *AIE* and Owner. The list shall include Shop Drawings, manufacturer's literature, certificates of compliance, materials Samples, materials colors, guarantees, and all other items identified throughout the Specifications.

ARTICLE 9. Liquidation Damages Schedule

In case of failure on the part of the contractor to complete the work within the time fixed in the contract, or any extension thereof, the owner may collect from the contractor or deduct from any funds owned the contractor an amount not to exceed that shown on the following liquidated damages schedule, plus a one-time fixed cost of $250 for Staff Judge Advocate review and contract modification.

Amount of Contract		Liquidated
More Than	But Less Than	Damages Per Day
$0	$25,000	$ 150
$5,000	$50,000	$ 250
$50,000	$100,000	$ 350
$100,000	$500,000	$ 450
$500,000	$750,000	$ 500
$750,000	$1,000,000	$ 650
$1,000,000	$1,500,000	$ 750
$1,500,000	$2,000,000	$ 900
$2,000,000	$2,500,000	$ 1,000
$2,500,000	$3,000,000	$ 1,200
$3,000,000		$ 1,500

Construction Schedule.

Milestone schedule shall be submitted to the ODR no later than 14 days after the Notice of Award.

ARTICLE 10. Payments

A/E shall review the construction payment schedule based on project specific milestones (or phases) and review the scope and complexity of the work performed. The GC wiU adhere to that payment schedule. Milestone and payment schedules shall be approved by TMD's ODR.

General Conditions, overhead and profit must be proportionally incorporated throughout each of the items in the milestone schedule. Additionally, each of these items will be listed independently to identify the cost.

Contractor will submit periodic progress payments based on milestone(s) and/or phase(s) for work completed, materials in place, suitably stored on site, or as otherwise agreed to by Owner and Contractor. Payment is not due until receipt by ODR or his designee of a correct and complete Pay Application in electronic and/or hard copy format as set forth in Supplementary General Conditions, Special Conditions, and a third party inspection report certifying milestone(s) and/or phase(s) as work completed. Milestone progress payments are made provisionally and do not constitute acceptance of work not in accordance with the Contract Documents. Owner will not process progress payment applications for Change Order Work until all parties execute the Change Order.

Payment submittals shall be submitted on TMD forms to include construction waste disposal and landfill diversion report(s).

ARTICLE 13. Warranty and Guarantee

In case of work performed by subcontractors and where guarantees are required, the contractor shall secure warranties from said subcontractor(s) addressed to an in favor of owner; deliver copies of same to the A/E upon completion of the work; and guarantee and assume full responsibility for the full period of said warranties. Delivery of said guarantees shall not relieve the contractor from any obligations assumed under any other provision of the contract. This warranty and guarantee is not the exclusive remedy of the owner, but is in addition to the general obligation of the contractor to faithfully perform the contract and it in no way limits the responsibility of the contractor for faulty materials or workmanship. Neither the final payment nor any provisions of the contract documents shall relieve the contractor of responsibility for faulty materials or workmanship.

ARTICLE 14. Suspension and Termination

a. The State Contracting Officer (SCO) may order the contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the SCO determines appropriate for the convenience of the owner.

b. If the performance of all or any part of the work is, for an unreasonable period of time,

suspended, delayed, or interrupted:

(1) By an act of the SCO in the administration of this contract, or

(2) By the SCO's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the umeasonable suspension, delay, or interruption of the contract modified in writing accordingly. However no adjustment shall be made under this clause for any suspension, delay or interruption to the extent that performance would have been so suspended, delay, or interrupted by any other cause, including the fault or negligence of the contractor , or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

c. A claim under this clause shall not be allowed:

(1) For any costs incurred more than 20 days before the contractor notifies the SCO in writing of the act or failure to act involved (this requirement shall not apply to any claim resulting from a suspension order), and

(2) Unless the claim, stated as a sum certain, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

d. Contractor must deliver all data, drawings, specifications, reports, estimates, summaries, and other information and materials accumulated in performing this contract, whether completed or in process, to the owner.

ARTICLE 15. DISPUTE RESOLUTION

a. The contractor's claims for breach of this contract that cannot be resolved in ordinary course of business must be submitted to the negotiation process provided in chapter 2260, subchapter B, of the Texas Government Code. To initiate the process, the contractor shall submit written notice, as required by subchapter B, to the State Contracting Officer, Texas Military Department, P.O. Box 5218, Austin, Texas 78763-5218. Said notice shall specifically state that the provisions of Chapter 2260, subchapter B are being invoked. A copy of the notice shall also be given to all other representatives of the Texas Military Department and the contractor otherwise entitled to notice under the parties' contract. Compliance by the contractor with subchapter B is a condition precedent to the filing of a contested case proceeding under Chapter 2260, subchapter C, of the Texas Government Code.

b. The contested case process provided in Chapter 2260, subchapter C, of the Texas Government Code is the contractor's sole and exclusive process for seeking a remedy for an alleged breach of contract by the Texas Military Department, if the parties are unable to resolve their disputes under subparagraph a. hereof.

c. Compliance with the contested case process provided in subchapter C is a condition precedent to seeking consent to sue from the Texas Legislature under Chapter 107 of the

Civil Practices and Remedies Code. Neither the execution of the contract by the Texas Military Department nor any other conduct of any representative of the Texas Military Department relating to the contract shall be considered a waiver of sovereign immunity to suit.

d. If the Texas Military Department has not adopted applicable rules regarding this form of claim resolution, the submission, processing, and resolution of a party's claim is governed by the published rules adopted by the Attorney General pursuant to Chapter 2260, as currently effective, hereafter enacted or subsequently amended.

e. Neither the occurrence of an event nor the pendency of a claim constitutes grounds for the suspension of performance by a party, in whole or in part.

ARTICLE 16. ABANDONMENT OR DEFAULT

If the A/E defaults on the Agreement, TMD reserves the right to cancel the Agreement without notice and either re-solicit or re-award the Agreement to the next best responsive and responsible respondent. The defaulting A/E will not be considered in the re-solicitation and may not be considered in future solicitations for the same type of work, unless the specification or scope of work significantly changed. The period of suspension will be determined by TMD based on the seriousness of the default.

ARTICLE 17. TECHNOLOGY ACCESS

a. Effective September 1, 2006 state agencies and institutions of higher education shall procure products which comply with the State of Texas Accessibility requirements for Electronic and Information Resources specified in 1 TAC Chapter 213 when such products are available in the commercial marketplace or when such products are developed in response to a procurement solicitation.

b. Vendor shall provide DIR with the URL to its Voluntary Product Accessibility Template (VPAT) for reviewing compliance with the State of Texas Accessibility requirements (based on the federal standards established under Section 508 of the Rehabilitation Act), or indicate that the product/service accessibility information is available from the General Services Administration "Buy Accessible Wizard" (http://www.buyaccessible.gov). Vendors not listed with the "Buy Accessible Wizard" or supplying a URL to their VPAT must provide DIR with a report that addresses the same accessibility criteria in substantively the same format. Additional information regarding the "Buy Accessible Wizard" or obtaining a copy of the VPAT is located at http://www.section508.gov/.

ATTACHMENT J – ADDENDUM 1 FROM JUNE 29, 2018 IFB POSTING

TEXAS MILITARY DEPARTMENT
STAR CAMPAIGN – WESLACO READINESS CENTER MAJOR MAINTENANCE
ADG17589A
ADDENDUM NO. 1
August 1, 2018

The following additions, deletions, modifications, or clarifications shall be made to the appropriate sections of the Contract Documents. Contractor shall acknowledge receipt of this Addendum in their proposal.



08/01/2018

FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144



08/01/2018

FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

TECHNICAL SPECIFICATIONS:

A1-1 Section 01 11 00 "Summary of Work"

A. Replace existing specification with attached updated specification.

A1-2 Section 01 22 00 "Unit Prices"

A. Replace existing specification with attached updated specification.

A1-3 Section 01 55 00 "Temporary Facilities and Controls"

A. Replace existing specification with attached updated specification.

A1-4 Section 01 57 00 "Temporary Controls"

A. Add attached specification.

A1-5 Section 13 34 23 "Modular Restroom and Shower Building"

A. Replace existing specification with attached updated specification.

A1-6 Section 22 00 01 "Plumbing Systems"

A. Replace existing specification with attached updated specification.

A1-7 Section 23 09 23 "BACNET Direct Digital Control Systems for HVAC"

A. Replace existing specification with attached updated specification.

A1-8 Section 32 31 13.53 "High-Security Chain Link Fence and Gates"

A. Replace existing specification with attached updated specification.

TEXAS MILITARY DEPARTMENT
STAR CAMPAIGN – WESLACO READINESS CENTER MAJOR MAINTENANCE
ADG17589A
ADDENDUM NO. 1
August 1, 2018

DRAWINGS:

A1-9 CIVIL

A. Remove the following drawings and replace with attached:

1. SHEET C-1 DEMOLITION PLAN
2. SHEET C-2 PAVING PLAN
3. SHEET C-3 GRADING PLAN

A1-10 ARCHITECTURE

B. Remove the following drawings and replace with attached:

1. SHEET A-3 SITE PLAN
2. SHEET A-4 SITE DETAILS – BID OPTION 9
3. SHEET A-5 SECURITY FENCING DETAILS – BID OPTION 9
4. SHEET A-6 OVERALL DEMOLITION FLOOR PLAN
5. SHEET A-10 DEMOLITION FLOOR PLAN – AREA 'D'
6. SHEET A-16 OVERALL FLOOR PLAN
7. SHEET A-26 ROOM FINISH SCHEDULE
8. SHEET A-32 EXTERIOR ELEVATIONS

A1-11 MECHANICAL

A. Remove the following drawings and replace with attached:

1. SHEET M-3 DEMOLITION PLAN – C
2. SHEET M-4 DEMOLITION PLAN – D
3. SHEET M-5 FLOOR PLAN – A
4. SHEET M-6 FLOOR PLAN – B
5. SHEET M-7 FLOOR PLAN – C
6. SHEET M-10 NETWORK ARCHITECTURE DIAGRAM

A1-12 PLUMBING

A. Remove the following drawings and replace with attached:

1. SHEET P-7 FLOOR PLAN – C
2. SHEET P-9 ENLARGED FLOOR PLAN
3. SHEET P-11 DOMESTIC WATER RISER DIAGRAMS

TEXAS MILITARY DEPARTMENT
STAR CAMPAIGN – WESLACO READINESS CENTER MAJOR MAINTENANCE
ADG17589A
ADDENDUM NO. 1
August 1, 2018

A1-13 ELECTRICAL

B. Remove the following drawings and replace with attached:

1. SHEET E-1 ELECTRICAL SITE PLAN
2. SHEET E-2 LIGHTING DEMOLITION PLAN – AREA 'A'
3. SHEET E-10 LIGHTING PLAN – AREA 'A'

A1-14 FIRE ALARM

A. Remove the following drawings and replace with attached:

1. SHEET FA-7 PLAN – AREA 'B'

ADDITIONAL ITEMS:

A1-15 IFB Documents

A. On the cover page, change "ATTN: Jennifer Escamilla" to "ATTN: Lanette Thaler".
B. All instances of "Jennifer Escamilla" shall be replaced with "Lanette Thaler"

A1-16 HAZMAT Reports

A. Incorporate the attached contractor Indoor Mold Assessment Report.
B. Incorporate the attached Comprehensive Asbestos and Lead Survey Report.

A1-17 Contractor Questions

C. Incorporate the attached contractor questions answered by the Owner & AE.

A1-18 Pre-Bid Meeting Sign-In Sheets

A. Incorporate the attached pre-bid meeting sign-in sheets.

END OF ADDENDUM NO. 1

01 11 00 SUMMARY OF WORK

1.00 GENERAL

1.01 WORK INCLUDED

A. Construct Work as described in the Contract Documents.

1. Provide the materials, equipment, and incidentals required to make the Project completely and fully operable.

2. Provide the labor, equipment, tools, and consumable supplies required for a complete Project.

3. Provide the civil, architectural, structural, mechanical, electrical, instrumentation and all other Work required for a complete and operable Project.

4. Test and place the completed Project in operation.

5. Provide the special tools, spare parts, lubricants, supplies, or other materials as indicated in Contract Documents for the operation and maintenance of the Project.

6. Install Owner provided products and place in operation.

7. The Contract Documents do not indicate or describe all of the Work required to complete the Project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer.

1.02 JOB CONDITIONS

A. The General Conditions, the Supplementary Conditions, and General Requirements apply to each Section of the Specifications.

B. Comply with all applicable state and local codes and regulations pertaining to the nature and character of the Work being performed.

1.03 DESCRIPTION OF WORK

A. Work is described in general, non-inclusive terms as:

1. Modernization of the Texas Army National Guard's Weslaco Readiness Center facility in order to mitigate life safety and code related deficiencies currently experienced at the project site. Interior building improvements include architectural, mechanical, electrical, plumbing, structural and IT/telecom trades. Exterior Building Improvements include site civil and utility modifications.

1.04 CONSTRUCTION OF UTILITIES

1. Contractor may provide temporary power, water, natural gas, telecomm and internet service if required for the project site through the governing utility.

2. Cost for providing temporary power, water, natural gas, telecomm and internet will be paid for by the Contractor.

3. Utilities will remain in Owner's name and contractor may judiciously use owner's utilities (electric, sewer, water, and gas) for constructions. Contractor may not use owner's data, telephone, internet, or other electronic medium connections/utilities.

1.05 OCCUPANCY

A. As soon as any portion of the structure and equipment are ready for use, the Owner shall have the right to occupy or operate that portion upon written notice to the Contractor.

B. The facility shall be unoccupied during the course of this project.

C. Testing of equipment and appurtenances including specified test periods, training, and startup does not constitute acceptance for operation.

D. Owner may accept the new work for continued use after startup and testing at the option of the Owner.

E. The execution of bonds is understood to indicate the consent of the surety to the technical provisions and design drawings provided for this project.

F. Provide an endorsement from the insurance carrier permitting owner partial occupancy of the structures in accordance with the provisions set forth by the Uniform General Conditions (UGCs) during the remaining period of construction.

G. Conduct operations to insure the least inconvenience to the Owner and general public.

1.06 WORK BY OWNER

A. Telecomm and IT System Components:

1. PRODUCTS Owner will perform or award separate contract for the installation of routers, switches, servers, and other accessories in all Telephone Equipment Rooms, upon Substantial Completion of the work in all telecom rooms.

B. Intrusion Detection Systems (IDS) Components:

1. There is no IDS work in this project.

C. Fire Extinguishers

1. Owner will provide all fire extinguishers for fire extinguisher cabinets upon substantial completion of all fire extinguisher cabinet work.

D. Emergency Generator

1. Owner will provide temporary generator for emergency power upon substantial completion of all emergency electrical system work.

2.00 PRODUCTS

2.01 MATERIALS

A. Provide materials and products per the individual Sections of the Specifications.

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

01 22 00 UNIT PRICES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Uniform General Conditions (UGCs)

2. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.

3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.03 DEFINITIONS

A. Unit price a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.04 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

2.00 PRODUCTS (NOT USED)

3.00 EXECUTION

3.01 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Repair of concrete cracking and concrete spalling in building.

1. Description: infill of cracked or spalled concrete, as required, according to design drawings and specification section 030130 “Maintenance of Cast-In-Place Concrete”.

2. Unit of Measurement: Cubic feet of spalled concrete repaired, based on in-place surveys of volume before and after filling. Linear feet of concrete cracks repaired, based on in-place surveys of crack length before and after filling.

3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012310 "Bid Options and Allowances."

END OF SECTION

01 50 00 TEMPORARY FACILITIES AND CONTROLS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish temporary facilities, including the Contractor's field offices, storage sheds, and temporary utilities needed to complete the work. Refer to specification 011100 "Summary of Work" for more information on temporary utilities.

B. Utilities will remain in Owner's name and contractor may judiciously use owner's utilities (electric, sewer, water, and gas) for constructions. Contractor may not use owner's data, telephone, internet, or other electronic medium connections/utilities.

C. Furnish temporary heating and cooling system for the buildings once finishes begin being applied if the permanent system is not operational. Contractor is responsible for locating and installing this system.

D. Furnish, install, and maintain temporary project identification signs. Provide temporary on-site informational signs to identify key elements of the construction facilities. Do not allow other signs to be displayed.

E. Cost for Temporary Facilities and Controls as described in this section and provided by Suppliers and Subcontractors as described in this section are to be included in the Cost of Work. Contractor efforts are included in the Contractor's fee for Construction Phase Services.

1.02 QUALITY ASSURANCE

A. Testing: Inspect and test each service before placing temporary utilities in use. Arrange for all required inspections and tests by regulatory agencies, and obtain required certifications and permits for use.

1.03 DELIVERY AND STORAGE

A. Arrange transportation, loading, and handling of temporary buildings and sheds.

1.04 JOB CONDITIONS

A. Locate buildings and sheds at the Site as indicated or as approved by the Owner.

B. Prepare the Site by removing debris and performing demolition needed to clear a space adequate for the structures.

C. Contractor is responsible for temporary restrooms facilities. If contractor chooses to have a temporary facility, contractor shall pay for the utilities used by temporary facilities during construction.

D. Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in the performance of the Work.

E. Maintain, expand as required, and modify temporary services and facilities as needed throughout the progress of the Work.

F. Operate temporary facilities in a safe and efficient manner.

1. Restrict loads on temporary services or facilities to within their designed or designated capacities.
2. Provide sanitary conditions. Prevent public nuisance, or hazardous conditions from developing or existing at the Site.
3. Prevent freezing of pipes, flooding, or the contamination of water.
4. Maintain site security and protection of the facilities.

1.05 OPTIONS

A. Construction offices may be prefabricated buildings on skids or mobile trailers.

B. Storage sheds may be prefabricated buildings on skids or truck trailers.

2.00 PRODUCTS

2.01 SIGN MATERIALS

A. Provide new or used signs, wood or metal with structure and framing in sound condition. Materials are to be structurally adequate and suitable for the indicated finish.

B. Temporary sign

2.02 TEMPORARY STORAGE BUILDINGS

A. Furnish storage buildings of adequate size to store any materials or equipment delivered to the Site that might be affected by weather.

2.03 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities at the Site from the commencement of the Project until project conclusion. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority.

B. Use these sanitary facilities. Do not use rest rooms within existing or Owner - occupied buildings.

3.00 EXECUTION

3.01 LOCATION AND DESIGN OF CONSTRUCTION SIGNAGE

A. Locate construction signage in location shown on architectural site plan. Construction signage shall be as shown in Figure 1 below.

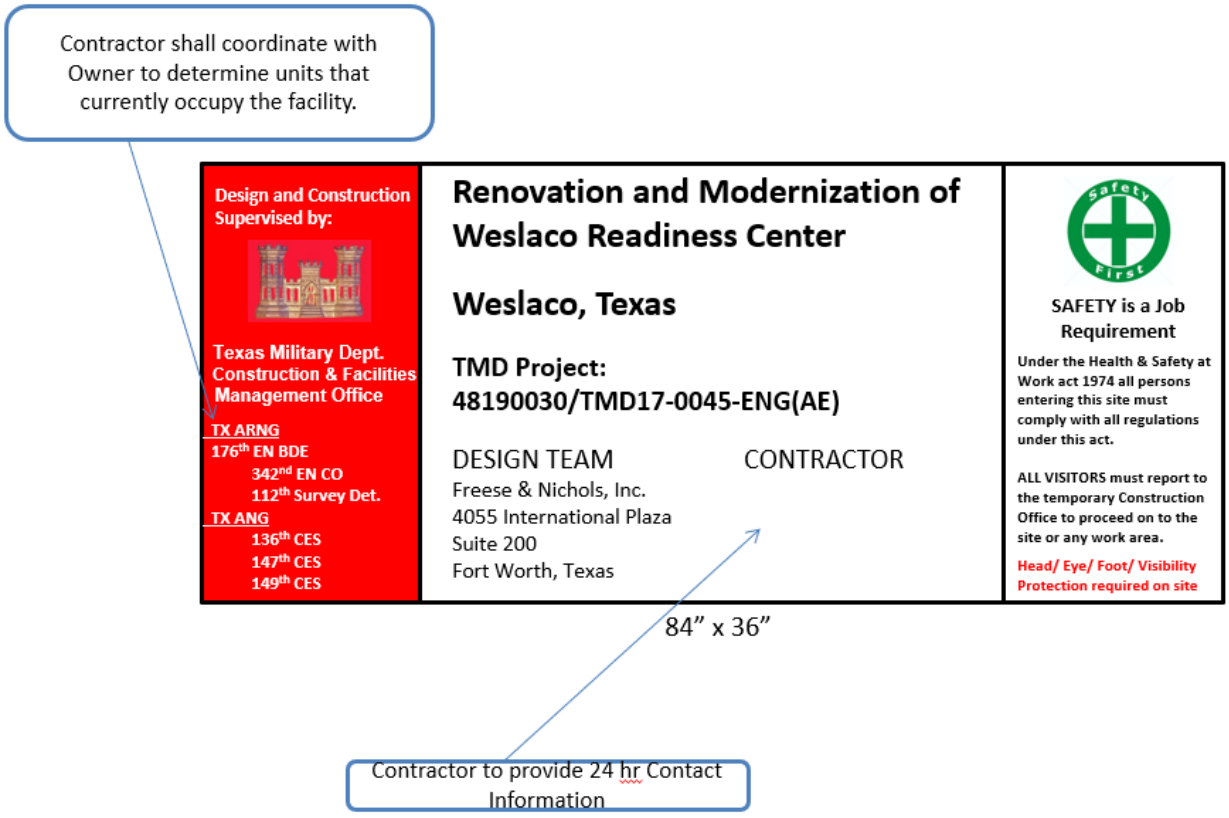


Figure 1. Temporary Construction Signage Example

3.02 LOCATION OF TEMPORARY FACILITIES

A. Locate all temporary facilities in areas approved by the Owner. Construct and install signs at locations approved by the Owner. Install informational signs so they are clearly visible.

3.03 TEMPORARY LIGHTING

A. Provide portable flood lights at any time that Work will be performed outside the structure at night. Provide adequate lighting to provide sufficient light at any location Work is being performed.

B. Work outside the hours or 7:00 a.m. to 6:00 p.m. will not normally be permitted. Obtain prior authorization from the Owner and Engineer for any night Work.

C. Provide Security light for the building entrance and secure parking areas at night.

3.04 CONSTRUCTION FENCE

A. Install and maintain a construction fence around the construction site and/or around the storage yard as indicated. Fence must be a minimum 6 feet high and may be wood picket or chain link construction. Provide gates with padlocks.

3.05 REMOVAL OF TEMPORARY FACILITIES

A. Remove temporary buildings, sheds, and utilities at the conclusion of the Project and restore the Site to original condition or finished in accordance with the Drawings.

B. Remove informational signs upon completion of construction.

C. Remove project identification signs, framing, supports, and foundations upon completion of the Project.

END OF SECTION

01 57 00 TEMPORARY CONTROLS

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.

B. Construct temporary impounding works, channels, diversions, furnishing and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.

C. Provide a Storm Water Pollution Prevention Plan in accordance with TCEQ General Permit TXR150000, file required legal notices and obtain required permits prior to beginning any construction activity.

D. Provide labor, materials, equipment, and incidentals necessary to prevent storm water pollution for the duration of the Project. Provide and maintain erosion and sediment control structures as required to preventive sediment and other pollutants from the Site from entering any storm water system, including open channels. Remove pollution control structures when no longer required to prevent storm water pollution.

E. Cost for Temporary Controls as described in this section and provided by Suppliers and Subcontractors as described in this section are to be included in the Cost of Work.

1.02 QUALITY ASSURANCE

A. Construct and maintain temporary controls with adequate workmanship using durable materials to provide effective environmental management systems meeting the requirements of the Contract Documents and requiring minimal maintenance that will disrupt construction activities while providing adequate protection of the environment.

B. Periodically inspect systems to determine that they are meeting the requirements of the Contract Documents.

1.03 SUBMITTALS

A. Provide copies of notices, records and reports required by the Contract Document or regulations as Record Data in accordance with Section 01 33 00 “Submittal Procedures.”

B. Provide documents requiring approval by the Owner or Engineer as Shop Drawings in accordance with Section 01 33 00 “Submittal Procedures.”

1.04 STANDARDS

A. Provide a storm water pollution prevention plan that complies with Local, State, and Federal requirements. Comply with all requirements of the Texas Commission on Environmental Quality General Permit (TXR150000) for storm water discharges from construction activities under the Texas Pollutant Discharge Elimination System (TPDES) program.

B. Perform Work to comply with “Best Practice” as established by the North Central Texas Council Of Governments (NCTCOG) integrated Storm Water Management (iSWM) Design Manual for Construction or the local agency of jurisdiction.

1.05 PERMIT EXCEPTION

A. In regards to the sections below: if less than 1 acre is disturbed, TMD does not require any permits be obtained. All other requirements must still be met, but an actual permit does not need to be obtained.

1.06 PERMITS

A. Submit the following to the TCEQ and the Operator of any Municipal Separate Storm Sewer System (MS4) receiving construction site discharge from the Site:

1. Notice of Intent (NOI) at least 48 hours prior to beginning construction activity. Construction activity may commence 24 hours after the submittal of an electronic NOI.
2. Notice of Change (NOC) letter when relevant facts or incorrect information was submitted in the NOI, or if relevant information in the NOI changes during the course of construction activity.
3. Notice of Termination (NOT) when the construction project has been completed and stabilized.

B. Post a copy of the NOI at the construction site in a location where it is readily available for viewing by the general public and Local, State, and Federal authorities prior to starting construction activities and maintain the posting until completion of the construction activities.

C. Maintain copies of a schedule of major construction activities, inspection reports, and revision documentation with the storm water pollution prevention plan (SWPPP) required under the TPDES General Permit (TXR150000) for Storm Water Discharges from Construction Activities for all projects.

1.07 STORM WATER POLLUTION CONTROL

A. Comply with the current requirements of TPDES General Permit No. TXR15000 (General Storm Water Permit) set forth by the Texas Commission on Environmental Quality for the duration of the Project:

1. Develop a Storm Water Pollution Prevention Plan meeting all requirements of the General Storm Water Permit.
2. Submit of a Notice of Intent to the Texas Commission on Environmental Quality.
3. Develop and implement appropriate Best Management Practices as established by local agencies of jurisdiction.
4. Provide all monitoring and/or sampling required for reporting to the Texas Commission on Environmental Quality.
5. Submit reports to the Texas Commission on Environmental Quality as required as a condition of the permit.

6. Submit copies of the reports to the Engineer as Record Data in accordance with Section 01 33 00 “Submittal Procedures.”

7. Retain copies of these documents on-site at all times for review and inspection by the Owner or regulatory agencies. Post a copy of the permit as required by regulations.

8. Pay all costs associated with complying with the provisions of the General Storm Water Permit. Assume solely responsible for implementing, updating, and modifying the General Storm Water Permit per regulatory requirements the Storm Water Pollution Prevention Plan and Best Management Practices.

B. Use forms required by the Texas Commission on Environmental Quality to file the Notice of Intent. Submit the Notice of Intent at least 2 days prior to the start of construction. Develop the Storm Water Pollution Prevention Plan prior to submitting the Notice of Intent. Provide draft copies of the Notice of Intent, Storm Water Pollution Prevention Plan, and any other pertinent Texas Commission on Environmental Quality submittal documents to Owner for review prior to submittal to the Texas Commission on Environmental Quality.

C. Return any property disturbed by construction activities to either specified conditions or pre-construction conditions as set forth in the Contract Documents. Provide an overall erosion and sedimentation control system that will protect all undisturbed areas and soil stockpiles/spoil areas. Implement appropriate Best Management Practices and techniques to control erosion and sedimentation and maintain these practices and techniques in effective operating condition during construction. Permanently stabilize exposed soil and fill as soon as practical during the Work.

D. Assume sole responsibility for the means, methods, techniques, sequences, and procedures for furnishing, installing, and maintaining erosion and sedimentation control structures and procedures and overall compliance with the General Storm Water Permit. Modify the system as required to effectively control erosion and sediment.

E. Retain copies of reports required by the General Storm Water Permit for 3 years from date of final completion.

1.08 POLLUTION CONTROL

A. Prevent the contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.

B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.

1. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-site locations in an acceptable manner.

2. Excavate contaminated soil and dispose at an off-site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.

3. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal site.

4. Comply with local, State and Federal regulations regarding the disposal of pollutants.

C. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or sludge-contaminated soil is considered contaminated. Contaminated water must not be allowed to enter streams or water courses, leave the Site in a non-contained form or enter non-contaminated areas of the Site.

1. Pump contaminated water to holding ponds constructed by the Contractor for this purpose, or discharge to areas on the interior of the Site, as designated by the Engineer.

2. Construct temporary earthen dikes or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.

3. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

1.09 EARTH CONTROL

A. Remove excess soil, spoil materials and other earth not required for backfill at the time of generation. Control stockpiled materials to eliminate interference with Contractor and Owner's operations.

B. Dispose of excess earth off the Site. Pay cost for disposal unless otherwise noted. Provide written approval by the property owner for all disposal on private property, and approval by the Owner if such disposal affects the use of Site or other easements.

1.10 MANAGEMENT OF WATER

A. Manage water resulting from rains or ground water at the Site. Maintain trenches and excavations free of water at all times.

B. Lower the water table in the construction area by acceptable means if necessary to maintain a dry and workable condition at all times. Provide drains, sumps, casings, well points, and other water control devices as necessary to remove excess water.

C. Provide continuous operation of water management actions. Maintain standby equipment to provide proper and continuous operation for water management.

D. Ensure that water drainage does not damage adjacent property. Divert water into the same natural watercourse in which its headwaters are located, or other natural stream or waterway as approved by the Owner. Assume responsibility for the discharge of water from the Site.

E. Remove the temporary construction and restore the Site in a manner acceptable to the Engineer and to match surrounding material at the conclusion of the Work.

2.00 PRODUCTS

2.01 MATERIALS

A. Provide materials meeting regulatory requirements.

3.00 EXECUTION

3.01 CONSTRUCTING, MAINTAINING AND REMOVING TEMPORARY CONTROLS

A. Construct temporary controls in accordance with regulatory requirements.

B. Maintain controls in accordance with regulatory requirements where applicable, or in accordance with the requirements of the Contract Documents.

C. Remove temporary control when no longer required, but before the Project is complete. Correct any damage or pollution that occurs as the result of removing controls before the point where they are no longer required.

END OF SECTION

13 34 23 MODULAR RESTROOM AND SHOWER BUILDING

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide work as described hereinafter.

1. Provide the labor, materials, equipment, and incidentals required to make the modular building completely operable.

2. Test and place the completed modular building in operation.

3. Drawings and specifications do not indicate or describe all of the work required to complete the project. Additional details required for the correct installation of selected products are to be provided by the Manufacturer and coordinated with the Owner.

B. Furnish equipment, manpower, products, and other items necessary to complete the modular building with an acceptable industry standard of quality and within the contract time.

C. Provide modular buildings complete with structural frame, axles, tires, floors, ADA compliant ramps, stairs, landings (at ADA restroom/shower trailer), ceilings, exterior walls, interior fixtures and finishes, lighting, plumbing, heating – ventilation and air conditioning, and all necessary appurtenances required for complete functionality of the building.

1. One Restroom Portable Modular Unit to include separate facilities for Men and Women. Modular building to include a total of at least 10 Water Closets. Basis of Design – Premium Comfort Station as provided by A Clean Portoco, or approved equal.

2. One Shower Modular Unit to include separate facilities for Men and Women. Modular building to include a total of at least 8 Showers. Basis of Design – Eight Stall Mobile Shower Trailer as provided by A Clean Portoco, or approved equal.

3. One ADA-Compliant Restroom/Shower Portable Modular Unit to include at least one ADA-compliant restroom, shower and lavatory with an ADA-compliant ramp and landing. Basis of Design - ADA accessible restroom/shower mobile trailer as provided by A Clean Portoco, or approved equal.

D. Deliver the building to the designated site in operational condition, requiring only the extension of utilities, electrical, plumbing and sanitary sewer to a single point of connection.

1.02 QUALITY ASSURANCE

A. Employ competent workmen, skilled in the occupation for which they are employed. Provide only first quality workmanship. Owner's Representative shall determine if the quality of work is acceptable.

B. A defective product is any product that has been found not to be up to manufacturer's standards or is damaged prior to final completion. Defective products shall be removed from the site immediately and replaced, or may remain at the site if arrangements have been made with the Owner's Representative to allow repair of the product at the site. Clearly mark the defective product as "defective" until removed or allowable repairs have been completed.

C. Assume responsibility for the design of the products to include structural stability and operational capability.

D. Provide products suitable for the intended service.

E. Do not use products for any purpose other than that for which it is designed.

F. Materials shall be suitable for service conditions.

1.03 SUBMITTALS

A. Submittals shall include:

1. Dimensioned layout showing sizes and locations of all utility single point connections.

2. Copies of Manufacturer's printed instructions to all parties involved in the installation of the product prior to beginning the work.

1.04 JOB CONDITIONS

A. Comply with all applicable state and local codes and regulations pertaining to the nature and character of the work being performed. The City of Weslaco currently requires compliance with the 2015 International Building Codes, including Plumbing, Mechanical, Energy, and Fire Codes.

B. Comply with the provisions of, and submit drawings to the Texas Department of Licensing and Regulations, for Texas Accessibility Standards Compliance where required by State law.

1.05 MODULAR BUILDING UTILITIES

A. The contractor is responsible for extending all utilities to modular buildings.

B. The modular building manufacturer shall provide a single point of connection for each utility, including:

1. Power

2. Plumbing

3. Sanitary Sewer

1.06 OWNER FURNISHED PRODUCTS

A. Products furnished and paid for by Owner:

1. Lock cores and keys.

1.07 MANUFACTURERS USE OF PROJECT SITE

A. Security Provisions comply with the Homeland Security Act. Comply with Federal, State, County and Local Laws and Ordinances. Persons entering this site by virtue thereof give consent to a search of their vehicles, property and persons without recourse.

B. Limit the use of project site for work and storage to the areas at the site approved by the Owner's Representative.

C. Coordinate the use of the premises with the Owner's Representative.

D. Assume full responsibility for the protection and safekeeping of products stored at the site until accepted by the owner.

E. Store products to allow Owner access for maintenance and operations.

F. Any damage to existing facilities, including contamination, caused by the Manufacturers personnel, visitors, materials, or equipment, shall be repaired or corrected at the Manufacturers expense.

G. Alcoholic beverages or illegal substances are prohibited on the site at any time, nor will persons under the influence of same be permitted to remain on the premises. Persons on site under the influence of alcoholic beverages or illegal substances will be permanently removed from the site in addition to possible criminal and civil penalties.

H. Park equipment and employees' vehicles in designated areas only.

I. The use of loud radios, obnoxious vulgar or abusive language, or sexual harassment in any form will not be tolerated and will be cause for immediate removal of the offender from the premises permanently, in addition to possible criminal or civil penalties.

J. Workers attire shall be professional and commensurate to the trade. Sleeveless shirts, shorts, exceedingly torn, ripped or soiled clothing shall not be permitted.

K. Firearms, concealed or illegal weapons are not permitted on the site under any conditions, including persons with concealed handgun permits.

1.08 HAZARDOUS MATERIALS

A. Contractor shall furnish Material Safety Data sheets for any material provided under this contract in accordance with Federal Standard 313 including but not limited to Paint, Varnish, adhesives and Sealers.

B. Asbestos Certification:

1. Prior to final payment, submit the following notarized certification on contractor's company letterhead: "To the best of my information, knowledge and belief, asbestos or asbestos containing materials have not been incorporated in the work."

1.09 PERFORMANCE REQUIREMENTS

A. Provide modular buildings capable of withstanding the effects of gravity loads and stresses; Seismic performance and thermal movements in accordance with the International Building Codes.

B. The exterior walls shall be framed braced and secured in accordance with the requirements of the International Building Code, based on wind loads applicable to the installation site.

2.00 PRODUCTS

2.01 MODULAR BUILDING CONSTRUCTION

A. Refer to section 1.01 C.

3.00 EXECUTION

3.01 SITE PREPARATION

A. The G.C. will prepare the sites to receive the modular buildings. Specific instructions will be provided to the Owner prior to delivery of each unit, a minimum of 10 days notice shall be provided to the Owner prior to delivery.

3.02 INSTALLATION

A. Set and level modular buildings on prepared sites.

B. Install exposed plumbing pipe, or pipe subject to freezing in such a manner and with adequate protection to prevent breakage caused by freezing temperatures. Provide freeze protection tape only on metallic pipe, provide copper or cast iron pipe on water and drain pipes subject to freezing to allow the installation of freeze protection tape.

END OF SECTION

22 00 01 PLUMBING SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and incidentals for complete, operable plumbing systems. Provide appurtenances for every pipe, valve, and fixture or equipment item for a complete operable system.

1.02 QUALITY ASSURANCE

A. Verify location, size, depth and pressure of each utility prior to beginning Work. If conditions are found that will adversely affect the installation, notify the Owners Representative in writing before proceeding with Work.

B. Plumbing fixtures and trim of like kind shall be of the same manufacturer throughout the Project, in the following categories:

1. Water closets, lavatories, urinals.
2. Showers.
3. Countertop sinks.
4. Service sinks.
5. Electric water coolers.
6. Faucets, mixing valves (other than thermostatic mixing valves).
7. Tailpiece, fixture traps, escutcheons, arm extensions, strainers.
8. Fixture carriers.

1.03 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 “Submittal Procedures” and include manufacturer’s Product Data sheets for the following:

1. Plumbing fixtures and trim.
2. Piping materials and valves.
3. Equipment and accessories.

B. Operation and Maintenance Data: Submit operation and maintenance data in accordance with Division 01.

1.04 STANDARDS

A. Authority Having Jurisdiction: Perform all Work in accordance with the regulations and ordinances of federal, state, and local agencies, who have lawful jurisdiction over the Place of Record. Notify proper authorities for inspections as Work progresses.

B. Codes and Ordinances: The design and installation shall be in accordance with the applicable provisions of the latest edition of the following codes and ordinances. These codes and ordinances shall apply as if written here in their entirety:

1. International Building Codes 2015 with local amendments.

2. International Plumbing Code (IPC) 2015, with local amendments.

3. International Fuel Gas Code (IFGC) 2015, with local amendments.

4. International Energy Conservation Code (IECC) 2015, with local amendments.

5. Occupational Safety and Health Standards (OSHA).

6. Architectural Barriers Act (ABA) Standards 2015.

7. UFC-3-420-01 Plumbing Systems.

8. UFC 4-010-01 DOD Minimum Antiterrorism Standards for Buildings.

9. UFC 1-200-02 High Performance and Sustainable Building Requirements.

10. Army National Guard DG 415-5 General Facilities Information Design Guide.

C. Standards:

1. The design and installation shall be in accordance with the applicable provisions of the following standards. These standards shall apply as if written here in their entirety:

a. American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).

b. American National Standards Institute (ANSI)/ American Society for Testing Materials (ASTM).

c. American National Standards Institute (ANSI)/ American Welding Society (AWS).

d. American National Standards Institute (ANSI)/ American Water Works Association (AWWA).

e. American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA).

f. American Society of Testing and Materials (ASTM) Publications.

g. American Welding Society (AWS) Specifications.

h. American Water Works Administration (AWWA) Publications.

i. American Society of Sanitary Engineering (ASSE).

j. Cast Iron Soil Pipe Institute (CIPE) Standards.

k. Texas Commission on Environmental Quality (TCEQ).

2. Comply with the provisions of the Buy American Act 41 U.S.C. §§ 8301–8305.

1.05 DELIVERY AND STORAGE

A. Deliver and store equipment and materials in accordance with Division 01. Handle pipe in a manner which prevents damage. Store on raised platforms or wood runners in neat piles. Prevent debris or dirt from entering open ends of pipe.

1.06 JOB CONDITIONS

A. Drawings are schematic and intended to show the general arrangement and extent of the Work. Follow dimensions without regard to scale. Determine the exact location and arrangement of piping regarding the actual equipment furnished, the surrounding conditions and the work installed by other trades.

B. Review the Drawings and each Section of the Specifications. Install Work indicated, regardless of which Drawing or Section of the Specifications it occurs. No allowances shall be made for the Contractor's failure to review complete Contract Documents.

C. Locate by field measurement the exact rough-in and final connection location of all fixtures, drains and plumbing. Center pipe between walls and chases.

D. Conform to the manufacturer's rough-in and installation requirements for each fixture equipment and appliance.

E. This project is a renovation to an existing building. Work of this discipline consists of additions and alterations to existing systems. Existing conditions depicted on the drawings are from record drawings, 'as built' drawings provided by the Owner and cursory field observations of unconcealed conditions. The exact location, size and type of existing fixtures, equipment, pipe valves fittings and other appurtenances may vary from what is indicated. Before proceeding with construction verify the exact location, size, type, and condition of each item and modify the new construction to coordinate with existing.

F. Perform cutting and patching required to install the Work under the requirements of the individual trade. Patching shall restore the area to the original condition. No structural member shall be cut without the written approval of the Engineer.

G. Schedule Work to avoid conflicts with other trades.

H. Materials within plenums, rated spaces above ceilings and as required by Code shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E84. PVC Piping installed in plenums shall be wrapped in an approved fire blanket or protective enclosure.

I. Installation of Liquid Propane gas to equipment and appliances; comply with the requirements and recommendations of the equipment manufacturer including engineering manuals and O & M/installation guides. Where the design of gas regulators, pipe sizes, and any other appurtenance conflicts with the manufacturers requirements and recommendation's, provide for the greater of the two – design or manufacturers recommendations in the bid.

J. Pipe penetrations through concrete walls shall be core drilled smooth with a maximum of ½" annular space around the pipe, or a sleeve is required. Where an existing pipe penetration has more than a 2" annular space around the pipe, a sleeve will be required. Where a sleeve is used, provide a sleeve with a maximum of ½" annular space between the pipe and sleeve. Load bearing walls shall be sleeved with schedule 40 steel pipe. Seal existing and new annular space between the opening and pipe. Seal pipe with approved rated materials for rated walls. Exposed pipe penetrations shall have escutcheons on the exposed side(s) of the wall.

1.07 GUARANTEES

A. In addition to the Contractor's standard 1 year guarantee, provide the manufacturer's warranty for all equipment installed. Include warranties in the O & M Manual, in accordance with Division 01.

2.00 PRODUCTS

2.01 PIPE AND FITTINGS

A. Water Piping Buried Within 5 Feet of Building:

1. Copper Tubing: For 2-inch diameter and less, (ASTM B88), Type L or K or annealed. Fittings: ANSI/ASME B16.18, cast copper or ANSI/ASME B16.22, wrought copper. Joints: AWS A5.8 BCuP silver braze.

2. Copper Tube for 2-1/2-inch Diameter and Greater: (ASTM B88) Type L or K hard drawn. Fittings ANSI/ASME B16.8 cast copper or ANSI/ASME B16.22 wrought copper. Joints: AWS A5.8 BCuP silver braze.

3. Ductile Iron Piping for 3-inch Diameter and Greater: Pipe: ANSI/AWWA C151, Class 50. Fittings: ANSI/AWWA C110, ductile iron, standard thickness. Joints: ANSI/AWWA C111, rubber gasket, mechanical joint. Pipe and fittings shall have tar coated outside and cement mortar lined inside in accordance with ANSI A21.4.

4. PVC, AWWA Pipe: AWWA C900, Class 150 with bell end with gasket, and with spigot end.

    a. Comply with UL 1285 for fire-service mains if indicated.

    b. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

    c. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

    d. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

        1). Gaskets: AWWA C111, rubber.

    e. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

        1). Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Water Piping Above Grade:

1. Copper Tubing: For 4-inch diameter and less, (ASTM B88), Type L or K, hard drawn. Fittings: ANSI/ASME B16.18, cast brass, or ANSI/ASME B16.22, wrought copper. Joints: (ANSI/ASTM B32), solder, (Grade 95TA) or Copper Pipe 2 through 6 inches may be installed using mechanical type couplings on roll-grooved pipe; coupling housing, ductile iron (ASTM A536) grade 65-45-12, with factory coat copper alkyd enamel paint. Gaskets, flanges, shall be rated for the system by the manufacturer.

C. Sanitary Drain, Sanitary Waste and Vent Piping (DWV) Buried:

1. PVC DWV Pipe: Polyvinyl Chloride, Schedule 40 (ASTM D2665) pipe, and fittings (ASTM D2466).

2. PVC Sewer Pipe (beyond 5 feet of building): Polyvinyl Chloride Gravity Sewer Pipe (ASTM 3034) SDR 35, or (ASTM F789) PS 46 and Fittings, with elastomeric Joints. (Uni-Bell B-4-82, ASTM D3212).

3. Cast Iron Pipe: (ASTM A74) service weight. Fittings: Cast iron. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International. Joints: Hub-and-spigot, CISPI HSN compression type with (ASTM C564) neoprene gaskets.

D. Sanitary Drain, Sanitary Waste and Vent Piping (DWV) Above Grade:

1. Cast Iron Pipe: For pipe below the first floor concrete slab - (ASTM A74), service weight. Fittings: Cast iron. Joints: Hub-and-spigot, CISPI HSN compression type with (ASTM C564) neoprene gaskets. For pipe beyond the building foundation - PVC DWV Pipe: Polyvinyl Chloride, Schedule 40 (ASTM D2665) pipe, and fittings (ASTM D2466).

2. Cast Iron Pipe: (CISPI 301), hubless (no-hub), service weight. Fittings: Cast iron. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International. Joints: Cast-iron couplings (ASTM A48, Class 30-A) with neoprene gaskets (ASTM C1277, ASTM D412 18-8 and CISPI 310) stainless steel bolts and nuts; manufactured by MG Piping Products Co. or equal.

3. PVC Pipe: (ASTM F1760 and ASTM D2665), Schedule 40. Fittings: PVC DWV Type, Schedule 40, (ASTM D2665). Joints: (ASTM D2885) and (ASTM D2564), solvent cemented. PVC pipe installed in plenums and above ceilings shall be wrapped or coated with an approved fire retardant to comply with requirements.

E. Roof and Storm Drainage Piping Below Grade:

1. PVC Pipe (ASTM F1760 and ASTM D2665). Joints: (ASTM D2885) and (ASTM D2564), solvent cemented.

2. Cast Iron Pipe: (ASTM A74) service weight. Fittings: Cast iron. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

F. Roof and Storm Drainage Piping Above Grade:

1. PVC Pipe (ASTM F1760 and ASTM D2665). Joints: (ASTM D2885) and (ASTM D2564), solvent cemented. PVC pipe installed in plenums and above ceilings shall be wrapped or coated with an approved fire retardant to comply with requirements.

2. Cast Iron Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe

Institute and be listed by NSF International. Joints: Cast-iron coupling (ASTM A48 Class 30-A) with neoprene gasket (ASTM D412) 18-8 stainless steel bolts and nuts.

G. Condensate Drain Piping, Above Grade:

1. Copper Tubing: For 4-inch diameter and less, (ASTM B88), Type L, hard drawn. Fittings: ANSI/ASME B16.18, cast brass, or ANSI/ASME B16.22, wrought copper. Joints: (ANSI/ASTM B32), solder, (Grade 95TA) or Copper Pipe 2 through 6 inches may be installed using mechanical type couplings on roll-grooved pipe; coupling housing, ductile iron (ASTM A536) grade 65-45-12, with factory coat copper alkyd enamel paint. Gaskets, flanges, shall be rated for the system by the manufacturer.

2. PVC, Schedule 40 Pipe: ASTM D 1785. or PVC, Schedule 40 Socket Fittings: ASTM D 2466. (Where installed above the ceiling in return air plenum space, PVC shall comply with 25/250 ASTM E84, and shall include insulation and pipe hangars at a maximum 5'–0").

H. Natural Gas Piping:

1. Natural Gas Piping, Buried:

a. Polyethylene Piping (for below ground use only): Pipe: ASTM D1248 and ASTM D2513, 75 psi rated working pressure. Fittings: PE fittings, ASTM D1248 and ASTM D2513, SDR 11, 50 psi rated working pressure. Joints: Butt fusion, in accordance with manufacturer's recommendations and the Department of Transportation Title 49 of Federal Specifications, as it applies to heat fusion.

2. Natural Gas Piping, Above Grade:

a. Steel Pipe: ASTM A53, Schedule 40 black. Fittings: ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type. Joints: Screwed for pipe 2 inches and under; ANSI/AWS D1.1, welded, for pipe over 2 inches.

b. Interior and Exterior Steel Piping Above Ground: Field apply two coats of exterior grade enamel paint. Color: Safety Yellow or as directed by Owner or authority having jurisdiction. The paint shall be the manufacturer's best quality product. Certification of paint grades shall be submitted. Paints which contain lead in excess of 0.06 percent by weight of the total non-volatile content shall not be used. Paints containing zinc chromate or strontium chromate pigments shall not be used. Exterior painting shall not be performed in rainy, damp or frosty weather, or until surface is thoroughly dry. Prepare surface by removing loose rust, loose mill scale and loose paint to firm surface by hand chipping, scraping, sanding or wire brushing. Follow with solvent wash to remove any remaining residue.

2.02 FLANGES, UNIONS, AND COUPLINGS

A. Pipe size 2 inches and under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, solder joints.

B. Pipe size over 2 inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

D. Gas Service Line Risers: PE pipe with coated, anodeless, steel pipe casing on riser section. Include inlet for heat-fusion connection to PE pipe and outlet for connection to shutoff valve.

2.03 NATURAL GAS REGULATORS

A. Service Regulators: AGA/IAS-listed for service regulators, single stage, steel jacketed, and corrosion resistant. Include atmospheric vent, elevation compensator, with threaded ends for NPS 2 and smaller, and flanged ends for NPS 2-1/2 and larger. Acceptable manufacturers: American Meter Co.; Equimeter, Inc.; Fisher Controls International, Inc.; National Meter; Schlumberger Industries, Gas Div.; or approved equal.

1. Regulator Vents: Factory-installed or field-installed, corrosion-resistant screen in opening.

2.04 VALVES (WITHIN 5 FEET OF BUILDING)

A. Ball Valves (For Water Shut-Off and Throttling):

1. Ball Valves 2 inches and Less: Full-port, rated 175-lb. minimum water, oil, air and gas pressure, brass or bronze construction, seat material as recommended by manufacturer for material conveying, lever handle, threaded or soldered connections. Throttling valves shall be provided with memory stops. Acceptable manufacturers and models: Crane, 9302, 9322; ITT Grinnell, 3500, 3500SJ; Milwaukee, BA-200, BA-250; Watts, B-6000, B-6001 and Nibco, T-580, S-580.

2. Ball Valves 2-1/2 inches and Greater: Full-port, rated 150-lb. minimum water, oil, air and gas pressure, bronze or carbon steel construction, seat material as recommended by manufacturer for material conveying, lever handle, flanged connections. Throttling valves shall be provided with memory stops. Acceptable manufacturers and models: Watts, G-4000M1; Crane, 941-TF; Apollo, 88-100 and Jamesbury, D150F.

B. Valves (For Gas Piping Only):

1. Non-lubricated, Tapered Plug Valves (for 2 inches and Smaller): Brass or cast-iron body, with brass tapered plug; lever operation; and complying with ASME B16.33, MSS SP-78, UL 842, or AGA/IAS listing. Include lever. Include locking device. Acceptable

manufacturers: Essex Brass Corp.; Grinnell Corp.-Mueller Co.-Gas Products Div.; Lyall, R.W. & Co., Inc.; McDonald, A.Y. Mfg. Co.

C. Check Valves (Swing Check Valves):

1. Check valves 2 inches and Less: MSS SP-80 rated 175-lb. minimum water and air pressure, brass or bronze construction, bronze disc, threaded or soldered connections. Acceptable manufacturers and models: Watts, B-5000 & B-5001; Nibco, T-413-B & S-413-B; Milwaukee, 509-1509; Crane, 37/1707 & 1707S.

2.05 DOMESTIC WATER HEATERS

A. Natural Gas Water Heaters (Direct Fired).

1. Domestic Water Heater (GWH1-GWH5): ASHRAE 90.1-2013 energy efficient, natural gas-fired, tankless, condensing, wall mounted. Water heater air intake and exhaust gas vent shall be Schedule 40 PVC. Water heater shall be controlled by an internal circuit board that monitors the inlet and outlet temperatures with installed thermistors, sensing and controlling flow rate to set point temperature with air-fuel ratio controls in order to maintain thermal combustion efficiency. Units shall include safety features such as flame sensor system, high limit sensors, overheat prevention device, freeze protection mode, and fan rotation detector. Manifolded units shall be installed by connecting the units using cable-only connections. Set outlet temperature to 127°F maximum. The Contractor shall extend vent piping to the outside of the building in accordance with manufacturer's instructions.

a. Acceptable Manufacturers and Models:

1). Navien NPE-240S-NG, or owner approved equal.

2.06 WATER HEATING SYSTEM ACCESSORIES

A. Circulation Pumps: Inline type, flanged connections, rated for 125 psi at 220 F, single stage, vertical split case, all bronze or stainless steel and provided with oil cups, 1/12 HP, 115V, 1 phase, 6 gpm at 10 ft hd. Acceptable manufacturer and Model: Bell & Gossett Ecocirc XL 20-35, or approved equal.

B. Thermostatic Control for Circulation Pumps: Heavy-duty snap-acting SPDT switch, copper constructed liquid filled capillary and bulb sensing element, 100 to 210°F setpoint adjustment range, 5 to 15°F adjustable differential, 120 VAC, UL listed. One 0-10V (Analog): Speed Control by external controller. One 4-20mA (Analog): Connection with an external pressure sensor for the pressure control mode (two different pressure sensor ranges: 0-15 PSI and 0-30 PSI) l One external temperature sensor input for Differential Temp operating mode. Sensor Type KTY38 PN:104502 l One built-in temperature sensor for Set Point Temp and Differential-Temp operating mode. REMOTE BUILDING MANAGEMENT SYSTEM, The

pump monitored or controlled by a signal from BMS (Building Management System). With built in BACnet protocols.

C. Expansion Tank for Water Heaters: Bladder type, factory pre-charged, fabricated steel shell, heavy duty butyl FDA approved bladder, 150 psig working pressure, 200°F operating temperature. Tank head shall be galvanized or polypropylene lined. Pre-charge tank to static pressure of system. Acceptable manufacturers and models: Taco, CAX Series and Amtrol, ST Series, WHTS, DET. Series.

2.07 PLUMBING FIXTURES AND TRIM

A. Water Closets:

1. Water Closet (WC1): Accessible floor-mounted, flush-valve type bottom outlet, white vitreous china, siphon-jet action, elongated bowl, 1 1/2 inch top inlet spud and designed to operate on 1.28 gallons per flush maximum. Mounting height to be 17 inches from finished floor to rim. Acceptable manufacturers and models: American Standard, 3461.001; Kohler K-4405; Zurn, Z5665-BWL.

2. Water Closet (WC2): Floor-mounted, flush-valve type bottom outlet, white vitreous china, siphon-jet action, elongated bowl, 1-1/2-inch top inlet spud and designed to operate on 1.28 gallons per flush maximum. Acceptable manufacturers and models: American Standard, 3451.001; Kohler, K-4406; Zurn, Z5655-BWL-AM.

B. Flush-Valves for Water Closets:

1. Flush-Valve for Water Closets (WC1 & WC2): Exposed type, chrome-plated, 1-inch supply inlet, screw driver back-check angle stop, vacuum breaker, lever activating handle, solid ring pipe support 1-1/2-inch top outlet spud with wall and spud flanges. Flush valve flow to be 1.8 gpf maximum. Inlet of flush-valve shall be 11-1/2 inches maximum, above rim of water closet, coordinate flush valve location with grab bars for accessible installations. Acceptable manufacturers and models: Sloan, Royal III-1.28; Delany, U402-1.28 and Zurn, Z-6000-AV-HET.WS-1.

C. Seats for Water Closets:

1. Seat for Water Closets (WC1 & WC2): White, posture molded, elongated type, open front, extra heavy construction, concealed check stainless steel hinges, and rubber bumpers. Provide with antimicrobial agent option. Acceptable manufacturers and models: Olsonite, 10CC; Church/Bemis, 1955C; Beneke, 527 or 533 and Kohler, K-4680-CA series.

D. Urinals:

1. Urinal (UR1): Accessible wall-mounted, white vitreous china, 14-inch minimum elongate rim type, siphon-jet action, flushing rim, integral trap, 3/4-inch top inlet spud and designed to operate on .125 gallon per flush maximum. Mounting height to be 17 inches from finished floor to rim. Acceptable manufacturers and models: American Standard, 6042.001EC; Kohler, K-4991-ET; Zurn, Z5738.207.00 Series.

2. Urinal (UR2): Wall-mounted, white vitreous china, 14-inch minimum elongate rim type, siphon-jet action, flushing rim, integral trap, 3/4-inch top inlet spud and designed to operate on .125 gallon per flush maximum. Standard mounting height. Acceptable manufacturers and models: American Standard, 6042.001EC; Kohler, K-4991-ET Zurn, Z5738.207.00 Series.

E. Flush Valves for Urinals:

1. Flush-Valve for Urinals (UR1 & UR2): Exposed type, chrome-plated, 3/4-inch supply inlet, screw driver back-check angle stop, vacuum breaker, lever activating handle, 3/4-inch top outlet spud with wall and spud flanges. Flush valve flow to be 0.125 gpf maximum. Acceptable manufacturers and models: Sloan Regal, 186-0125; Delany, 451-0125 and Zurn, Z-6003AV-ULF.

F. Urinal Carriers:

1. Carriers for Urinals: Mounted on concrete block walls or walls other than concrete block, wall and floor supported type, compatible with specified urinal, complete with chrome-plated finished exposed trim, adjustable through the wall frame including top and bottom hanger plates, steel uprights, block foot supports, and accessories. Acceptable manufacturers and models: Josam, 17810 Series; Jay R. Smith, 637 Series; Tyler/Wade, W-400-AM11 Watts Drainage CA-321 and Zurn, Z-1222 Series.

G. Lavatories:

1. Lavatory (L1): Under-countertop mounted, white vitreous china, nominal size including rim 21 by 17 by 5-1/2 inches deep (bowl size: 19” x 15-3/8” x 5-1/2” deep), oval, unglazed rim, template and sealant, rear overflow. Acceptable manufacturers and models: American Standard, 0497.221; Toto, LT587.

H. Faucets for Lavatories:

1. Faucet for Lavatories (L1): Chrome-plated brass, soft flow, vandal proof spout, proximity sensoring with vandal proof 24-VAC solenoid sensor unit. All metal construction, 0.5 gpm vandal resistant spray outlet, soft flow spout, serviceable filter screen upstream of the valve, 4-inch centers for hot and cold water supplies. Provide with thermal mixing valve. Equipped with infra-red sensor activated with vandal proof 24-VAC solenoid sensor unit. Acceptable manufacturers and models: American Standard, 6059.205; Delta, 591TP0250 and Zurn Z6950-XL-S-CP4-CWB.

I. Supplies and Stops for Lavatories:

1. Supply and Stop for Lavatories (L1): Supplied through the wall, chrome-plated cast brass stop, 1/2-inch female standard pipe thread inlet by 3/8-inch O.D. compression type outlet angle stop, wheel or four-armed handle, 3/8-inch O.D. chrome-plated copper flexible riser, and wall escutcheon. Acceptable manufacturers and models: McGuire, 2165LK; Eljer, American Standard, Cambridge/Delta, Zurn and Engineered Brass (Just), Specified trim.

J. Strainer and Tailpiece for Lavatories:

1. Offset Strainer for Lavatories (L1): Heavy Duty 17-gauge chrome plated wheelchair strainer and tailpiece, cast grid drain plug with strainer. Acceptable manufacturers and models: McGuire, 155WC; Eljer, American Standard, Crane, Cambridge/Delta, Specified Trim ST155WC, Zurn and Engineered Brass (Just).

K. P-Trap for Lavatories:

1. P-Trap for Lavatories (L1): 17-gauge chrome-plated brass size 1-1/4 inches, integral cleanout, and wall escutcheon. Acceptable manufacturers: McGuire, B8872**;** Eljer, American Standard, Crane, Cambridge/Delta, Zurn and Engineered Brass (Just).

L. Lavatory Insulation Kits: Fully molded closed cell vinyl insulation 3/16-inch thick with nylon fasteners. K factor of 1.17 (ASTM C177) self-extinguishing burn characteristics (ASTM D635). Insulation kit for p-trap, tailpiece, trap arm, hot and cold water supplies, white. Acceptable manufacturers and models**;** Truebro Inc., #102 with accessory #105**;** Brocar Products Inc., Plumberex, and TCI Products.

M. Sinks

1. Sink (S1): Countertop mounted, double compartment, 18-gauge stainless steel, self-rimming, faucet deck, with four 1-1/2-inch diameter holes, 4-inch centers, with undercoated underside. Size 21 by 33 by 5-1/2 inches deep. Acceptable manufacturers and models: Elkay, LRAD-3321 and Just, DL-ADA-3321-A-GR -L or R.

N. Faucets for sinks

1. Faucets for Sinks (S1): Chrome-plated brass, deck mount, 8” centers, swing gooseneck soft flow spout with 8”-9” reach (centerline of spout inlet to centerline of spout outlet), vinyl hose with deck mounted automatic spray diverter, and chrome-plated brass lever or wing handles. Faucet shall automatically divert water to spray when spray handle is used. Hose connection to faucet shall be provided with backflow preventer under counter. Maximum flow is 2.20 GPM. Acceptable manufacturer and models: Chicago Faucet, 1102, E3, 1000; T & S Brass, B-1172, B-970; Royal Brass, 5269.3-BH-136;

Speakman, SC-5773; American Standard, 7231.000 with .342H lever or .352H Cross handles, Cambridge/Delta, 2276LHP and Zurn, Z-87163-HS.

O. Supplies and stops for sinks

1. Supply and Stop for Sinks: Supplied through the wall, chrome-plated cast brass stop, 1/2" female standard pipe thread inlet by 3/8" O.D. compression type outlet angle stop, wheel or four-armed handle, 3/8" O.D. chrome-plated copper flexible riser, and wall escutcheon. Acceptable manufacturers: McGuire, Eljer, American Standard, Cambridge/Delta, Zurn and Engineered Brass (Just).

P. Strainer and tailpiece for sinks

1. Offset Strainer for Sinks (S1): 17-gauge chrome plated wheelchair strainer and tailpiece, cast grid drain plug with strainer. Acceptable manufacturers: McGuire, Eljer, American Standard, Crane, Cambridge/Delta, Zurn and Engineered Brass (Just).

Q. P-traps for sinks

1. P-Trap for Sinks (S1): Chrome-plated, 17-gauge cast brass, size 1-1/2", with integral cleanout, and wall escutcheon. Acceptable manufacturers: McGuire, Eljer, American Standard, Crane, Cambridge/Delta, Zurn and Engineered Brass (Just).

R. Insulation kit for accessible sinks

1. Sink Insulation Kits: Fully molded closed cell vinyl insulation 3/16" thick with nylon fasteners. K factor of 1.17 (ASTM C-177) self-extinguishing burn characteristics (ASTM D635). Insulation kit for p-trap, tailpiece, trap arm, hot and cold water supplies, white. Acceptable manufacturers: Truebro Inc., Brocar Products Inc., Plumberex, TCI Products. Insulation kit is not required if a trap/supplies enclosure is provided under another division.

S. Electric Water Coolers:

1. Electric Water Cooler (EWC1): Wall-mounted, dual unit, bi-level, wheelchair type, complete water station including laminar flow 1.1 gpm flow rate bottle filling station on high unit and dual water coolers, a hermetically sealed compressor with built-in overload protection, large capacity dryer-strainer, condenser and self-lubricated fan. Refrigeration system to use R-134A refrigerant. Unit shall meet NSF/ANSI 61/372, UL 399 and ASHRAE requirements. Minimum energy-efficiency performance per CSA 815-99. Front and sides push bars with raised lettering, stainless steel top, stainless steel cabinet with flexible hooded two-stream bubblers, inlet strainer and NSF/ANSI 42 certified carbon activated class 1 chlorine and particulate 3,000-gallon capacity filter with NSF/ANSI 53 certified lead reduction media. Bottle filling station to include electronic no-touch sensor activated laminar flow spout with 20 second shut off timer

and green, yellow and red LED light visual filter maintenance monitor. Provide optional stainless steel apron on high unit as required by TAS/ADA for each installation. Wheelchair unit shall be mounted in accordance with TAS/ADA requirements. Water cooler shall deliver a 7.5 gph minimum of 50 F water, based upon 80 F inlet water temperature and 90 F ambient air temperature. Acceptable manufacturers and models: Halsey Taylor HTHB-HACG8BLSS-WF, or approved equal.

T. Supplies and Stops for Electric Water Coolers:

1. Supply and Stop for Electric Water Coolers: Supplied through the wall, chrome-plated brass, 1/2-inch female standard pipe thread inlet by 3/8-inch O.D. compression type outlet angle stop, wheel or four-armed handle, with flexible riser and wall escutcheon. Acceptable manufacturers and models: McGuire, 2166LK; Eljer, American Standard, Cambridge/Delta, Specified Trim, Zurn and Engineered Brass (Just).

U. P-Trap for Electric Water Coolers:

1. P-Trap for Electrical Water Coolers: 17-gauge chrome-plated brass, size 1-1/4 inches, integral cleanout, and wall escutcheons. Acceptable manufacturers and models: McGuire, B8912; Eljer, American Standard, Cambridge/Delta, Zurn and Engineered Brass (Just).

V. Electric Water Cooler Carriers:

1. Carriers for Electric Water Coolers Mounted on Concrete Block Walls or Walls other than Concrete Block: Wall and floor supported type, compatible with specified electric water cooler, complete with adjustable through the wall frame including top and bottom hanger plates, steel uprights, and block foot supports, and accessories. Acceptable manufacturers and models: Josam, 17900; Jay R. Smith, 830; Tyler/Wade, W400-AM11; HAWS, 6800; MC-33 (Bi-Level type); Watts Drainage CA-321 and Zurn, Z-1225.

W. Service Sinks:

1. Service Sink (SSK1): Floor-mounted, corner type, terrazzo material, five-sided, nominal size 28 by 28 by 12 inches, 6-inch drop front corner, 3-inch drain, with mop hanger, hose and hose bracket, stainless steel curb caps, removable stainless steel strainer, cast integral stainless steel drain body, provide for a caulked lead connection of not less than 1 inch deep to a 3-inch drain pipe. One piece basin constructed of black and white marble chips cast in gray Portland cement, to produce a compressive strength of 3000 psi, 7 days after casting, ground smooth, grouted and sealed to resist stains and moisture. Acceptable manufacturers and models: Florestone, (Basin) 96; Florestone, (Hose & Bracket), MR-370; Florestone (Mop Hanger), MR-372; Florestone (Wall Guard), MR-377 (24-inch).

X. Faucets for Service Sinks:

1. Faucets for Service Sinks: Chrome-plated, 3/4-inch hose thread outlet, wall-mounted for concealed supply pipe, wall brace, integral stops, pail hook, and vacuum breaker. Maximum flow is 2.20 gpm. Acceptable manufacturers and models: Chicago Faucet, 897; T & S Brass, B-665-BSTR; Royal Brass, 552-49; Speakman, SC-5811-RCP; American Standard, 8344.111; Fiat, 830AA; Moen 8124, Cambridge/Delta 28T2263, Stern Williams, T-15-VB and Zurn, Z-841MI.

Y. Traps for Service Sinks:

1. Trap for Floor-Mounted Service Sinks: 3-inch cast iron, under floor.

Z. Showers:

1. Accessible Shower (SH1): 36” x 36” (nominal) Accessible Shower enclosure is a built-up type. Refer to the architecture drawings and specifications.

2. Accessible Wide Shower (SH2): 36” x 60” (nominal) Accessible Wide Shower enclosure is a built-up type. Refer to the architecture drawings and specifications.

AA. Mixing Valve Assembly for Showers:

1. Mixing Valve Assembly for Shower (SH1): Pressure balancing type mixing valve with integral volume control, adjustable temperature limit stop, single lever handle, and integral service and check stops. Maximum flow for shower head is 2.75 gpm. Acceptable manufacturers and models: Leonard, 5500 w/accessories; Powers, 902 w/accessories; Speakman, SM-1422 w/accessories; Symmons, S-86 w/accessories; Bradley, IC-EF w/accessories; American Standard, 1312 SS.014, Cambridge/Delta 11T5113 and Zurn, TEMPGARD 7120 with accessories.

2. Mixing valve assembly for showers (SH2): Pressure balancing mixing valve with integral volume control, adjustable temperature limit stop, integral service and check stops, lever handles, separate lever handle diverter and volume control with shower arm, hand held sprayer, escutcheon, flexible 5-foot hose, wall connection, flange, in-line vacuum breaker, 30-inch polished chrome finish slide bar. Acceptable manufacturers: Symmons, Powers, Leonard, Bradley, American Standard, Cambridge/Delta, Speakman, Acorn, and Zurn –Tempgard.

BB. Shower Heads for Showers:

1. Shower SH1 Shower Heads: Provided with shower enclosure. Chrome plated brass, 1.5 gpm, ball joint fitting, two mode. Acceptable manufacturer and model: Symmons model 4-231-1.5, or approved equal.

2. Shower SH2 Accessible Hand Held Sprayer: Polished chrome, 1.5 gpm, integral service stops, integral check stops. Acceptable manufacturer and model: Symmons Temptrol C-96-500B30-V–1.5, or approved equal.

CC. Shower Pans and Drain Flashings:

1. Shower pans shall be copper or nonplasticized chlorinated polyethylene sheet.

a. Sheet copper shall be 16 ounce weight.

b. Sheet nonplasticized chlorinated polyethylene shall be 40 mils thickness. Acceptable manufacturer and model: The Noble Co., “Chloraloy”.

2.08 PLUMBING SPECIALTIES

A. Floor Drains:

1. Floor Drain (FD1) (for use in finished floor areas and showers): ANSI A112.21.1; cast iron body, double drainage flange, weepholes, bottom outlet, vandal proof secured 6-inch diameter nickel bronze adjustable flat strainer, and non-puncturing flashing collar.

a. Acceptable Manufacturers and Models:

1). Josam: Series 30000-6A.

2). Jay R. Smith: Series 2005 or 2010.

3). Wade: Series W-1100.

4). Zurn: Series Z-415.

5). Mifab: Series F-1100.

A. Floor Sink Drains:

1. Floor Sink Drain (FS1): ANSI A112.21.1; square cast iron body, double drainage flange, weepholes, bottom outlet aluminum dome strainer, non-puncturing flashing collar, porcelain enamel or epoxy coated interior and 1/2 grate. Size 8 by 8 by 6 inches. Provide with trap primer connection adapter.

a. Acceptable Manufacturers and Models:

1). Josam: Series 4900.

2). Jay R. Smith: Series 3100.

3). Wade: Series W-9110-24.

4). Zurn: Series ZN-1815.

5). Mifab: Series FS-1520.

B. Cleanouts:

1. Floor Cleanout (FCO) (for Use in Finished Floors): Cast iron body, adjustable type, inside caulk connection, vandal proof secured, standard round nickel bronze top, threaded brass plug.

a. Acceptable Manufacturers and Models:

1). Josam: Series 56000.

2). Jay R. Smith: Series 4128-NB.

3). Wade: Series W-6000.

4). Zurn: Series Z-1405-2.

5). Mifab: Series C-1100.

6). Watts Drainage: Series CO-200.

2. Wall Cleanout (WCO): Recessed wall type, cast iron body with threaded brass plug, flush mounted stainless steel access cover with countersunk center screw and vandal proof secured.

a. Acceptable Manufacturers and Models:

1). Josam: Series 58710.

2). Jay R. Smith: Series 4402.

3). Wade: Series W-8450-R.

4). Zurn: Series ZN-1440-1.

5). Mifab: Series C-1400.

6). Watts Drainage: Series CO-380.

3. Plug Cleanout (PCO): Cast iron body with threaded brass plug, specify with no access cover.

a. Acceptable Manufacturers and Models:

1). Josam: Series 58710, Less cover.

2). Jay R. Smith: Series 4402, Less cover.

3). Wade: Series W-8450-R, Less cover.

4). Zurn: Series ZN-1440, Less cover.

5). Watts Drainage: Series CO-380, less cover.

4. Grade Cleanout (GCO & DGCO): Cast iron body, with straight body for caulking into soil pipe hub with countersunk tapered threaded bronze plug. Provide "T" handle wrench. Double Grade Cleanouts (DGCO) will require two GCO's as described above, along with the proper two-way cleanout pipe fitting.

a. Acceptable Manufacturers and Models:

1). Josam: Series 58850-22.

2). Jay R. Smith: Series 4338.

3). Wade: Series W-8530.

4). Zurn: Series Z-1450.

5). Mifab: Series C-1300.

6). Watts Drainage: Series CO-260.

C. Roof Drainage Downspouts:

1. Downspout Nozzle (DSN): Bronze, wall flange and threaded inlet. Coordinate height and location with Architecture and also with all other discipline's equipment or devices on exterior wall.

a. Acceptable Manufacturers and Models:

1). Josam: Series 25010.

2). Jay R. Smith: Series 1770.

3). Wade: Series W-3940.

4). Zurn: Series Z-199.

5). Mifab: Series R-1940.

6). Watts Drainage: Series RD-940.

D. Backflow Preventers:

a. All fixtures and hose bibbs or hydrants shall be provided with approved individual backflow devices in accordance with the Authority Having Jurisdiction. Provide RPZ or DCV building backflow preventers where required by the AHJ.

E. Water Hammer Arrestors:

1. Water Hammer Arrestors (WHA): ANSI A112.26.1, ASSE 1010, and PDI WH-201; permanently sealed bellows or expanding chamber. Sizing designations indicated on the Drawings are standard classifications established by Plumbing and Drainage Institute "Standard PDI-WH201." Verify that system pressure meets minimum required for water hammer arrestor provided.

a. Acceptable Manufacturers and Models:

1). Josam: 75000.

2). Jay R. Smith: 5000.

3). Wade: "SHOKSTOP" Series.

4). Zurn: Z-1700.

5). Sioux Chief: "Hydra-Rester" Series.

6). Watts: No. 15M2 Series.

7). PPP: SC & SWA Series.

8). Mifab: WHB Series.

F. Trap Seals:

1. Trap Seals (TS): Flexible elastomeric or neoprene trap seal device utilizes a normally closed seal to prevent evaporation of the liquid trap seal and also protects against sewer gases from backing up into the building or surrounding areas. The device opens when liquid enters to allow drainage to flow through into the building drainage piping, and closes when there is no drainage flow entering the drain. Provide in all floor drains, floor sinks, area drains and hub drains connected to the sanitary sewer system or to other systems that may have sewer gases present in the drainage system.

a. Acceptable Manufacturers and Models:

1). ProVent Systems, Inc.: ProSet Trap Guard Series.

2). Mifab: Mi-Gard Series.

3). SureSeal.

4). Jay R. Smith Mfg. Co.: Quad Close Series.

2. Thermostatic Tempering Valves:

a. Thermostatic Tempering Valve (TTV): The valve shall be constructed of solid brass/bronze. The valve shall feature union connection, integral checks, locking temperature adjustment. All internal components shall be lead-free, stainless steel, Teflon, or other corrosion resistant materials. The valve shall be CSA B125 certified and meet ASSE 1017 requirements. Temperature adjustment shall be vandal resistant. In the event of interruption of the cold water supply, the control mechanism shall close off the hot water port, stopping all flow. In the event of interruption of the hot water supply, the control mechanism shall allow cold flow only. In the event that the thermostatic tempering mechanism fails, the control mechanism shall close off the hot water port and allow cold water flow only. Valve assembly shall be equipped with spring loaded in-line check valves and ball valve shut-offs.

b. Capacity of the valve at a 45 psi differential shall be as follows and must be able to control down to 0.5 gpm: 1/2 inch = 17 gpm, 3/4 inch = 20 gpm, 1 inch = 23 gpm.

1). Acceptable Manufacturers and Models:

a). Powers: LFLM490 Series.

b). Watts: USG-B or MMV-M1.

c). Leonard: Eco-Mix LF Series.

d). Symmons.

e). Lawler.

f). Armstrong.

G. Hose Bibbs:

1. Hose Bibb (HB): Chrome plated brass, provided with wall flange, 1/2-inch female NPT inlet by 3/4-inch male N.H.T. outlet, with chrome plated vacuum breaker in conformance with ANSI/ASSE 1011.

a. Acceptable Manufacturers and Models:

1). Chicago Faucet: 15-E27 or 7-E27.

2). T&S Brass: B-702-B-972.

3). Royal Brass: 5115-136-G.

4). Woodford: 24P.

5). Watts: SC8-1.

H. Wall Hydrants:

1. Non-Freeze Wall Hydrant (NFWH1): ANSI/ASSE 1019; exposed flush mount, wall hydrant type, with chrome plated brass or nickel bronze finish on brass castings, freezeless, 3/4-inch hose thread nozzle, integral vacuum breaker, and loose key handle.

a. Acceptable Manufacturers and Models:

1). Woodford: 65.

2). Josam: 71050.

3). Jay R. Smith: 5609.

4). Wade: W-8620.

5). Zurn: Z-1310.

6). Watts: HY-420.

I. Ice Maker Outlet Boxes:

1. Ice Maker Outlet Box (IMOB): Recessed 16-gauge steel cabinet with white powder coated finish, 1/2-inch domestic water ball valve meeting lead-free requirements.

a. Acceptable Manufacturers and Models:

1). Guy Gray: MIB1DAB, or approved equal.

J. Pipe Hangers and Supports:

1. Hangers for pipe sizes 1/2 to 1-1/2 inches: Malleable iron, adjustable swivel, split ring.

2. Hangers for pipe sizes 2 to 4 inches and cold pipe sizes 6 inches and over: Carbon steel, adjustable, clevis.

3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for hot pipe sizes 6 inches and over.

4. Vertical Support: Steel riser clamp.

5. Floor Support for pipe sizes to 4 inches and all cold pipe sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

7. Shields for insulated piping 2 inches and smaller: 18 gage galvanized steel shield over insulation in 180 degree segments, minimum 12-foot long at pipe support.

8. Shields for insulated piping 2-1/2 inches and larger (Except Cold Water Piping): Pipe covering protective saddles.

9. Shields for insulated cold water piping 2-1/2 inches and larger: Hard block non-conducting saddles in 90 degree segments, 12-inch minimum length, block thickness same as insulation thickness.

10. Shields for Vertical Copper Pipe Risers: Sheet lead.

11. Adjustable rooftop pipe supports:

    a. Adjustable rooftop supports for piping shall be provided for installation without requiring roof penetrations, flashing, or damage to the roofing material. Support Bases shall be made of a UV-stabilized, EPDM rubber sized to fit the diameter of the pipe or conduit being supported. The support shall contain appropriate additives for UV protection.

    b. The support shall allow for tool-free pipe installation and integrally-connected height adjustability of up to 4", 6" or 7" in ½" increments.

    c. The support shall have a continuous bottom surface to minimize point loading of the roof membrane. The support shall not have discontinuities, cutouts, or pockets on the surface contacting the roof. The placement of slip sheets or mats between the support and the roof surface shall not satisfy the continuous bottom surface requirement.

    d. Acceptable Manufacturers and Models: Erico, Caddy Pyramid or approved equal.

12. Support horizontal piping as follows:

Pipe Size	Max. Hanger Spacing	Hanger Diameter
1/2" to 1-1/4"	6'-6"	3/8"
1-1/2" to 2"	10'-0"	3/8"
2-1/2" to 3"	10'-0"	1/2"
4" to 6"	10'-0"	5/8"
PVC (All Sizes)	5'-0"	3/8"
C.I. Bell and Spigot (or No-Hub)	5'-0" and at Joints	

13. Hanger Notes:

a. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent Work.

b. Place a hanger within 12 inches of each horizontal elbow.

c. Use hangers with 1-1/2-inch maximum vertical adjustment.

d. Support horizontal cast iron pipe adjacent to each hub, with 5-inch maximum spacing between hangers.

e. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

f. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers. Consult with project structural engineer for approval.

g. Support riser piping independently of connected horizontal piping.

h. For below floor hanger installations, place one hanger at each pipe penetration thru a concrete grade beam, at either side, a minimum of 12 inches from the face of the grade beam.

K. Hanger Rods:

1. Steel Hanger Rods: Threaded both ends.

L. Inserts:

1. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

M. Insulation:

1. Pipe insulation for domestic hot and cold water pipe.

a. Heavy duty preformed fiberglass (ASTM C547, type 1, 2 or 3). Schuller, Knauf or Certainteed.

b. Preformed flexible elastomeric insulation (ASTM C534) Armstrong “Armaflex”, or Schuller “Rubatex.”

c. Preformed unicellular polyolefin foam (ASTM C534) tubular preslit with adhesive. IMCOA.

Insulation Schedule

Insulation Schedule	
Cold Water	1” thick up to 2” pipe size 1-1/2” thick over 2” pipe size
Hot Water	1” thick up to 2” pipe size 1-1/2” thick over 2” pipe size
Condensate Drainage	1” thick
Roof Drainage	2” thick up to and including 4” pipe size and body, 1” thick for pipe sizes over 4”

d. Provide all purpose jacket, high density white kraft bonded to aluminum foil, reinforced with fiberglass yarn lap and butt, self-sealing, pressure sensitive. Schuller “Micro-Lok”, Certainteed “Snap-On.”

e. PVC fitting covers, one piece pre molded high impact PVC white gloss insulating fitting covers and jackets. Schuller “Zeston 2000PVC.”

2. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

a. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

b. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

N. Piping Identification:

1. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

a. Pipes with OD, Including Insulation, Less than 6 inches: Pre-tensioned pipe markers. Use size to match pipe and ensure a tight fit.

b. Pipes with OD, Including Insulation, 6 inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

c. Locate pipe markers and color bands on piping as follows: Near each valve and control device; Near each branch connection, excluding short takeoffs; Where flow pattern is not obvious, mark each pipe at branch; At other points of origination and termination; Spaced at maximum intervals of 50 feet along each run; Reduce intervals to 25 feet in areas of congested piping and equipment.

3.00 EXECUTION

3.01 PREPARATION

A. Establish invert elevations for drainage piping within 5 feet of building. Minimum slopes for drainage pipe is 1/4 inch per foot for 2 1/2-inch diameter and less and 1/8 inch per foot for 3-inch diameter pipe and greater.

B. Close equipment shutoff valves before turning off gas to premises or piping section.

C. Inspect liquid propane gas piping according to NFPA 54 to determine that liquid propane gas utilization devices are turned off in piping section affected.

D. Comply with NFPA 54, Part 1, “Prevention of Accidental Ignition” Paragraph.

3.02 INSTALLATION

A. Pipe, Valves and Fittings:

1. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

2. Provide clearance for installation of insulation, and access to valves and fittings.

3. Provide access doors where valves and equipment are not accessible. Coordinate size and location of access doors with applicable Section.

4. Install sanitary piping and storm drainage piping true to line with proper grading. Connect horizontal branches to one another with 45 degrees “Y” fittings, combination “Y” and 1/8 bend fittings. Connect horizontal lines to vertical stacks using 45 degrees “Y” branches, 60 degree “Y” branches, or combination “Y” and 1/8 bend fittings. Horizontal branches turning down to vertical stacks may use a short sweep or 1/2 bend. Branches connecting to mains or to other branches shall enter the branch line at a 45 degree angle, tilted 45 degrees upward, so that the entry is from the side and top.

5. Materials exposed within ducts or plenums (ceiling spaces used as supply or return air plenums) shall have a flame-spread index of not more than 25 and a smoke-developed rating of not more than 50 when tested in accordance with the test for Surface Burning Characteristics of Materials, UBC Standard (ASTM E84). Wrap or enclose with rated materials, any CPVC, PVC or PEX piping installed in rated spaces, including return air plenums.

6. Piping hangers shall be sized large enough to allow insulation to pass through. Hangers for piping 2-1/2 inches and greater shall be provided with pipe covering protection saddle, or high compressive strength insulation saddle. Hangers for piping 2 inches and

less shall be provided with pipe covering shields. On cold water piping provide vapor barrier through hanger.

7. Anchor piping with regard to the transmission of vibration and noise. Securely anchor copper piping to studs or wood blocking with “C” clamp of proper size for piping. At each fixture location where the piping penetrates the partition, back the elbow inside the partition, or chase, with wood blocking. Anchor with “C” clamps or cast brass drop ear elbows to prevent movement. Do not use wire as an anchoring device.

8. Piping shall not come into direct contact with metal studs, beams, or other construction elements. Provide a non-metallic separation between dissimilar metals when copper piping is installed in direct contact with steel.

9. Install unions in piping 2 inches and smaller and flanges in piping 2-1/2 inches and larger, adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.

10. Install piping adjacent to equipment and specialties to allow service and maintenance.

11. Install piping free of sags and bends.

12. Install strainers on inlet side of service regulators.

13. Install metal shutoff valves on aboveground, gas distribution piping.

14. Install aboveground, shutoff valves in accessible locations, protected from physical damage. Include metal tag, attached to valve with metal chain, indicating piping systems supplied.

15. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on or near each service regulator and meter.

    a. Text: Distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.

16. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tape during backfilling of trenches for piping.

B. Plumbing Specialties and Equipment:

1. Pipe relief valves and drains to nearest floor drain. Minimum slope 1/16 inch per foot. Provide 2-inch air gap.

2. Install equipment plumb and square to wall on a 4-inch thick (minimum) reinforced concrete housekeeping pad.

3. Provide all interconnecting electrical power and control wiring from control panels to equipment and accessories for a complete operable systems. All exposed wiring shall be in conduit. Comply with Division 26.

4. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

5. Encase grade cleanouts in concrete flush with grade when not located in concrete, pavement, sidewalk, etc.

6. Grade cleanouts located in pavement or sidewalks shall have a brass or cast iron cover that extends to grade and a brass cap shall be installed.

7. Trap all drains connected to the sanitary sewer.

8. Install floor and area drains with top depressed 1/2 inch below finished floor elevation.

9. In addition to cleanouts, as shown on the Drawings, Contractor shall provide any additional cleanouts required by local codes and ordinances at no additional cost to the Owner.

10. Outlet of plumbing vents and flues shall be located a minimum of 25 feet from fresh air intakes. Provide offset as required.

11. Relief valve discharge drain from reduced pressure backflow preventers shall be piped full outlet size down to nearest floor sink. Drain line shall terminate above floor drain with air gap unless otherwise indicated on the drawings.

12. Prior to ordering and installing water hammer arrestors, verify that the pressure at the point of installation does not drop to below 30 psig at any time. If the pressure drops below 30 psig, do not install piston type water hammer arrestors. Install bellows type arrestors under low pressure circumstances. Provide access panel directly in front of each water hammer arrestor.

C. Plumbing Fixtures and Connections:

1. Furnish and install plumbing fixtures, as noted on the Drawings. Each fixture shall be complete with trim and fittings, including traps and supply fittings. Set fixture with close tolerance to wall and floor surfaces.

2. Provide all wall mounted fixtures with floor carriers. Install and secure fixtures in place with wall supports carriers and bolts. Exposed bolts, nuts, etc. shall be stainless steel or chrome-plated brass.

3. Seal fixtures to wall and floor surfaces with white mildew resistant sealant.

4. Mount fixtures to Architectural Drawings interior wall elevations, manufacturers recommended elevations or the requirements of the ADA or TAS, whichever is applicable.

5. Provide removable insulation covering on stops and supplies and drains and P-traps on all handicapped lavatories. All lavatories in rooms with handicapped water closets are considered handicapped lavatories.

6. Provide accessible stops on all water supplies to fixtures and equipment.

7. Provide accessible water hammer arresters on hot and cold water supplies to plumbing fixtures and/or fixture groups in accordance with Standard PDI-WH-201. Water hammer arresters shall be as shown on diagrams and if not shown, provide for plumbing fixtures and/or fixture groups in accordance with Standard PDI-WH-201.

8. Provide drainage and vent piping run-outs to plumbing fixtures and drains, with approved trap, of sizes indicated, but in no case smaller than required by the governing Plumbing Code.

9. Provide drainage piping run-outs to urinals of cast iron material. Copper or brass material is prohibited.

D. Trenching, Excavation and Backfill:

1. Perform excavating and backfilling necessary for the installation of Work. Shore, bail, pump and maintain all trenches dry until the Work is completed. Keep trenches open until piping has been inspected, tested and approved. Take necessary precautions to protect the public from open trenches. Erect and maintain barricades and warning devices in accordance with OSHA requirements.

2. Backfill trenches after piping has been tested and approved. Material for backfilling shall be a clean, sandy loam up to 4 inches above the top of pipe. Above that point, use overburden removed in the excavation process. Overburden shall be free of trash, debris, rocks or boulders. Deposit backfill material in 12-inch layers and compact to the density of the adjacent, undisturbed soil. Remove all excess material from the Site.

3.03 TESTING

A. Piping Systems:

1. General: Furnish pumps, compressors,-gauges, equipment and personnel required, and test as necessary to demonstrate the integrity of the finished installation.

2. Sanitary Waste and Vent, Storm Drainage: Unless otherwise directed by the authority having jurisdiction, plug all openings except for the highest opening and fill with water to the point of overflow. Perform a water test consisting of no less than 10 feet of head

shall be applied to the system. Allow to stand 1 hour or longer as required. The system should be water tight and leak free. If leaks exist, repair and retest.

3. Water: Unless otherwise directed by the authority having jurisdiction, hydrostatically test and make tight the entire system at 120 psi. Retain for 4 hours. The system should be water tight and leak free. If leaks exist, repair and retest.

4. Liquid Propane Gas: Unless otherwise directed by the authority having jurisdiction, and after flushing of gas piping, pneumatically test and make tight all new and existing gas piping systems from the meter and throughout the building. Test at 1-1/2 times the normal operating pressure and not less than 50 psi. Where the test pressure exceeds 125 psi, the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe. Reduce test pressure if required. Retain for 4 hours minimum or not less than 1/2 hour for each 500 cubic feet of pipe volume or fraction thereof. When testing a system having a volume of less than 10 cubic feet, the test duration shall be permitted to be reduced to 10 minutes. For piping systems having a volume of more than 24,000 cubic feet, the duration of the test shall not be required to be more than 2 hours. Test every pipe, fitting, regulator, valve and appurtenance on the gas system including appliances and equipment. The system shall be air tight and leak free. If leaks exist, repair and retest the entire system. Verify capacities and pressure ratings of service regulators and meters. Verify correct pressure settings for service regulators. PROVIDE A CERTIFICATE OF FLUSHING AND TESTING TO THE OWNER UPON COMPLETION, INDICATING THAT THE SYSTEM HAS BEEN TESTED IN ACCORDANCE WITH THIS SPECIFICATION AND NFPA 54, THE NATIONAL FUEL GAS CODE. CERTIFICATE SHALL INDICATE TESTING COMPANY NAME AND PERSONNEL COMPLETING TESTS AND TWO WITNESSES COMPLETE WITH NAMES AND ADDRESSES.

3.04 DEMONSTRATION OF EQUIPMENT

A. Prior to final acceptance, Contractor and Manufacturer's Representative of Domestic Water Heaters and associated accessories and controls, each shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of the equipment.

B. Prior to final acceptance, Contractor shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of all the plumbing equipment and associated accessories and controls.

3.05 FLUSHING

A. General: After piping systems have been tested and approved, systems shall be flushed. Furnished compressors, pumps, equipment, personnel, etc. required to flush piping systems.

B. Soil, Sanitary Waste and Vent, Storm Drainage: Unless otherwise directed by the authority having jurisdiction, thoroughly flush piping systems with water until free of debris, or detrimental materials that may cause partial or full blockage. As a minimum comply with the International Plumbing Code, Section 302, of the latest edition.

C. Water Piping: Unless otherwise directed by the authority having jurisdiction, flush piping with water until water flows clear for a minimum of 60 seconds per 100 linear feet of piping being flushed at a velocity of 9 feet per second.

D. Liquid Propane Gas Piping: Unless otherwise directed by the authority having jurisdiction, and prior to pipe integrity testing, flush all new and existing piping with clean, dry compressed air until air flows clear for a minimum of 60 seconds per 100 linear feet of piping being flushed at 25 cfm per 1-inch diameter of pipe from every outlet.

E. All strainers and filters shall be cleaned and replaced prior to start-up.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting Work, verify system is complete, flushed and clean.

B. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum five remote outlets.

D. Maintain disinfectant in system for 24 hours.

E. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

F. Take Samples no sooner than 24 hours after flushing, from five remote outlets and from water entry, and analyze in accordance with AWWA C601.

G. Disinfection and disinfection procedures shall be witnessed and approved by the Owners Representative.

H. After disinfection is completed, submit “Disinfection Certificate of Approval” for domestic water piping systems to the Owners Representative stating that all test results are satisfactory. Certificate of Approval must be signed by Contractor, Testing Laboratory. Certificate shall show the date, time and residual of each of the following tests:

1. Initial disinfection residual (50 ppm minimum) - five Samples.

2. Final disinfection residual (25 ppm minimum) - five Samples.

3. After flushing residual (5 ppm maximum) - five Samples.

4. Analyze in accordance AWWA C601 - five Samples.

3.07 CLOSING IN UNINSPECTED WORK

A. Do not cover up or enclose Work until it has been properly and completely inspected and approved. Should any of the Work be covered up or enclosed prior to all required inspections and approvals, uncover the Work as required. After it has been completely inspected and approved, make all repairs and replacements as necessary to the satisfaction of the Owner's representative. Repairs and replacements shall be at no additional cost to the Owner.

END OF SECTION

23 09 23 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC

1.00 GENERAL

1.01 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(2012) Laboratory Methods of Testing Dampers for Rating

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135	(2012; Errata 1 2013; INT 1-9 2013; Errata 2 2013; INT 10-12 2014; Errata 3 2014) BACnet— A Data Communication Protocol for Building Automation and Control Networks

ARCNET TRADE ASSOCIATION (ATA)

ATA 878.1	(1999) Local Area Network: Token Bus ASME INTERNATIONAL (ASME)
ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	(2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(2013) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
ASME B31.1	(2014; INT 1-47) Power Piping
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC	(2010) Boiler and Pressure Vessels Code

ASTM INTERNATIONAL (ASTM)

ASTM A126	(2004; R 2014) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B75/B75M	(2011) Standard Specification for Seamless Copper Tube
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2013) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM D1238	(2013) Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D1693	(2013) Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D635	(2010) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D638	(2010) Standard Test Method for Tensile Properties of Plastics
ASTM D792	(2013) Density and Specific Gravity (Relative Density) of Plastics by Displacement

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-D	(2014) Control Network Protocol Specification

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13	(2008; INT 2009) Standard Requirements for Instrument Transformers
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.45	(2002; R 2008) Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000v and less) AC Power Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8802-3	(2000) Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA/ANSI C12.10	(2011) Physical Aspects of Watthour Meters - Safety Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 22013; Errata 2 2013; AMD 3 2014; Errata 3 2014) National Electrical Code
NFPA 72	(2013) National Fire Alarm and Signaling Code
NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

UNDERWRITERS LABORATORIES (UL)

UL 1449	(2014) Surge Protective Devices
UL 506	(2008; Reprint Oct 2013) Specialty Transformers
UL 508A	(2013; Reprint Jan 2014) Industrial Control Panels
UL 916	(2007; Reprint Aug 2014) Standard for Energy Management Equipment

1.02 DEFINITIONS

A. ANSI/ASHRAE Standard 135

1. ANSI/ASHRAE Standard 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks, referred to as "BACnet". ASHRAE developed BACnet to provide a method for diverse building automation devices to communicate and share data over a network.

B. ARCNET

1. ATA 878.1 - Attached Resource Computer Network. ARCNET is a deterministic LAN technology; meaning it's possible to determine the maximum delay before a device is able to transmit a message.

C. BACnet

1. Building Automation and Control Network; the common name for the communication standard ASHRAE 135. The standard defines methods and protocol for cooperating building automation devices to communicate over a variety of LAN technologies.

D. BACnet/IP

1. An extension of BACnet, Annex J, defines this mechanism using a reserved UDP socket to transmit BACnet messages over IP networks.A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.See also "BACnet Broadcast Management Device".

E. BACnet Internetwork

1. Two or more BACnet networks, possibly using different LAN technologies, connected with routers. In a BACnet internetwork, there exists only one message path between devices.

F. BACnet Network

1. One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

G. BACnet Segment

1. One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

H. BBMD

1. BACnet Broadcast Management Device (BBMD). A communications device, typically combined with a BACnet router. A BBMD forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs connected to the same BACnet/IP network. Every IP subnetwork that is part of a BACnet/IP network must have only one BBMD. See also "BACnet/IP".

I. BAS

1. Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

J. BAS Owner

1. The regional or local user responsible for managing all aspects of the BAS operation, including: network connections, workstation management, submittal review, technical

support, control parameters, and daily operation. The BAS Owner for this project is Texas Military Department.

K. BIBBs

1. BACnet Interoperability Building Blocks. A collection of BACnet services used to describe supported tasks. BIBBs are often described in terms of "A" (client) and "B" (server) devices. The “A” device uses data provided by the "B" device, or requests an action from the “B” device.

L. BI

1. BACnet International, formerly two organizations: the BACnet Manufacturers Association (BMA) and the BACnet Interest Group - North America (BIG-NA).

M. BI/BTL

1. BACnet International/BACnet Testing Laboratories (Formerly BMA/BTL).The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

N. Bridge

1. Network hardware that connects two or more network (or BACnet internetwork) segments at the physical and data link layers. A bridge may also filter messages.

O. Broadcast

1. A message sent to all devices on a network segment.

P. Device

1. Any control system component, usually a digital controller that contains a BACnet Device Object and uses BACnet to communicate with other devices. See also "Digital Controller".

Q. Device Object

1. Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

R. Device Profile

1. A collection of BIBBs determining minimum BACnet capabilities of a device, defined in ASHRAE Standard 135-2004, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing BIBBs supported.

S. Digital Controller

1. An electronic controller, usually with internal programming logic and digital and analog input/output capability, which performs control functions. In most cases, synonymous with a BACnet device described in this specification. See also "Device".

T. Direct Digital Control (DDC)

1. Digital controllers performing control logic. Usually the controller directly senses physical values, makes control decisions with internal programs, and outputs control signals to directly operate switches, valves, dampers, and motor controllers.

U. DDC System

1. A network of digital controllers, communication architecture, and user interfaces. A DDC system may include programming, sensors, actuators, switches, relays, factory controls, operator workstations, and various other devices, components, and attributes.

V. Ethernet

1. A family of local-area-network technologies providing high-speed networking features over various media.

W. Firmware

1. Software programmed into read only memory (ROM), flash memory, electrically erasable programmable read only memory (EEPROM), or erasable programmable read only memory (EPROM) chips.

X. Gateway

1. Communication hardware connecting two or more different protocols, similar to human language translators. The Gateway translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

Y. Half Router

1. A device that participates as one partner in a BACnet point-to-point (PTP) connection. Two half-routers in an active PTP connection combine to form a single router.

Z. Hub

1. A common connection point for devices on a network.

AA. Internet Protocol (IP, TCP/IP, UDP/IP)

1. A communication method, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying and routing packets of information over various LAN media. Two common protocols using IP are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

BB. Input/Output (I/O)

1. Physical inputs and outputs to and from a device, although the term sometimes describes software, or "virtual" I/O. See also "Points".

CC. I/O Expansion Unit

1. An I/O expansion unit provides additional point capacity to a digital controller.

DD. IP subnet

1. Internet protocol (IP) identifies individual devices with a 32-bit number divided into four groups from 0 to 255. Devices are often grouped and share some portion of this number. For example, one device has IP address 209.185.47.68 and another device has IP address 209.185.47.82. These two devices share Class C subnet 209.185.47.00

EE. Local-Area Network (LAN)

1. A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

FF. LonTalk

1. CEA-709.1-D. A communication protocol developed by Echelon Corp. LonTalk is an optional physical and data link layer for BACnet.

GG. MAC Address

1. Media Access Control address. The physical node address that identifies a device on a Local Area Network.

HH. Master-Slave/Token-Passing (MS/TP)

1. ISO 8802-3. One of the LAN options for BACnet. MSTP uses twisted-pair wiring for relatively low speed and low cost communication (up to 4,000 ft at 76.8K bps).

II. Native BACnet Device

1. A device that uses BACnet as its primary, if not only, method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

JJ. Network

1. Communication technology for data communications. BACnet approved network types are BACnet over Internet Protocol (IP), Point to Point (PTP) Ethernet, ARCNET, MS/TP, and LonTalk®.

KK. Network Number

1. A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

LL. Object

1. The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

MM. Object Identifier

1. An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

NN. Object Properties

1. Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

OO. Peer-to-Peer

1. Peer-to-peer refers to devices where any device can initiate and respond to communication with other devices.

PP. Performance Verification Test (PVT)

1. The procedure for determining if the installed BAS meets design criteria prior to final acceptance. The PVT is performed after installation, testing, and balancing of mechanical systems. Typically the PVT is performed by the Contractor in the presence of the Government.

QQ. PID

1. Proportional, integral, and derivative control; three parameters used to control modulating equipment to maintain a setpoint. Derivative control is often not required for HVAC systems (leaving "PI" control).

RR. PICS

1. Protocol Implementation Conformance Statement (PICS), describing the BACnet capabilities of a device. See BACnet, Annex A for the standard format and content of a PICS statement.

SS. Points

1. Physical and virtual inputs and outputs. See also "Input/Output".

TT. PTP

1. Point-to-Point protocol connects individual BACnet devices or networks using serial connections like modem-to-modem links.

UU. Repeater

1. A network component that connects two or more physical segments at the physical layer.

VV. Router

1. A BACnet router is a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

WW. Stand-Alone Control

1. Refers to devices performing equipment-specific and small system control without communication to other devices or computers for physical I/O, excluding outside air and other common shared conditions. Devices are located near controlled equipment, with physical input and output points limited to 64 or less per device, except for complex individual equipment or systems. Failure of any single device will not cause other network devices to fail. BACnet "Smart" actuators (B-SA profile) and sensors (B-SS

profile) communicating on a network with a parent device are exempt from stand-alone requirements.

1.03 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC DESCRIPTION

A. Scope Description

1. For the BASE BID:

a. Provide a Tridium Niagara N4 framework global building controller (as described in Part 1.03.B) for integration of new energy meters.

2. If SECO BID OPTION #2 is selected:

a. Utilize the global building controller specified in Part 1.03.A.1 above in addition to the requirements therein.

b. Provide a new totally native BACnet based systems including a Microsoft 10 compatible operators workstation, associated equipment and accessories. The operator’s workstation, all building controllers, application controllers, and all input/output devices shall be accessible using a Web browser interface and shall communicate using the protocols and network standards as defined by the latest version of the ANSI/ASHRAE Standard 135, BACnet. In other words, all workstations and controllers, including unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section unless gateways are shown on the design drawings and specifically requested by the Government. Gateways may be used for communication to existing systems or to systems installed under other sections. Where gateways are allowed, they must support ASHRAE 135, including all object properties and read-write services shown on Government approved interoperability schedules. Manufacturer's products, including design, materials, fabrication, assembly, inspection, and testing shall be in accordance with ASHRAE 135, ASME B31.1, and NFPA 70, except where indicated otherwise.

B. The Global Building Controller shall be based on a Tridium Niagara N4 framework and shall be able to communicate with a Niagara N4 or AX Supervisor system. The Niagara AX Supervisor system will be provided under a separate contract and will be located in Building 18 at Camp Mabry. Provide the required Niagara N4 License to allow the N4 Global Building Controller to communicate with a Niagara AX system.

C. The Owner shall own and shall have full rights to all features of the Niagara AX software.

D. Provide all necessary BACnet-compliant hardware and software to meet the system’s functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers

E. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

F. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

G. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

H. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

I. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

J. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

K. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

L. Provide a comprehensive operator and technician training program as described herein.

M. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

N. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.

1.04 DESIGN REQUIREMENTS

A. Control System Drawings Title Sheet

1. Provide a title sheet for the control system drawing set. Include the project title, project location, contract number, the controls contractor preparing the drawings, an index of the control drawings in the set, and a legend of the symbols and abbreviations used throughout the control system drawings.

B. List of I/O Points

1. Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Binary Output (BO), Binary Input (BI)), point sensor range, point actuator range, point address, BACnet object, associated BIBBS (where applicable), and point connection terminal number. Typical schedules for multiple

identical equipment are allowed unless otherwise requested in design or contract criteria.

C. Control System Components List

1. Provide a complete list of control system components installed on this project. Include for each controller and device: control system schematic name, control system schematic designation, device description, manufacturer, and manufacturer part number. For sensors, include point name, sensor range, and operating limits. For valves, include body style, Cv, design flow rate, pressure drop, valve characteristic (linear or equal percentage), and pipe connection size. For actuators, include point name, spring or non-spring return, modulating or two-position action, normal (power fail) position, nominal control signal operating range (0-10 volts DC or 4-20 milliamps), and operating limits.

D. Control System Schematics

1. Provide control system schematics. Typical schematics for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. Include the following:

a. Location of each input and output device

b. Flow diagram for each piece of HVAC equipment

c. Name or symbol for each control system component, such as V-1 for a valve

d. Setpoints, with differential or proportional band values

e. Written sequence of operation for the HVAC equipment

f. Valve and Damper Schedules, with normal (power fail) position

E. HVAC Equipment Electrical Ladder Diagrams

1. Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

F. Component Wiring Diagrams

1. Provide a wiring diagram for each type of input device and output device. Indicate how each device is wired and powered; showing typical connections at the digital controller and power supply. Show for all field connected devices such as control relays, motor starters, actuators, sensors, and transmitters.

G. Terminal Strip Diagrams

1. Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

H. BACnet Communication Architecture Schematic

1. Provide a schematic showing the project's entire BACnet communication network, including addressing used for LANs, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connection to existing networks.

1.05 SUBMITTALS

A. Submit detailed and annotated manufacturer's data, drawings, and specification sheets for each item listed, that clearly show compliance with the project specifications. Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00.

1. SD-01 Firm & Installer Qualifications:

    a. Address of local office from where the site will be serviced.

    b. Address of local support facility that will be to supply parts and inventory for the site.

    c. List of similar sized projects completed by firm in past three (3) years. List start and finish dates, scope of controls and list of systems programmed.

    d. Name and qualification of the full-time, on-site experienced project manager for each site.

    e. Name and qualifications of manufacturer authorized and trained personnel who will be working on these sites.

    f. Additional supporting documents to demonstrate compliance with section 1.06/F of this document.

2. SD-02 Shop Drawings: Include the following in the project's control system drawing set:

    a. Control system drawings title sheet.

    b. List of I/O Points.

    c. Control System Components List.

    d. Control system schematics.

    e. HVAC Equipment Electrical Ladder diagrams.

    f. Component wiring diagrams.

    g. Terminal strip diagrams.

    h. BACnet communication architecture schematic.

3. SD-03 Product Data

    a. Direct Digital Controllers: Include BACnet PICS for each controller/device type, including smart sensors (B-SS) and smart actuators (B-SA).

    b. BACnet Gateways: Include BACnet and workstation display information; bi-directional communication ability; compliance with interoperability schedule; expansion capacity; handling of alarms, events, scheduling and trend data; and single device capability (not depending on multiple devices for exchanging information from either side of the gateway).

c. BACnet Protocol Analyzer: Include capability to store and report data traffic on BACnet networks, measure bandwidth usage, filter information, and identify BACnet devices.

d. DDC Software.

e. BACnet Operator Workstation.

f. BACnet Operator Workstation DDC Software. Include BACnet PICS for Operator Workstation software.

g. Notebook Computer.

h. Sensors and Input Hardware.

i. Output Hardware.

j. Surge and transient protection.

k. Indicators.

l. Duct smoke detectors.

4. SD-05 Design Data

    a. Performance Verification Testing Plan.

    b. Pre-Performance Verification Testing Checklist.

5. SD-06 Test Reports

    a. Performance Verification Testing Report.

6. SD-07 Certificates

    a. Contractor's Qualifications.

7. SD-09 Manufacturer's Field Reports

    a. Pre-PVT Checklist.

8. SD-10 Operation and Maintenance Data: Comply with requirements for data packages in Section 01 78 23 OPERATION AND MAINTENANCE DATA, except as supplemented and modified in this specification.

    a. BACnet Direct Digital Control Systems, Data Package 4.

    b. Controls System Operators Manuals, Data Package 4.

9. SD-11 Closeout Submittals

    a. Training documentation.

1.06 QUALITY ASSURANCE

A. Standard Products

1. Provide material and equipment that are standard manufacturer's products currently in production and supported by a local service organization.

2. Materials and equipment shall be manufacturer's latest standard design that complies with the specification requirements. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled

B. Delivery, Storage, and Handling

1. Handle, store, and protect equipment and materials to prevent damage before and during installation according to manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

C. Operating Environment

1. Protect components from humidity and temperature variation, dust, and contaminants. If components are stored before installation, keep them within the manufacturer's limits.

D. Finish of New Equipment

1. New equipment finishing shall be factory provided. Manufacturer's standard factory finishing shall be proven to withstand 125 hours in a salt-spray fog test. Equipment located outdoors shall be proven to withstand 500 hours in a salt-spray fog test.

2. Salt-spray fog test shall be according to ASTM B117, with acceptance criteria as follows: immediately after completion of the test, the finish shall show no signs of degradation or loss of adhesion beyond 0.125 inch on either side of the scratch mark.

E. Verification of Dimensions

1. The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

F. Contractor's Qualifications

1. The Building Automation System (BAS) system shall be designed, installed, commissioned, and serviced by manufacturer authorized and trained personnel. System provider shall have an in-place support facility within 2 hours response time of the site with technical staff, spare parts inventory, and necessary test and diagnostic equipment.

2. The contractor shall provide full-time, on-site, experienced project manager for this work, responsible for direct supervision of the design, installation, start-up and commissioning of the BAS system.

3. The Bidder shall be regularly engaged in the design, installation and maintenance of BAS systems and shall have demonstrated technical expertise and experience in the design, installation and maintenance of BAS systems similar in size and complexity to this project.

4. Control system shall be engineered, programmed and supported completely by representative’s local office that must be within 100 miles of project site.

5. Submit documentation supporting the above requirements and certifying the controls Contractor performing the work has completed at least three DDC systems installations of a similar design to this project, and programmed similar sequences of operation for at least two years. Controls Contractor shall provide a list of at these projects with project information and references.

G. Modification of References

1. The advisory provisions in ASME B31.1 and NFPA 70 are mandatory. Substitute "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Contracting Officer.

H. Project Sequence

1. The control system work for this project shall proceed in the following order:

a. Submit and receive approval on the Shop Drawings, Product Data, and Certificates specified under the paragraph entitled "SUBMITTALS."

b. Perform the control system installation work, including all field check-outs and tuning.

c. Provide support to TAB personnel as specified under the paragraph "TEST AND BALANCE SUPPORT."

d. Submit and receive approval of the Controls System Operators Manual specified under the paragraph "CONTROLS SYSTEM OPERATORS MANUALS."

e. Submit and receive approval of the Performance Verification Testing Plan and the Pre-PVT Checklist specified under the paragraph "PERFORMANCE VERIFICATION TESTING."

f. Perform the Performance Verification Testing.

g. Submit and receive approval on the PVT Report.

h. Submit and receive approval on the Training Documentation specified under the paragraph "INSTRUCTION TO GOVERNMENT PERSONNEL". Submit at least 30 days before training.

i. Deliver the final Controls System Operators Manuals.

j. Conduct Training.

k. Submit and receive approval of Closeout Submittals.

2.00 PRODUCTS

2.01 DDC SYSTEM

Provide a networked DDC system for stand-alone control in compliance with the latest revision of the ANSI/ASHRAE Standard 135 BACnet. Include all programming, objects, and services required to meet the sequence of control. Provide BACnet communications between the DDC system and native BACnet devices furnished with HVAC equipment and plant equipment including boilers, chillers, and variable frequency drives.

Provide an operator workstation laptop with complete interface software capable of programming, configuring, and monitoring the digital controllers.

A. Direct Digital Controllers

1. Direct digital controllers shall be UL 916 rated.

B. I/O Point Limitation

1. The total number of I/O hardware points used by a single stand-alone digital controller, including I/O expansion units, shall not exceed 64, except for complex individual equipment or systems. Place I/O expansion units in the same cabinet as the digital controller.

C. Environmental Limits

1. Controllers shall be suitable for, or placed in protective enclosures suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

D. Stand-Alone Control

1. Provide stand-alone digital controllers.

E. Internal Clock

1. Provide internal clocks for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

F. Memory

1. Provide sufficient memory for each controller to support the required control, communication, trends, alarms, and messages. Protect programs residing in memory with EEPROM, flash memory, or by an uninterruptible power source (battery or uninterruptible power supply). The backup power source shall have capacity to maintain the memory during a 72-hour continuous power outage. Rechargeable power sources shall be constantly charged while the controller is operating under normal line power. Batteries shall be replaceable without soldering. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long.

G. Immunity to Power Fluctuations

1. Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

H. Transformer

1. The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

I. Wiring Terminations

1. Use screw terminal wiring terminations for all field-installed controllers. Provide field-removable modular terminal strip or a termination card connected by a ribbon cable for all controllers other than terminal units.

J. Input and Output Interface

1. Provide hard-wired input and output interface for all controllers as follows:

a. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage.

b. Binary Inputs: Binary inputs shall have a toggle switch and monitor on and off contacts from a "dry" remote device without external power, and external 5-24 VDC voltage inputs.

c. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and accumulate pulses at a resolution suitable to the application.

d. d. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 VDC), current (4-20 mA), or resistance (thermistor or RTD) signals.

e. Binary Outputs: Binary outputs shall have a toggle switch and send a pulsed 24 VDC low-voltage signal for modulation control, or provide a maintained open-closed position for on-off control. For HVAC equipment and plant controllers, provide for manual overrides, either with three-position (on-off-auto) override switches and status lights, or with an adjacent operator display and interface. Where appropriate, provide a method to select normally open or normally closed operation.

f. Analog Outputs: Analog outputs shall send modulating 0-10 VDC or 4-20 mA signals to control output devices.

g. Tri-State Outputs: Tri-State outputs shall provide three-point floating control of terminal unit electronic actuators.

K. Digital Controller BACnet Internetwork

1. Provide a BACnet internetwork with control products, communication media, connectors, repeaters, hubs, and routers. Provide intermediate gateways, only when requested by the Government and shown on the contract drawings, to connect existing non-BACnet devices to the BACnet internetwork. Controller and operator interface communication shall conform to ASHRAE 135, BACnet. Coordinate connections to existing Ethernet backbones with the BAS Owner and LAN administrator. If a controller becomes non-responsive, the remaining controllers shall continue operating and not be affected by the failed controller.

L. Communications Ports

1. Direct-Connect Interface Ports: Provide at least one extra communication port at each local BACnet network for direct connecting a notebook computer or BACnet hand-held terminal so all network BACnet objects and properties may be viewed and edited by the operator.

M. BACnet Gateways

1. Provide BACnet communication ports, whenever available as a plant equipment OEM standard option, for DDC integration via a single communication cable. Typical BACnet controlled plant equipment includes, but is not limited to, boilers, chillers, and variable frequency motor drives.

2. Provide gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC controlled plant equipment, only when specifically requested and approved by the Government, and shown on the Government approved BACnet Communication Architecture Schematic. Provide with each gateway an

interoperability schedule [Use gateway interoperability schedules shown on design drawings or other project documents], showing each point or event on the legacy side that the BACnet "client" will read, and each parameter that the BACnet network will write to. Describe this interoperability in terms of BACnet services, or Interoperability Building Blocks (BIBBS), defined in ASHRAE 135 Annex K. Provide two-year minimum warranty for each gateway, including parts and labor.

3. The following minimum capabilities are required:

    a. Gateways shall be able to read and view all readable object properties listed in the interoperability schedule on the non-BACnet network to the BACnet network and vice versa where applicable.

    b. Gateways shall be able to write to all writeable object properties listed in the interoperability schedule on the non-BACnet network from the BACnet network and vice versa where applicable.

    c. Gateways shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.

    d. Gateways shall meet the requirements of Data Sharing Read Property (DS-RP-B), Data Sharing Write Property (DS-WP-B), Device Management Dynamic Device Binding-B (DM-DDB-B), and Device Management Communication Control (DM-DCC-B) BIBBs, in accordance with ASHRAE 135.

    e. Gateways shall include all hardware, software, software licenses, and configuration tools for operator-to-gateway communications. Provide backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

N. Digital Controller Cabinet

1. Provide each digital controller in a factory fabricated cabinet enclosure. Cabinets located indoors shall protect against dust and have a minimum NEMA 1 rating, except where indicated otherwise. Cabinets located outdoors or in damp environments shall protect against all outdoor conditions and have a minimum NEMA 4 rating. Outdoor control panels and controllers must be able to withstand extreme ambient conditions, without malfunction or failure, whether or not the controlled equipment is running. If necessary, provide a thermostatically controlled panel heater in freezing locations, and an internal ventilating fan in locations exposed to direct sunlight. Cabinets shall have a hinged lockable door and an offset removable metal back plate, except controllers integral with terminal units, like those mounted on VAV boxes. Provide like-keyed locks

for all hinged panels provided and a set of two keys at each panel, with one key inserted in the lock.

O. Main Power Switch and Receptacle

1. Provide each control cabinet with a main external power on/off switch located inside the cabinet. Also provide each cabinet with a separate 120 VAC duplex receptacle.

2.02 SOFTWARE

A. Programming

1. Provide programming to execute the sequence of operation indicated. Provide all programming and tools to configure and program all controllers. Provide programming routines in simple, easy-to-follow logic with detailed text comments describing what the logic does and how it corresponds to the project's written sequence of operation.

a. The Owner shall own and shall have full rights to all features of the software.

b. Graphic-based programming shall use a library of function blocks made from pre-programmed code designed for BAS control. Function blocks shall be assembled with interconnecting lines, depicting the control sequence in a flowchart. If providing a computer with device programming tools as part of the project, graphic programs shall be viewable in real time showing present values and logical results from each function block.

c. Menu-based programming shall be done by entering parameters, definitions, conditions, requirements, and constraints.

d. For line-by-line and text-based programming, declare variable types (local, global, real, integer, etc.) at the beginning of the program. Use descriptive comments frequently to describe the programming.

e. If providing a computer with device programming tools as part of the project, provide a means for detecting program errors and testing software strategies with a simulation tool. Simulation may be inherent within the programming software suite, or provided by physical controllers mounted in a NEMA 1 test enclosure. The test enclosure shall contain one dedicated controller of each type provided under this contract, complete with power supply and relevant accessories.

B. Parameter Modification

1. All writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable for devices at any network level, including those accessible with web-browser communication, and regardless of programming methods used to create the applications.

C. Short Cycling Prevention

1. Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

D. Equipment Status Delay

1. Provide an adjustable delay from when equipment is commanded on or off and when the control program looks to the status input for confirmation.

E. Run Time Accumulation

1. Use the Elapsed Time Property to provide re-settable run time accumulation for each Binary Output Object connected to mechanical loads greater than 1 HP, electrical loads greater than 10 KW, or wherever else specified.

F. Timed Local Override

1. Provide an adjustable override time for each push of a timed local override button.

G. Time Synchronization

1. Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

H. Scheduling

1. Provide operating schedules as indicated, with equipment assigned to groups. Changing the schedule of a group shall change the operating schedule of all equipment in the group. Groups shall be capable of operator creation, modification, and deletion. Provide capability to view and modify schedules in a seven-day week format. Provide capability to enter holiday and override schedules one full year at a time.

I. Object Property Override

1. Allow writeable object property values to accept overrides to any valid value. Where specified or required for the sequence of control, the Out-Of-Service property of Objects shall be modifiable using BACnet's write property service. When documented, exceptions to these requirement are allowed for life, machine, and process safeties.

J. Alarms and Events

1. Alarms and events shall be capable of having programmed time delays and high-low limits. When a computer workstation or web server is connected to the BACnet internetwork, alarms/events shall report to the computer, printer, e-mail, cell phone, as defined by an authorized operator. Otherwise alarms/events shall be stored within a device on the BACnet network until connected to a user interface device and retrieved.

Provide alarms/events in agreement with the point schedule, sequence of operation, and the BAS Owner. At a minimum, provide programming to initiate alarms/events any time a piece of equipment fails to operate, a control point is outside normal range or condition shown on schedules, communication to a device is lost, a device has failed, or a controller has lost its memory.

K. Trending

1. Provide BACnet trend services capable of trending all object present values set points, and other parameters indicated for trending on project schedules. Trends may be associated into groups, and a trend report may be set up for each group. Trends are stored within a device on the BACnet network, with operator selectable trend intervals from 10 seconds up to 60 minutes. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, the most recent data shall overwrite the oldest data.

2. The operator workstation shall upload trends automatically upon reaching 3/4 of the device buffer limit (via Notification Threshold property), by operator request, or by time schedule for archiving. Archived and real-time trend data shall be available for viewing numerically and graphically for at the workstation and connected notebook computers.

L. Device Diagnostics

1. Each controller shall have diagnostic LEDs for power, communication, and device fault condition. The DDC system shall recognize and report a non-responsive controller.

M. Power Loss

1. Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

2.03 BACNET OPERATOR WORKSTATION

The workstation shall be capable of accessing all DDC system devices and communicate using the BACnet protocol. The workstation shall be capable of displaying, modifying, creating, archiving, and deleting (as applicable): all points, objects, object properties, programming, alarms, trends, messages, schedules, and reports.

A. BACnet Operator Workstation Hardware

1. Configure according to system manufacturer's specifications and conforming to BACnet Operator Workstation (B-OWS) device standards found in ASHRAE 135, Annex L. Install to permit complete monitoring and troubleshooting of the DDC system.

2. The operator workstation shall comply with the following specifications:

a. Dell Latitude 5285 2 in 1 Tablet

b. 12.3 inch IPS Display with FHD (1920 x 1080) resolution with 10-pt capacitive touch

c. Microsoft Windows 10 Pro 64 Operating System

d. 64-bit English/French Intel® HD Graphics 620

e. 16GB LPDDR3 1600MHz Memory

f. 360GB Solid State Storage

g. Qualcomm QCA61x4A 802.11ac Dual Band (2x2) Wireless Adapter+ Bluetooth 4.1

h. No DDPE Encryption Software

i. Dell Tablet Dock v2.0 with Gigabit Ethernet

j. Dell Tablet Keyboard – Mobile Documentation

k. Dell Active Stylus

l. Dell WM524 Wireless Travel Mouse

m. Dell Urban 2.0 Top load Carrying Case -15.6”

n. SCM SCR3310V2 Smart USB Card Reader

o. Targus Dell Latitude 13 Laptop Auto/Air Charger

p. 1M High Speed HDMI to HDMI Micro Cable with Ethernet (3.3ft)

q. Dell Adapter – USB 3.0 to Ethernet PXE Boot

r. C2G HDMI Micro to VGA and Stereo Audio Adapter Converter Dongle - Video converter - black Intel® Core™ M-5Y71 vPro™ processor

s. McAfee Security Center 12 month Subscription

t. Intel vPro™ Technology's Advanced Management Features

u. 38Whr Battery

v. Intel Core M-5Y71, 8GB, Wifi/WWAN near Field Communications

w. Integrated 2MP HD Webcam (front) / 8MP (back) Software Driver

x. TPM 1.2 hardware security Regulatory Label

y. 24 Watt AC Adapter

z. Manufacturer’s 3 Year Hardware Service with Onsite Service after Remote Diagnosis

aa. Manufacturer’s 3-year next business day on-site warranty with the Government listed as the warranty owner

bb. Include all original licenses, installation media, documentation, and recovery CDs capable of restoring the original configuration in a three binder with the project information and site location on cover. Include a table of contents as the first page of the binder. The Binder shall be handed over the Owner.

B. Password Protection

1. Provide at least five levels of password protection for operator interfaces. The lowest level only allow viewing graphics. The second level allows viewing graphics and changing space temperature setpoints. The third level allows the previous level's capability, plus changing operating schedules. The fourth level allows access to all functions except passwords. The highest level provides all administrator rights and allows full access to all programming, including setting new passwords and access levels. Provide the BAS Owner with the highest level password access. Provide automatic log out if no keyboard or mouse activity is detected after a user-defined time delay.

C. BACnet Operator Workstation DDC Software

1. Provide the workstation software with the manufacturer's installation CDs and licenses. Configure the software according to the DDC system manufacturer's specifications and in agreement with BACnet Operator Workstation (B-OWS) device standards found in ASHRAE 135, Annex L.

2. The workstation software shall permit complete monitoring, modification, and troubleshooting interface with the DDC system. The operator interface with the software shall be menu-driven with appropriate displays and menu commands to manipulate the DDC system's objects, point data, operating schedules, control routines, system configuration, trends, alarms, messages, graphics, and reports. Trends shall be capable of graphic display in real time, with variables plotted as functions of time. Each alarmed point shall be capable of displaying its alarm history, showing when it went into alarm, if and when it was acknowledged, and when it went out of alarm. The modification of DDC system parameters and object properties shall be accomplished with "fill in the blank" and/or "point and drag" methods. Modifications shall download to the appropriate controllers at the operator's request.

3. The Owner shall own and shall have full rights to all features of the software.

D. Graphics Software

1. Provide web-based system graphics viewable on latest versions of browsers such as Internet Explorer, Chrome, etc. using an industry-standard file format such as HTML, BMP, JPEG, or GIF.

2. Graphic displays shall have full-screen resolution when viewed on the workstation and notebook computers. Dynamic data on graphics pages shall refresh within 10 seconds using an Internet connection, or 30 seconds using a dial-up modem connection. Graphics viewing shall not require additional "plug-in" software like Java, Shockwave and Flash applications unless the software is readily available for free over the Internet, and certified for use with Reserve Component Automation System (RCAS) computers.

3. The graphics shall show the present value and object name for each of the project's I/O points on at least one graphic page. Arrange point values and names on the graphic displays in their appropriate physical locations with respect to the floor plan or equipment graphic displayed. Graphics shall allow the operator to monitor current status, view zone and equipment summaries, use point-and-click navigation between graphic pages, and edit setpoints and parameters directly from the screens. Items in alarm shall be displayed using a different color or other obvious visual indicator. Provide graphics with the following:

    a. Graphic Types: Provide at least one graphic display for each piece of HVAC equipment, building floor, and controlled zone. Indicate dynamic point values, operating statuses, alarm conditions, and control setpoints on each display. Provide summary pages where appropriate.

        1). Building Elevation: For buildings more than one story, provide an elevation view of the building with links to each of the building's floor plans. Simulate the building's architecture and include the building number and floor numbers. If possible, use an actual photograph of the building.

        2). Building Floor Plans: Provide a floor plan graphic for each of the building's floors [and roof] with dynamic display of space temperature and other important data. If used, indicate and provide links to sub-plan areas. If possible, use the project's electronic drawing files for the graphic backgrounds. Provide clear names for important areas, such as "Main Conference Room." Include room names and numbers where applicable. Include features such as stairwells, elevators, and main entrances. Where applicable, include the mechanical room, HVAC equipment, and control component locations, with corresponding links to the equipment graphics.

        3). Sub-plan Areas: Where a building's floor plan is too large to adequately display on the screen, sub-divide the plan into distinct areas, and provide a separate graphic display for each area. Provide same level of detail requested in building floor plan section above.

        4). HVAC Equipment: Provide a graphic display for each piece of HVAC equipment, such as a fan coil unit, VAV terminal, or air handling unit. Equipment shall be represented by a two or three-dimensional drawing. Where multiple pieces of

equipment combine to form a system, such as a central chiller plant or central heating plant, provide one graphic to depict the entire plant. Indicate the equipment, piping, ductwork, dampers, and control valves in the installed location. Include labels for equipment, piping, ductwork, dampers, and control valves. Show the direction of air and water flow. Include dynamic display of applicable object data with clear names in appropriate locations.

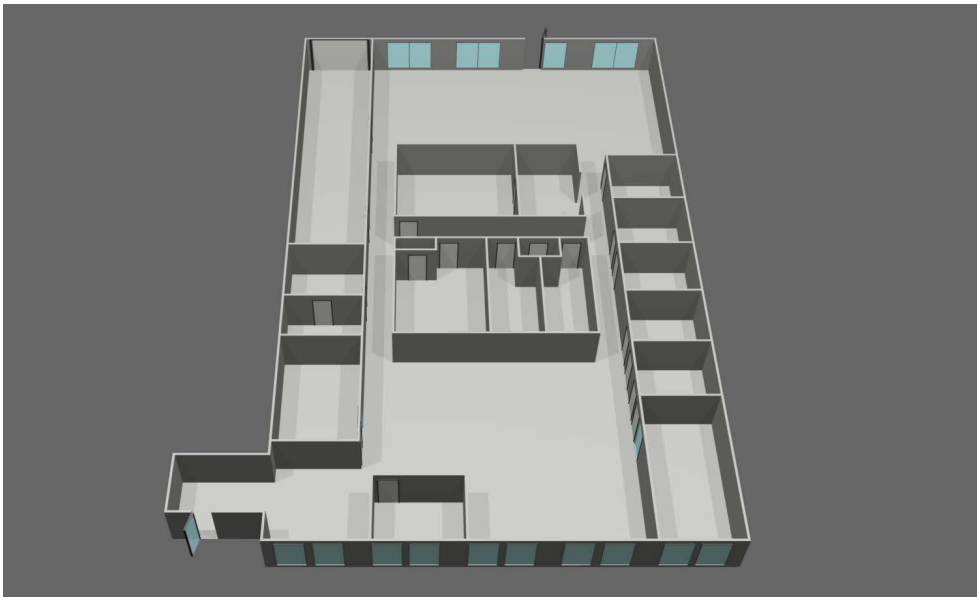
5). Sequence of Operation: Provide a graphic screen displaying the written out full sequence of operation for each piece of HVAC equipment. Provide a link to the sequence of operation displays on their respective equipment graphics.

6). The Contractor shall utilize standard Niagara AX graphics from Tridium. These graphics shall be modified or altered to match the systems and equipment in the project.

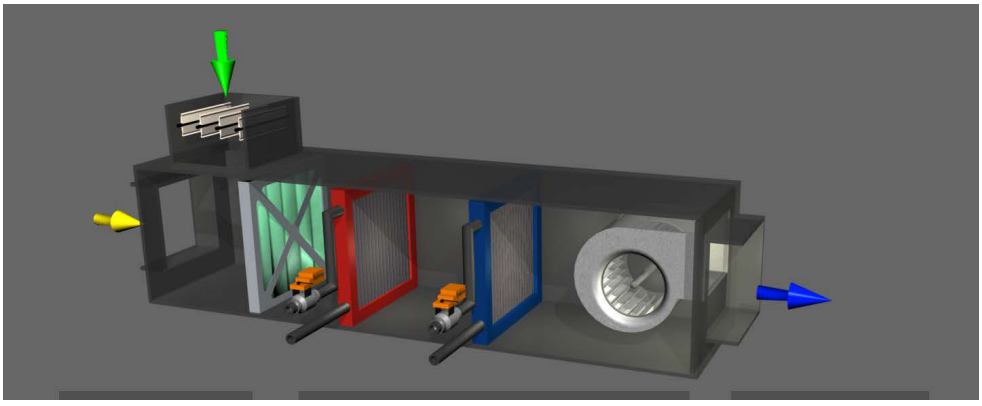
7). The BAS system shall be provided a library of graphics which may be used unaltered or modified by the operator. BAS shall include a library of equipment graphic components to assemble custom graphics. Systems that do not allow customization or creation of new graphic objects by the operator (or with third-party software) shall not be allowed.

8). Sample of Graphics:

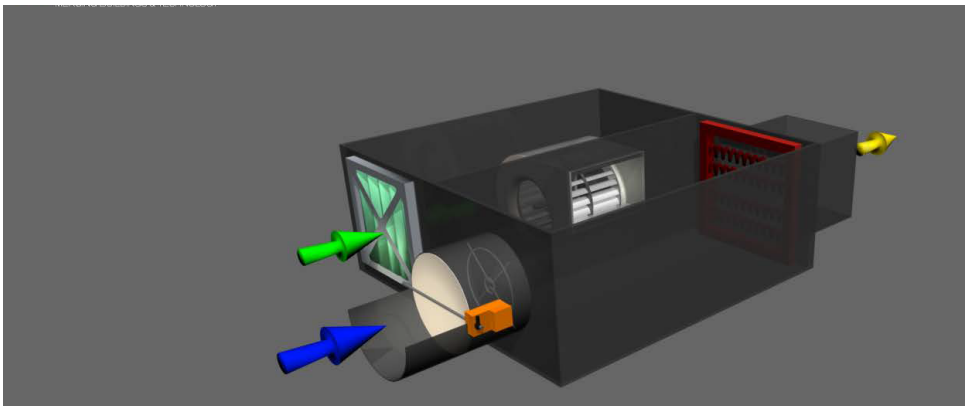
a). Floorplan.



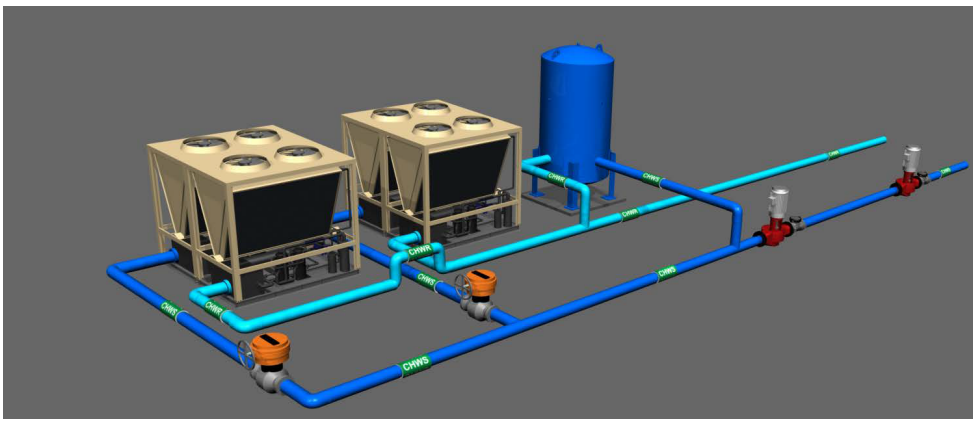
b). Air Handler (will resemble actual equipment type and configuration).



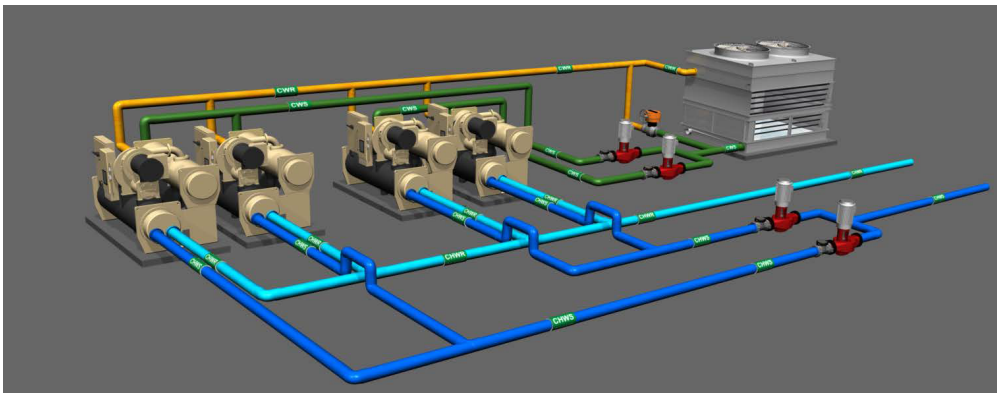
c). VAV Box (will resemble actual equipment type and configuration).



d). Air Cooled Chiller (will resemble actual equipment type and configuration).



e). Chilled Water Plant (will resemble actual equipment type and configuration).



b. Graphic Title: Provide a prominent, descriptive title on each graphic page.

c. Dynamic Update: When the workstation is on-line, all graphic I/O object values shall update with change-of-value services, or by operator selected discrete intervals.

d. Graphic Linking: Provide forward and backward linking between floor plans, sub-plans, and equipment.

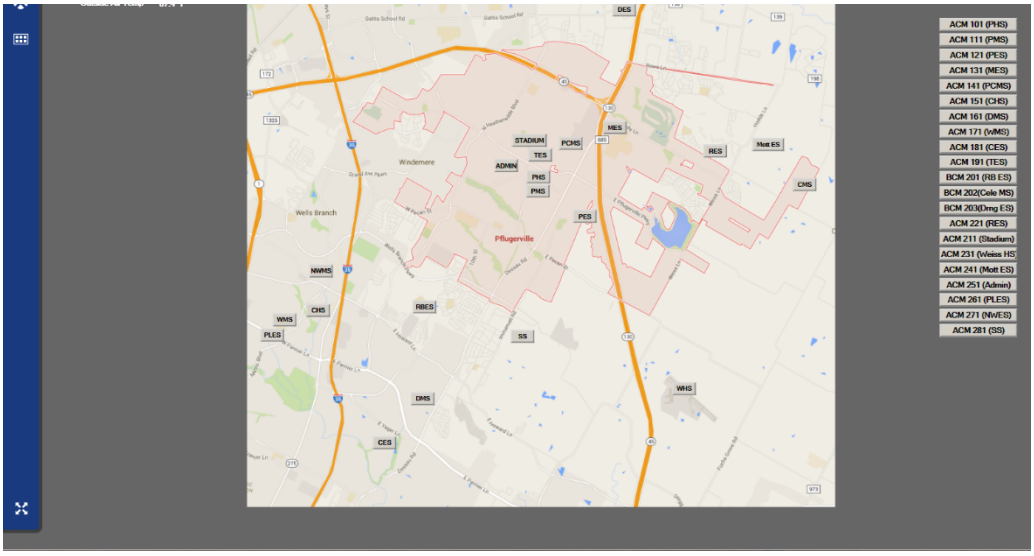
e. Graphic Editing: Provide installed software to create, modify, and delete the DDC graphics. Include the ability to store graphic symbols in a symbol directory and import these symbols into the graphics.

f. Dynamic Point Editing: Provide full editing capability for deleting, adding, and modifying dynamic points on the graphics.

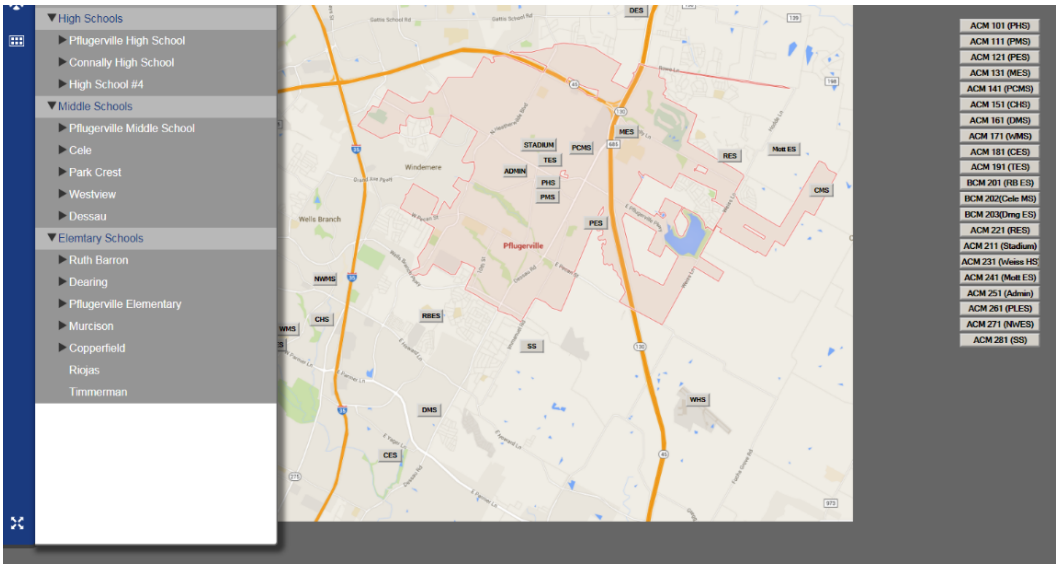
g. Character Limit < 24 characters: With new control systems the limit on the number of characters can range from 30-255 but they should be limited to less than 24 for space constraints in displays and unknown limits that may be imposed from other interfacing systems.

h. Example Front End Graphics Home Page:

1). Front End Home Page.



2). Front End Home Page with Navigation Tree.



i. Point Naming Conventions: Existing systems point names vary by system capabilities and site conventions. The site naming convention must be followed where possible. Approval is required from HNC prior to alternative point name creation. This is to ensure there are no conflicts with the MDMS gateway requirements.

1). Primary equipment names:

a). Servers are named EEDRS. However, the local data center server naming convention takes priority.

b). Building/Facility Point of Connection (BPOC/FPOC). Name is by site and building. Use no space, period or dash unless system constraints dictate otherwise: SiteBuilding#. Example: FTBRAGG3720

c). LON TP/FT10 channel names. Name in this order: Protocol Site Building#. Example: LON Bragg 100. Note that here a space is used to separate.

2). The following point naming conventions are approved for new system installations:

a). SiteName is the Post name.

b). Building# - is the building number containing the meter; it is always the number of the building, although that building number may include a letter.

c). Meter - is the meter type within the building: electric, gas, water, steam; use the word METER for electric meters and the words GAS, WATER, STEAM, BTU for the other types of meters.

d). Meter # - is the meter number (the nth number) within the building.

e). Parameter - is the name of the measured variable

For single site systems:

Building#_Meter_Meter#_Parameter

Building#.Meter_Meter#.Parameter

Example:

BLDG_2315_METER_2_VOLTS_A_B

BLDG_2315.METER_2.VOLTS_A_B

For multi-site systems, where a regional host exists:

SiteName_Building#_Meter_Meter#_Parameter

Sitename.Building#.Meter_Meter#.Parameter

Example:

HOOD_2315_METER_2_KW

HOOD_2315.METER_2.KW

Where a site area designator is required:

SiteName_Area_Building#_METER_Meter#_Parameter

Example:

Hood_A_2315_METER_2_KW

Hood_A.2315.METER_2.KW

Note: Some UMCS host software may automatically attach the Building/Facility Point of Connection (JACEx or NAE) to the point name.

4. Object Naming Conventions: The following naming conventions shall be used:

Systems & Actions	Abbreviation
Adjustment	Adj
Air	Air
Air Flow	AirFlow
Alarm	Alm
Basin	Basin
Breakglass	Breakglass
Building	Bldg
Bypass	Bypass
Carbon Dioxide	Co2
Carbon Dioxide	CO2
Carbon Monoxide	CO
Chilled	Ch
Chilled Water	CHW
Circuit	Ckt
Circuit	Circuit
Closed	Clo
Cold	Cld
Cold Deck	CldDk
Command	Cmd
Condenser	Cd
Condenser Water	CDW
Control	Control
Cooler	Cooler
Cooling	Clg
Cubic Feet per Minute	Cfm
Current	Current
Cut Out	CutOut
Damper	Dmpr
Deck	Dk
Differential	Diff
Differential Pressure	DP
Discharge	Disch
Domestic	Dom
Domestic Cold Water	DCW
Domestic Hot Water	DHW
Duct Smoke Detector	Dsd
Enable	Ena
Energy	Energy
Entering	Ent
Exhaust	Exh
Fan	Fan
Fault	Flt
Filter	Filter
Flow	Flow
Flow Switch	FlowSwitch

Systems & Actions	Abbreviation
Freeze	Freeze
Freezer	Freezer
Gas	Gas
Heat	H
Heater	Heater
Heating	Htg
Heating Hot Water	HHW
High Static	HighStatic
Hot	Hot
Hot Deck	HotDeck
Hot Gas	HotGas
Hot Gas Bypass	HotGasBypass
Hot Water	HW
Relative Humidity	RH
Inlet	Inlet
Isolation	ISO
Leaving	Lvg
Lighting	Ltg
Meter	Meter
Mixed	Mixed
Mixing	Mixing
Occupancy	Occ
Open	Opn
Outlet	Outlet
Outside Air	OA
Override	Ovr
Position	Pos
Potable	Pot
Power	Power
Pre Filter	PreFilter
Preheat	Preheat
Pressure	Press
Primary	Pri
Pulse	Pulse
Recovery	Recovery
Relative Humidity	RH
Re-Heat	ReHeat
Return	Ret
Roof Top	Rooftop
Secondary	Sec
Sensor	Sensor
Setpoint	Stpt
Signal	Signal
Smoke	Smoke
Space	Space

Systems & Actions	Abbreviation
Speed	Speed
Stage	Stage
Start Stop	StartStop
Static	S
Status	Status
Supervisory	Sup
Supply	Supply
System	Sys
Temperature	Temp
Tower	Twr
Trouble	Tbl
Valve	Vlv
Variable	V
Variable Frequency Drive	VFD
Volume	V
Warning	Warn
Water	W
Wheel	Wheel
Zone	Zone

Object Naming Conventions (Contd.)

Equipment & Devices	Abbreviation	Followed by Equipment #
Air Handling Unit	AHU	Yes
Boiler	B	Yes
Chilled Water Pump	CHWP	Yes
Chiller	CH	Yes
Condenser Water Pump	CDWP	Yes
Cooling Tower	CT	Yes
Energy Recovery Unit	ERU	Yes
Exhaust Air Damper	EAD	
Exhaust Fan	EF	Yes
Fan Coil Unit	FCU	Yes
Freezer	Freezer	Yes
Heatpump - Air Rooftop	RTHP	Yes
Heatpump - water	WSHP	Yes
Heatpump Air Split	SSHP	Yes
Hot Water Pump	HWP	Yes
Make Up Air Unit	MUA	Yes
Mixed Air Damper	MAD	
Outside Air Damper	OAD	
Outside Air Unit	OAU	Yes
Primary Chilled Water Pump	PCHWP	
Pump	P	Yes
Return Air Damper	RAD	
Rooftop AC Unit	RTAC	Yes
Secondary Chilled Water Pump	SCHWP	Yes
Split Unit AC	AC	Yes
Supply Air Damper	SAD	
SupplyFan	SF	Yes
Unit Heater	UH	Yes
Variable Air Volume	VAV	Yes

Units	Abbreviation
AC Volts	VAC
Amps	Amps
DC Volts	VDC
Gauge Pressure	PSIG
Kilowatt (real power)	Kw
Kilovolt-Amp (apparent power)	Kva
Milliamps	Ma
Power Factor	Pf
Volts	Volts

Units should always be in the Unit property or facets. These abbrevaitions are used only to differntiate points with simialr names such as as a meter with multiple units example: OutputVAC and OutputKw

Object Name Examples:

Example of Object Name using Recommended Abbreviations	Include Equipment # in Object Name
ANALOG INPUTS - Object Names	
AirFlow	
B3RetTemp	Yes
B3SupplyTemp	Yes
BldgDP	
BldgDPSPress	
CldDkSPress	
CldDkSupplyAirTemp	
CH3DP	Yes
CH3RetAirTemp	Yes
CH3SupplyAirTemp	Yes
CHWDP	
CHWRetTemp	
CHWSupplyTemp	
CoolerTemp	
CT2RetTemp	Yes
CT2SupplyTemp	Yes
CDWRetTemp	
CDWSupplyTemp	
DischAirTemp	
FreezerTemp	
HWRetTemp	
HWSupplyTemp	
KWPulse	
KwhPulse	
MixedAirTemp	
OARH	
OATemp	
PriCHW	
PreHeatTemp	
RetAirCO2	
RetAirRH	
RetAirTemp	
SpaceTemp	
SupplyAirTemp	
SpaceCO2	
SpaceRH	
ZoneSpaceCO2	
ZoneSpaceRH	
ZoneSpaceTemp	
CHWPriSupplyTemp	
CHWPriRetTemp	
CHWSecSupplyTemp	
CHWSecRetTemp	
CT2CDWHotBasinTemp	

Example of Object Name using Recommended Abbreviations	Include Equipment # in Object Name
ANALOG INPUTS - Object Names	
DHWBldgSupplyTemp	
DHWBldgRetTemp	
Meter23Current	Yes
Meter24Volts	Yes
CHWP2Speed	Yes
CHWP2Power, Kw, etc.	Yes
CH2IsoVlvPos	Yes
BINARY INPUTS - Object Names	
B1Alm	Yes
B1Status	Yes
BreakGlassAlm	
CldDkHighStaticCutOutAlm	
CH2Alm	Yes
CH2FlowSwitchAlm	Yes
CH2Status	Yes
CHWP1Status	Yes
CT2FanStatus	Yes
CDWP1Status	Yes
DmprPosStatus	
DuctSmokeDetectorAlm	
EF5Status	Yes
FilterDPStatus	
FanStatus	
FreezeAlm	
HighStaticCutOutAlm	
HWPStatus	
HotDkStaticCutOutAlm	
OccStatus	
PCHWP2Status	Yes
PreFilterDPStatus	
SpaceTempOvrStatus	
RetAirDsdAlm	
SupplyAirDsdAlm	
SCHWP2Status	Yes
ZoneTempOvrStatus	
BINARY OUTPUTS - Object Names	
B2StartStop	Yes
CH2StartStop	Yes
CH2IsoVlvCmd	Yes
CHWBypassVlvStartStop	
CHWP2StartStop	Yes
CT2FanStartStop	Yes
CT2IsoVlvCmd	Yes
CDWP1StartStop	Yes

Example of Object Name using Recommended Abbreviations	Include Equipment # in Object Name
BINARY OUTPUTS - Object Names	
CHWPIsoVlvCmd	Yes
DmprOpnCmd	
EF2StartStop	Yes
FanStartStop	
HotGasBypassCmd	
HWP2StartStop	Yes
HWP2IsoVlvCmd	Yes
LtgCktStartStop	Yes
OADOpnCmd	
PriCHWP2StartStop	Yes
RADOpnCmd	
SupplyAirFanCmd	
SCHWP2StartStop	Yes
Stage2ClgCmd	Yes
Stage2HtgCmd	Yes
ANALOG OUTPUTS - Object Names	
BypassDmprSignal	
CWP2VFDSignal	Yes
CHWVlvSignal	
CT2BasinVlvSignal	Yes
CDWP3SpeedSignal	Yes
CHWBypassVlvSignal	
DmprSignal	
EADSignal	
HWMixingVlvSignal	
HWPMixingVlvSignal	
HWVlvSignal	
OADSignal	
PCHWP2SpeedSignal	Yes
PreheatVlvSignal	
RADSignal	
ReheatVlvSignal	
SFSpeedControl	
SCHWP2SpeedSignal	Yes
Zone3DmprSignal	Yes

a. Character-Object Formatting Rules:

1). Must start with Alpha character

2). No special characters are to be used. The only special character that can be use is an underscore '_' in special cases.

3). Separate naming parts using camelback notation where the first letter is capitalized for each part. Example: DischAirTemp.

4). Specified abbreviations can be in all caps for their part. Example: OATemp

5). Whenever using the names Supply and Return on chilled and condenser water systems. Supply refers to the coldest water and return refers to the warmest water.

6). When naming the temperature output from a thermistor sensing device such as a space temperature sensor ensure the word Sensor is added to the object name, for instance SpaceTempSensor or SupplyAirTempSensor. This identifies the output as coming from the sensor before any offset or calibration. The displayed value after offset or calibration would be an AV and would be labeled as SpaceTemp or SupplyAirTemp. This approach helps to avoid confusion as to where the value comes from during searches for the temperature from thermistor devices. This rule will also apply to any other type of sensor where a raw value is brought in before correction or conversion.

2.04 BACNET PROTOCOL ANALYZER

A. Provide a BACnet protocol analyzer and required cables and fittings for connection to the BACnet network. The analyzer shall include the following minimum capabilities:

1. Capture and store to a file data traffic on all network levels.

2. Measure bandwidth usage.

3. Filtering options with ability to ignore select traffic.

2.05 SENSORS AND INPUT HARDWARE

A. Coordinate sensor types with the BAS Owner to keep them consistent with existing installations.

B. Field-Installed Temperature Sensors

1. Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary.

2. Thermistors

    a. Precision thermistors may be used in applications below 200 degrees F. Sensor accuracy over the application range shall be 0.36 degree F or less between 32 to 150 degrees F. Stability error of the thermistor over five years shall not exceed 0.25 degrees F cumulative. A/D conversion resolution error shall be kept to 0.1 degrees F. Total error for a thermistor circuit shall not exceed 0.5 degrees F.

3. Resistance Temperature Detectors (RTDs)

    a. Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32 degrees F. Temperature sensor stability error over five years shall not exceed 0.25 degrees F cumulative. Direct connection of RTDs to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25 degrees F. The total error for a RTD circuit shall not exceed 0.5 degrees F.

4. Temperature Sensor Details

    a. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor. Provide room temperature sensors with timed override button, setpoint adjustment lever, digital temperature display. Provide a communication port or 802.11x wireless support for a portable operator interface like a notebook computer or PDA.

    b. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.

    c. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 feet.

    d. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.

    e. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.

2.06 TRANSMITTERS

A. Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a year.

1. Relative Humidity Transmitters

a. Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90 percent scale, and less than one percent drift per year. Sensing elements shall be the polymer type.

B. Pressure Transmitters

1. Provide transmitters integral with the pressure transducer.

C. Current Transducers

1. Provide current transducers to monitor motor amperage, unless current switches are shown on design drawings or point tables.

2. Air Quality Sensors

a. Provide power supply for each sensor.

3. CO2 Sensors

a. Provide photo-acoustic type CO2 sensors with integral transducers and linear output. The devices shall read CO2 concentrations between 0 and 2000 ppm with full scale accuracy of at least plus or minus 100 ppm.

D. Air Quality Sensors

1. Provide full spectrum air quality sensors using a hot wire element based on the Taguchi principle. The sensor shall monitor a wide range of gaseous volatile organic components common in indoor air contaminants like paint fumes, solvents, cigarette smoke, and vehicle exhaust. The sensor shall automatically compensate for temperature and humidity, have span and calibration potentiometers, operate on 24 VDC power with output of 0-10 VDC, and have a service rating of 32 to 140 degrees F and 5 to 95 percent relative humidity.

2.07 INPUT SWITCHES

A. Timed Local Overrides

1. Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24 hour continuous operation.

2.08 FREEZE PROTECTION THERMOSTATS

A. Provide special purpose thermostats with flexible capillary elements 20 feet minimum length for coil face areas up to 40 square feet. Provide longer elements for larger coils at 1-foot of element for every 4 square feet of coil face area, or provide additional thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

2.09 AIR FLOW MEASUREMENT STATIONS

A. Air flow measurement stations shall have an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be the RTD or thermistor type, traversing the ducted air in at least two directions. The air flow pressure drop across the station shall not exceed 0.08 inch water gage at a velocity of 2,000 fpm. The station shall be suitable for air flows up to 5,000 fpm, and a temperature range of 40 to 120 degrees F. The station's measurement accuracy over the range of 125 to 2,500 fpm shall be plus or minus 3 percent of the measured velocity. Station transmitters shall provide a linear, temperature-compensated 4 to 20 mA or 0 to 10 VDC output. The output shall be capable of being accurately converted to a corresponding air flow rate in cubic feet per minute. Transmitters shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the measurement.

2.10 ENERGY METERING

A. Electric Meters

1. Provide kilowatt-hour (kWh) meter(s) shown in accordance with NEMA/ANSI C12.10, suitable for the intended voltage, phases, and wye/delta configuration, with three current transformers and an output signal compatible with the DDC system. The meter shall have a box-mounted socket and an automatic circuit-closing bypass. Provide the meter with at least four pointer-type kWh registers, provisions for pulse initiation, and universal Class 2 indicating maximum kW demand register, sweep pointer indicating type, and at minimum a 15-minute interval. The meter accuracy shall be within plus or minus one percent of the actual kWh. Provide the correct multiplier on the meter face. Provide the current transformers in accordance with IEEE C57.13, with 600-volt insulation, and rated for metering with voltage, IL, momentary, and burden ratings

coordinated with the ratings of corresponding meters. Provide butyl-molded donut or window type transformers mounted on a bracket to allow secondary cables to connect to the transformer bushings. Provide wiring identification of the current transformer secondary feeders to permit field measurements to be taken with hook-on ammeters.

2. Electric meter shall be interfaced to the building automation system via BACnet MS/TP. Controls vendor to provide required communication device(s) to interface to the BACnet MS/TP trunk.

B. Gas Service Sub-Meters

1. Smart Sub-Meters: AGA/IAS-listed, positive displacement rotary type, gas meter with built-in diagnostics, compact size, no moving parts, high resolution large LCD screen, pressure compensating, non-temperature compensating, aluminum allow NEMA 3R enclosure, including a commercial grade electronic transmitter/counter and strainer. Factory set meter pressure for 5 psig. Pulse meter output set at 100 cubic feet per pulse. Powered by a replaceable lithium battery with 20-year minimum anticipated life. Provide interface interlocks with BacNet building automation system in the mechanical room. Provide a metering transmitting recording smart meter system including all required appurtenances, devices, fittings for a complete, operable system. Acceptable manufacturer and Model: Meter – Romet, RM3000, or approved equal; with electronic transmitter/counter – Romet, Adem-S, or approved equal; with Pulse output and Cable, 1 pulse = 100CF.

C. Water Meters

1. Smart Sub-Meters: Direct Couple Floating Rotor turbine meter, lead free bronze alloy housing complying with NSF/ANSI Standards 61 and 372. Meters meet or exceed registration accuracy for the low flow rates (95%), normal operating flow rates (100 ± 1.5%), and maximum continuous operation flow rates as specifically stated in AWWA Standard C700. Max. working pressure shall be 150 PSIG. Provide with register as described in paragraph 2 below. Acceptable Manufacturer and Model: Badger Meter Recordall Turbine Meter, or approved equal.

2. Register/Encoder: Electronic flow rate encoder with instant flow rate and accumulated total, and with Scaleable 4-20 mA analog output proportional to flow rate, battery operated. The 4-20mA output of this Register shall be used as the input to the Flow Monitor described in paragraph 3 below. Acceptable Manufacturer and Model: Badger Meter Recordall Encoder, Model HR-LCD 4-20; or approved equal.

3. Flow Monitor: Flow Monitor shall receive the 4-20mA output of the Register via connection cabling (twisted shielded pair). Provide with power supply accessory. Mount monitor near BAS Cabinet on wall at 5’-0”AFF. 120 V electrical power is required for the power supply accessory. Monitor shall be interlocked with and shall communicate with

BacNet building automation system via RS-485 MSTP BACnet MS/TP. Acceptable Manufacturer and Model: Badger Impeller Industrial Flow Monitor, Series 3000-11; or approved equal. Provide with Badger A1028 power supply; or approved equal.

D. BACnet MS/TP Interface

1. All meters shall be interfaced to the building automation system via BACnet MS/TP. Controls vendor to provide required communication device(s) to interface all digital meters to the BACnet MS/TP trunk interfaced to the building level controller.

E. Contactor shall comply with the requirements of the UMCS-MCX Army Metering Program Guidance for Advance Meters Dated 26 May 2016 (Revision 8). A copy of the document is included at the end of this section.

2.11 OUTPUT HARDWARE

A. Control Dampers

1. Refer to 23 33 00 “Air Duct Accessories”. Provide factory manufactured stainless steel dampers where indicated. Control dampers shall comply with SMACNA 1966 except as modified or supplemented by this specification. Published damper leakage rates and respective pressure drops shall have been verified by tests in compliance with AMCA 500-D requirements.

B. Provide damper assembly frames constructed of 0.064 inch minimum thickness stainless steel channels with mitered and welded corners. Damper axles shall be 0.5 inches minimum diameter plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings.

C. Dampers shall be rated for not less than 2000 fpm air velocity. The pressure drop through each damper when full-open shall not exceed 0.04 inches water gage at 1000 fpm face velocity. Damper assemblies in ductwork subject to above 3-inch water gauge static air pressure shall be constructed to meet SMACNA Seal Class "A" construction requirements.

D. Provide the damper operating linkages outside of the air stream, including crank arms, connecting rods, and other hardware that transmits motion from the damper actuators to the dampers, shall be adjustable. Additionally, operating linkages shall be designed and constructed to have a 2 to 1 safety factor when loaded with the maximum required damper operating force. Linkages shall be brass, bronze, galvanized steel, or stainless steel.

E. Provide access doors or panels in hard ceilings and walls for access to all concealed damper operators and damper locking setscrews.

F. For field-installed control dampers, a single damper section shall have blades no longer than 48 inches and no higher than 72 inches. The maximum damper blade width shall be 12 inches. Larger sized dampers shall be built using a combination of sections.

G. Frames shall be at least 2 inches wide. Flat blades shall have edges folded for rigidity. Blades shall be provided with compressible gasket seals along the full length of the blades to prevent air leakage when closed.

H. The damper frames shall be provided with jamb seals to minimize air leakage. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F.

I. The leakage rate of each damper when full-closed shall be no more than 4 cfm per sq. foot of damper face area at 1.0 inches water gage static pressure.

2.12 ACTUATORS

A. Provide direct-drive electric actuators for all control applications, except where indicated otherwise.

B. Electric Actuators

1. Each actuator shall deliver the torque required for continuous uniform motion and shall have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators shall function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds. Provide two-position actuators of single direction, spring return, or reversing type. Provide modulating actuators capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Thermal type actuators may only be used on terminal fan coil units, terminal VAV units, convectors, and unit heaters. Spring return actuators shall be provided on all control dampers and all control valves except terminal fan coil units, terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between.

C. Output Switches

1. Control Relays

a. Field installed and DDC panel relays shall be double pole, double throw, UL listed, with contacts rated for the intended application, indicator light, and dust proof

enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.13 ELECTRICAL POWER AND DISTRIBUTION

A. Transformers

1. Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

B. Surge and Transient Protection

1. Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.

2.14 POWER LINE SURGE PROTECTION

A. Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:

1. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.

2. The device shall react within 5 nanoseconds and automatically reset.

3. The voltage protection threshold, line to neutral, shall be no more than 211 volts.

4. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.

5. The primary suppression system components shall be pure silicon avalanche diodes.

6. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.

7. The device shall have an indication light to indicate the protection components are functioning.

8. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.

9. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.

10. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.

11. The device shall be capable of operating between minus 20 degrees F and plus 122 degrees F.

B. Telephone and Communication Line Surge Protection

1. Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines, in accordance with the following:

a. The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges.

b. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology.

c. The device shall be installed at the distance recommended by its manufacturer.

C. Controller Input/Output Protection

1. Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.

2.15 WIRING

Provide complete electrical wiring for the DDC System, including wiring to transformer primaries. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in enclosed spaces. Examples of these spaces include HVAC plenums, within walls, above suspended ceilings, in attics, and within ductwork.

A. Power Wiring

1. The following requirements are for field-installed wiring:

a. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.

b. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

B. Analog Signal Wiring

1. Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

3.00 EXECUTION

3.01 INSTALLATION

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.

A. BACnet Naming and Addressing

1. Coordinate with the BAS Owner and provide unique naming and addressing for BACnet networks and devices.

a. MAC Address

1). Every BACnet device shall have an assigned and documented MAC Address unique to its network. For Ethernet networks, document the MAC Address assigned at its creation. For ARCNET or MS/TP, assign from 00 to 64.

b. Network Numbering

1). Assign unique numbers to each new network installed on the BACnet internetwork. Provide ability for changing the network number; either by device switches, network computer, or field operator interface. The BACnet internetwork (all possible connected networks) can contain up to 65,534 possible unique networks.

c. Device Object Identifier Property Number

1). Assign unique Device "Object_Identifier" property numbers or device instances for each device on the BACnet internetwork. Provide for future modification of the device instance number; either by device switches, network computer, or field interface. BACnet allows up to 4,194,302 possible unique devices per internetwork.

d. Device Object Name Property Text

1). The Device Object Name property field shall support 32 minimum printable characters. Assign unique Device "Object_Name" property names with plain-English descriptive names for each device

2). For example:

3). The Device Object Name that for the device controlling the chiller plant at Building 3408 would be: Device Object_Name = CW System B3408

4). A Device Object Name for a VAV box controller might be: Device Object_Name = VAV BOX25

e. Object Name Property Text (Other than Device Objects)

1). The Object Name property field shall support 32 minimum printable characters. Assign Object Name properties with plain-English names descriptive of the application. Examples include "Zone 1 Temperature" and "Fan Start/Stop".

f. Object Identifier Property Number (Other than Device Objects)

1). Assign Object Identifier property numbers according to design drawings or tables if provided. If not provided, Object Identifier property numbers may be assigned at the Contractor's discretion but must be approved by the Government. In this case they must be documented and unique for like object types within the device.

B. Minimum BACnet Object Requirements

1. Use of Standard BACnet Objects

a. For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and all relevant object properties can be modified using BACnet's Write Property Service: all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

b. BACnet Object Description Property

1). The Object Description property shall support 32 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.

c. Analog Input, Output, and Value Objects

1). Support and provide Description and/or Device Type text strings matching signal type and engineering units shown on the points list.

d. Binary Input, Output, and Value Objects

1). Support and provide Inactive Text and Active Text property descriptions matching conditions shown on the points list.

e. Calendar Object

1). For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. All operators may view Calendar Objects; authorized operators may make modifications from a workstation. Enable the writeable Date List property and support all calendar entry data types.

f. Schedule Object

1). Use Schedule Objects for all building system scheduling. All operators may view schedule entries; authorized operators may modify schedules from a workstation.

g. Loop Object or Equal

1). Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint, Proportional Constant, Integral Constant, and Derivative Constant using BACnet read/write services.

C. Minimum BACnet Service Requirements

1. Command Priorities: Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below. If the sequence of operation requires a different priority, obtain approval from the Contracting Officer.

Priority Level	Application
1	Manual-Life Safety

2	Automatic-Life Safety
3	(User Defined)
4	(User Defined)
5	Critical Equipment Control
6	Minimum On/Off
7	(User Defined)
8	Manual Operator
9	(User Defined)
10	(User Defined)
11	Load Shedding
12	(User Defined)
13	(User Defined)
14	(User Defined)
15	(User Defined)
16	(User Defined)

2. Alarming

    a. Alarm Priorities - Coordinate alarm and event notification with the BAS Owner.

    b. Notification Class - Enable writeable Priority, Ack Required, and Recipient List properties of Notification Class objects.

    c. Event Notification Message Texts - Use condition specific narrative text and numerical references for alarm and event notification.

3. Updating Displayed Property Values

    a. Allow workstations to display property values at discrete polled intervals, or based on receipt of confirmed and unconfirmed Change of Value notifications. The COV increment shall be adjustable by an operator using BACnet services, and polled intervals shall be adjustable at the operator workstation.

D. Local Area Networks

1. Obtain Government approval before connecting new networks with existing networks. Network numbers and device instance numbers shall remain unique when joining networks. Do not change existing network addressing without Government approval. See also "BACnet Naming and Addressing".

E. BACnet Routers, Bridges, and Switches

1. Provide the quantity of BACnet routers, bridges, and switches necessary for communications shown on the BACnet Communication Architecture schematic. Provide BACnet routers with BACnet Broadcast Message Device (BBMD) capability on each BACnet internetwork communicating across an IP network. Configure each BACnet device and bridge, router, or switch to communicate on its network segment.

F. Wiring Criteria

1. Run circuits operating at more than 100 volts in rigid or flexible conduit, metallic tubing, covered metal raceways, or armored cable.

2. Do not run binary control circuit wiring in the same conduit as power wiring over 100 volts. Where analog signal wiring requires conduit, do not run in the same conduit with AC power circuits or control circuits operating at more than 100 volts.

3. Provide circuit and wiring protection required by NFPA 70.

4. Run all wiring located inside mechanical rooms in conduit.

5. Do not bury aluminum-sheathed cable or aluminum conduit in concrete.

6. Input/output identification: Permanently label each field-installed wire, cable, and pneumatic tube at each end with descriptive text using a commercial wire marking system that fully encircles the wire, cable, or tube. Locate the markers within 2 inches of each termination. Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the word "power" in the label. Number each pneumatic tube every six feet. Label all terminal blocks with alpha/numeric labels. All wiring and the wiring methods shall be in accordance with UL 508A.

7. For controller power, provide new 120 VAC circuits, with ground. Provide each circuit with a dedicated breaker, and run wiring in its own conduit, separate from any control wiring. Connect the controller's ground wire to the electrical panel ground; conduit grounds are not acceptable.

8. Surge Protection: Install surge protection according to manufacturer's instructions. Multiple controllers fed from a common power supply may be protected by common surge protector, properly sized for the total connected devices.

9. Grounding: Ground controllers and cabinets to a good earth ground as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Conduit grounding is not acceptable; all grounding shall have a direct path to the building earth ground. Ground sensor drain wire shields at the controller end.

10. The Contractor shall be responsible for correcting all associated ground loop problems.

11. Run wiring in panel enclosures in covered wire track.

G. Accessibility

1. Install all equipment so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install digital controllers, data ports, and

concealed actuators, valves, dampers, and like equipment in locations freely accessible through access doors.

H. Digital Controllers

1. Install as stand alone control devices (see definitions).

2. Locate control cabinets at the locations shown on the drawings. If not shown on the drawings, install in the most accessible space, close to the controlled equipment.

I. Hand-Off-Auto Switches

1. Wire safety controls such as smoke detectors and freeze protection thermostats to protect the equipment during both hand and auto operation.

J. Temperature Sensors

1. Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.

K. Room Temperature Sensors

1. Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor at the heights indicated on drawings.

L. Duct Temperature Sensors

1. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.

2. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit, maximum 18 by 18 inches. For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.

M. Outside Air Temperature Sensors

1. Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.

N. Energy Meters

1. Locate energy meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage. Refer to design drawings for more information.

O. Damper Actuators

1. Where possible, mount actuators outside the air stream in accessible areas.

P. Thermometers and Gages

1. Mount devices to allow reading while standing on the floor or ground, as applicable.

Q. Pressure Sensors

1. Locate pressure sensors as indicated.

R. Component Identification Labeling

1. Using an electronic hand-held label maker with white tape and bold black block lettering, provide an identification label on the exterior of each new control panel, control device, actuator, and sensor. Also provide labels on the exterior of each new control actuator indicating the (full) open and (full) closed positions. For labels located outdoors, use exterior grade label tape, and provide labels on both the inside and outside of the panel door or device cover. Acceptable alternatives are white plastic labels with engraved bold black block lettering permanently attached to the control panel, control device, actuator, and sensor. Have the labels and wording approved by the BAS Owner prior to installation.

S. Network and Telephone Communication Lines

1. When telephone lines or network connections by the Government are required, provide the Contracting Officer at least 60 days advance notice of need.

3.02 TEST AND BALANCE SUPPORT

A. The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel specified under Section 23 05 93 TESTING, ADJUSTING AND BALANCING. This support shall include:

1. On-site operation and manipulation of control systems during the testing and balancing.

2. Control setpoint adjustments for balancing all relevant mechanical systems, including VAV boxes.

3. Tuning control loops with setpoints and adjustments determined by TAB personnel.

3.03 CONTROLS SYSTEM OPERATORS MANUALS

A. Provide two electronic and printed copies of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.

B. Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable. Provide CDs in jewel case with printed and dated project-specific labels on both the CD and the case. For text and drawings, use Adobe Acrobat or MS Office file types. When approved by the Government, AutoCAD and Visio files are allowed. Give files descriptive English names and organize in folders.

C. Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls

contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:

1. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph "Submittals." Indicate all field changes and modifications.

2. A copy of the project's mechanical design drawings, including any official modifications and revisions.

3. A copy of the project's approved Product Data submittals provided under the paragraph "Submittals."

4. A copy of the project's approved Performance Verification Testing Plan and Report.

5. A copy of the project's approved final TAB Report.

6. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.

7. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.

8. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.

9. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.

10. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.

11. A written statement entitled "Technical Support" stating the control system manufacturer or authorized representative will provide toll-free telephone technical support at no additional cost to the Government for a minimum of two years from project acceptance, will be furnished by experienced service technicians, and will be available during normal weekday working hours. Include the toll-free technical support telephone number.

12. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Government for a minimum of two years from contract acceptance. Include a table of all

DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

D. Storage Cabinets

1. In each project mechanical room, provide a wall-mounted metal storage cabinet with hinged doors. In addition to the number of manuals specified above, provide an additional copy of the manuals in each of these mechanical room storage cabinets. Provide cabinets large enough to hold the entire set of Controls System Operators Manuals, and the HVAC operation and maintenance manuals provided under Division 15 MECHANICAL. Locate cabinets adjacent to DDC control panels where applicable. Have each cabinet's proposed installation site approved in advance by the Contracting Officer and the BAS Owner. Prominently label each cabinet with the wording "OPERATION AND MAINTENANCE MANUALS." Prominently label each binder with the wording "MECHANICAL ROOM COPY - DO NOT REMOVE."

3.04 PERFORMANCE VERIFICATION TESTING (PVT)

A. General

1. The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor and witnessed and approved by the Engineer and/or Government’s approved representative. If the project is phased, provide separate testing for each phase. A Pre-PVT meeting to review the Pre-PVT Checklist is required to coordinate all aspects of the PVT and shall include the Contractor's QA representative, the Contractor's PVT administrator, the Contracting Officer's representative, and the BAS Owner.

B. Performance Verification Testing Plan

1. Submit a detailed PVT Plan of the proposed testing for the Engineer and/or Government’s approved representative approval. Develop the PVT Plan specifically for the control system in this contract. The PVT Plan shall be a clear list of test items arranged in a logical sequence. Include the intended test procedure, the expected response, and the pass/fail criteria for every component tested.

2. The plan shall clearly describe how each item is tested, indicate where assisting personnel are required (like the mechanical contractor), and include what procedures are used to simulate conditions. Include a separate column for each checked item and extra space for comments. Where sequences of operations are checked, insert each corresponding routine from the project’s sequence of operation. For each test area, include signature and date lines for the Contractor's PVT administrator, the Contractor's QA representative, the Contracting Officer's representative, and the BAS Owner to

acknowledge successful completion. The BAS Owner can provide sample PVT forms and procedures upon request.

C. PVT Sample Size

1. Test all central plant equipment and primary air handling unit controllers unless otherwise directed. Twenty percent sample testing is allowed for identical controllers typical of terminal control like VAV boxes and fan coil units. The Engineer and/or Government's approved representative may require testing of like controllers beyond a statistical sample if sample controllers require retesting or do not have consistent results.

2. The Engineer and/or Government's approved representative may witness all testing, or random samples of PVT items. When only random samples are witnessed, the Engineer and/or Government's approved representative may choose which ones.

D. Pre-Performance Verification Testing Checklist

1. Submit the following as a list with items checked off once verified. Provide a detailed explanation for any items that are not completed or verified.

a. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).

b. Verify HVAC motors operate below full-load amperage ratings.

c. Verify all required control system components, wiring, and accessories are installed.

d. Verify the installed control system architecture matches approved drawings.

e. Verify all control circuits operate at the proper voltage and are free from grounds or faults.

f. Verify all required surge protection is installed.

g. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.

h. Verify all DDC network communications function properly, including uploading and downloading programming changes.

i. Using the BACnet protocol analyzer (if provided or required in this specification), verify communications are error free.

j. Verify each digital controller's programming is backed up.

k. Verify all wiring, components, and panels are properly labeled.

l. Verify all required points are programmed into devices.

m. Verify all TAB work affecting controls is complete.

n. Verify all valve and actuator zero and span adjustments are set properly.

o. Verify all sensor readings are accurate and calibrated.

p. Verify each control valve and actuator goes to normal position upon loss of power.

q. Verify all control loops are tuned for smooth and stable operation.

1). View trend data where applicable.

r. Verify each controller works properly in stand-alone mode.

s. Verify all safety controls and devices function properly, including freeze protection and interfaces with building fire alarm systems.

t. Verify all electrical interlocks work properly.

u. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each workstation and notebook.

v. Verify the as-built (shop) control drawings are completed.

E. Conducting Performance Verification Testing

1. Conduct Engineer and/or Government’s approved representative witnessed PVT after approval of the PVT Plan and the completed Pre-PVT Checklist. Notify the Engineer and/or Government’s approved representative of the planned PVT at least 15 days prior to testing. Provide an estimated time table required to perform the testing. Furnish personnel, equipment, instrumentation, and supplies necessary to perform all aspects of the PVT. Ensure that testing personnel are regularly employed in the testing and calibration of DDC systems. Using the project's as-built control system (shop) drawings, the project's mechanical design drawings, the approved Pre-PVT Checklist, and the approved PVT Plan, conduct the PVT.

2. During testing, identify any items that do not meet the contract requirements and if time permits, conduct immediate repairs and re-test. Otherwise, deficiencies shall be investigated, corrected, and re-tested later. Document each deficiency and corrective action taken.

3. If re-testing is required, follow the procedures for the initial PVT. The Government may require re-testing of any control system components affected by the original failed test.

F. Controller Capability and Labeling Test the following for each controller:

1. Memory: Demonstrate that programmed data, parameters, and trend/ alarm history collected during normal operation is not lost during power failure.

2. Direct Connect Interface: Demonstrate the ability to connect directly to each type of digital controller with a portable electronic device like a notebook computer or PDA. Show that maintenance personnel interface tools perform as specified in the manufacturer's technical literature.

3. Stand Alone Ability: Demonstrate controllers provide stable and reliable stand-alone operation using default values or other method for values normally read over the network.

4. Wiring and AC Power: Demonstrate the ability to disconnect any controller safely from its power source using the AC Power Table. Demonstrate the ability to match wiring labels easily with the control drawings. Demonstrate the ability to locate a controller's location using the BACnet Communication Architecture Schematic and floor plans.

5. Nameplates and Tags: Show the nameplates and tags are accurate and permanently attached to control panel doors, devices, sensors, and actuators.

G. Workstation and Software Operation: For every user workstation or notebook provided:

1. Show points lists agree with naming conventions.

2. Show that graphics are complete.

3. Show the UPS operates as specified.

H. BACnet Communications and Interoperability Areas

1. Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. If available or required in this specification, use a BACnet protocol analyzer to assist with identifying devices, viewing network traffic, and verifying interoperability. These requirements must be met even if there is only one manufacturer of equipment installed. Testing includes the following:

a. Data Presentation: On each BACnet Operator Workstation, demonstrate graphic display capabilities.

b. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.

c. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters in the sequence of control or listed on project schedules.

Modifications are made with BACnet messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.

d. Peer-to-Peer Data Exchange: Show all BACnet devices are installed and configured to perform BACnet read/write services directly (without the need for operator or workstation intervention), to implement the project sequence of operation, and to share global data.

e. Alarm and Event Management: Show that alarms/events are installed and prioritized according to the BAS Owner. Demonstrate time delays and other logic is set up to avoid nuisance tripping, e.g., no status alarms during unoccupied times or high supply air during cold morning start-up. Show that operators with sufficient privilege can read and write alarm/event parameters for all standard BACnet event types. Show that operators with sufficient privilege can change routing (BACnet notification classes) for each alarm/event including the destination, priority, day of week, time of day, and the type of transition involved (TO-OFF NORMAL, TO-NORMAL, etc.).

f. Schedule Lists: Show that schedules are configured for start/stop, mode change, occupant overrides, and night setback as defined in the sequence of operations.

g. Schedule Display and Modification: Show the ability to display any schedule with start and stop times for the calendar year. Show that all calendar entries and schedules are modifiable from any connected workstation by an operator with sufficient privilege.

h. Archival Storage of Data: Show that data archiving is handled by the operator workstation/server, and local trend archiving and display is accomplished with BACnet Trend Log objects.

i. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.

j. Device and Network Management: Show the following capabilities:

    1). Display of Device Status Information

    2). Display of BACnet Object Information

    3). Silencing Devices that are Transmitting Erroneous Data

    4). Time Synchronization

    5). Remote Device Reinitialization

6). Backup and Restore Device Programming and Master Database(s)

7). Configuration Management of Half-Routers, Routers and BBMDs

I. Execution of Sequence of Operation

1. Demonstrate that the HVAC system operates properly through the complete sequence of operation. Use read/write property services to globally read and modify parameters over the internetwork.

J. Control Loop Stability and Accuracy

1. For all control loops tested, give the Engineer and/or Government's approved representative trend graphs of the control variable over time, demonstrating that the control loop responds to a 20 percent sudden change of the control variable set point without excessive overshoot and undershoot. If the process does not allow a 20 percent set point change, use the largest change possible. Show that once the new set point is reached, it is stable and maintained. Control loop trend data shall be in real-time with the time between data points 30 seconds or less.

K. Performance Verification Testing Report

1. Upon successful completion of the PVT, submit a PVT Report to the Engineer and/or Government's approved representative and prior to the Government taking use and possession of the facility. Do not submit the report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action taken. Include a written certification that the installation and testing of the control system is complete and meets all of the contract's requirements.

3.05 TRAINING REQUIREMENTS

Provide a qualified instructor (or instructors) with two years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Contracting Officer and BAS Owner after receiving approval of the training course documentation. Training shall take place at the job site and/or a nearby Government-furnished location. A training day shall occur during normal working hours, last no longer than 8 hours and include a one-hour break for lunch and two additional 15-minute breaks. The project's approved Controls System Operators Manual shall be used as the training text. The Contractor shall ensure the manuals are submitted, approved, and available to hand out to the trainees before the start of training.

A. Training Documentation

1. Submit training documentation for review 30 days minimum before training. Documentation shall include an agenda for each training day, objectives, a synopses of each lesson, and the instructor's background and qualifications. The training

documentation can be submitted at the same time as the project's Controls System Operators Manual.

B. Training

1. Provide a total of 80 hours of training to the Government. This shall be split into one (1) day onsite training, one (1) day classroom training and the remaining hours shall be distributed at 8 hours training session every quarter. The training hours shall not have an expiry date. The training session shall be conducted in a classroom environment with complete audio-visual aids provided by the contractor. The trainee shall have a laptop computer connected to the DDC system workstation Provide each trainee a printed 8.5 by 11 inch hard-copy of all visual aids used. Upon completion of the Training, each trainee should fully understand the project's DDC system fundamentals and system operation. The training session shall include the following:

    a. BACnet fundamentals (objects, services, addressing) and how/where they are used on this project

    b. This project's list of control system components

    c. This project's list of points and objects

    d. This project's device and network communication architecture

    e. This project's sequences of control, and:

    f. Alarm capabilities

    g. Trending capabilities

    h. Troubleshooting communication errors

    i. Troubleshooting hardware errors

    j. A walk-through tour of the mechanical system and the installed DDC components (controllers, valves, dampers, surge protection, switches, thermostats, sensors, etc.)

    k. A discussion of the components and functions at each DDC panel c. Logging- in and navigating at each operator interface type

    l. Using each operator interface to find, read, and write to specific controllers and objects

    m. Modifying and downloading control program changes

    n. Modifying setpoints

    o. Creating, editing, and viewing trends

p. Creating, editing, and viewing alarms

q. Creating, editing, and viewing operating schedules and schedule objects

r. Backing-up and restoring programming and data bases

s. Modifying graphic text, backgrounds, dynamic data displays, and links to other graphics

t. Creating new graphics and adding new dynamic data displays and links

u. Alarm and Event management

v. Adding and removing network devices

3.06 UMCS-MCX ARMY METERING PROGRAM GUIDANCE FOR ADVANCED METERS

UMCS-MCX
Army Metering Program
Guidance for Advanced Meters

26 May 2016
Revision 8

Note: Revision 8 deletes the reference to AWWA C706 in Paragraph 3.5 Water Meter as it no longer exists and has no replacement.

Purpose:

a. The purpose of the following guidance is to achieve meter equipment compatibility with the Army Metering Program pursuant to Public Law 109-58, Section 103 of the Energy Policy Act of 2005. This does not replace the Unified Facility Guide Specifications on metering; additional technical and installation requirements and applicable references may be located there as needed. This guidance provides guidance to meet the minimum requirements for metering as established by public law and Army policy. The intent is for all advanced meters to report their data to an installation-centric energy reporting and management system such as a Utility Monitoring and Control System or Advanced Metering Data Management System (MDMS) Installation Level front end. This approach is consistent with UFC 1-200-02, High Performance and Sustainable Building Requirements**,** Paragraphs 2-4.4 and 3-4.3, Measurement, states: "All meters must be connected to a base wide energy and utility monitoring and control system using the installation's advanced metering protocols. The installation of meters is required per DoDI 4170.11." The advanced meters must provide data at least daily and measure at least hourly consumption of electricity in fifteen minute intervals.

b. General Theory of Operation: Utility Meters are installed to monitor electricity, gas, water, and steam usage. Typically, meters are connected to a field control network utilizing either LonTalk

(ANSI 709.1-C) over TP/FT-10, Modbus RTU over EIA 485, or BACnet over EIA 485. Generally, meters communicate over a local building-level network to a building/facility point of connection (BPOC/FPOC) which then communicates via the installation's Network Enterprise Center (NEC) IP network to an "Installation Level Front End", often an existing Utility Monitoring and Control System/Energy Monitoring and Control System (UMCS/EMCS) Front-End server. Meter data is provided to the graphical user interface for display and to any associated UMCS applications programmed to optimize operations. The data is then stored in a Structured Query Language (SQL) database. The SQL database may be the database regularly used by the UMCS applications or a separate SQL database installed specifically for meter data. On a regular basis the MDMS Gateway, located in the DMZ (demilitarized zone) of the installation (outside the inner firewall), or RCC (Regional Cyber Center), retrieves data from the SQL database and sends it to the MDMS Enterprise Server.

Notes:

1) In some cases electric meters may be connected directly to an IP network, but this is considered a non-standard approach.

2) The approach detailed above is used for other (non-electrical) metering also, but generally only total consumption is measured for non-electricity meters, and non-electricity meters may provide a pulse output that is measured by an electric meter digital input or controller on the network in lieu of being connected to the network themselves. Electrical meters with additional external digital inputs are allowed for other meter data collection.

c. The means for meter data transmission using open-protocols such as ANSI/CEA 709.1-C, Modbus RTU, and BACnet over Government owned transport media (LAN, telephone carrier, wireless, radio, microwave, or power line carrier, etc.) will be site specific and subject to the approval of the Network Enterprise Center (NEC). This guidance provides the flexibility needed to support the various data transmission system alternatives in addition to meeting the minimum standards for energy consumption data recording and reporting. A key element for success will be integrating these systems with the Army's Information Technology (IT) networks supported by Network Enterprise Centers (NEC).

Applicability: These requirements apply to all Army meters for use on facilities that meet the size and energy-consumption selection criteria regardless of the funding source and method of procurement (i.e. Military Construction Army (MCA) projects, Utility Privatization contracts, Energy Savings and Performance Contracts, or Sustainment Modernization and Repair projects).

Definitions:

a. Advanced Metering Data Management System Installation Level front end. This term as used in the guidance refers to the system that will collect, manage, and display the meter data for the local energy manager. It may be a new system or it may consist of the existing Legacy UMCS/EMCS and its associated building level controllers that have been upgraded with the necessary hardware/software as

required. The intent of the Army Metering Program is to provide the metering data to the local engineering staff first within the building automation system that can execute application programs to affect savings, and then transmit to the Enterprise Meter Data Management System, when activated.

b. Advanced Meters. For this guidance, Advanced Meters are those that have the capability to measure and record interval data (at least hourly for electricity), and communicate the data to a remote location in a format that can be easily integrated into an advanced meter data management system. EPAct Section 103 requires at least daily data collection capability; and although the policy requires at least hourly, to best analyze rate data, a 15 minute recording interval is recommended. Most advanced meters offer additional features which may be attractive to system owners. Advanced meters do not offer two way communications or a kill switch for power to the facility. These functions are normally associated with smart meters.

References:

a. UFGS 25 10 10, Utility Monitoring and Control System (UMCS) Front End and Integration

b. UFGS 26 27 13.10 30, Electric Meters - prepared by the Air Force

c. UFGS 26 27 14.00 20, Electricity Metering - prepared by the Navy

d. UFGS 33 51 13.00 30, Natural-Gas Metering - prepared by the Air Force

e. UFGS 33 12 33.00 30, Water Utility Metering - prepared by the Air Force

f. UFGS 33 63 23, Exterior Aboveground Steam Distribution - prepared by the Navy

g. UFC 1-200-02, High Performance and Sustainable Buildings

With respect to the two Electrical Metering Guide specifications and although these are listed as Unified in the Construction Criteria Base, the preparing activity has focused on their specific requirements that may not fulfill the Army's needs. However, as this Mandatory Center of Expertise (MCX) guidance is not intended to provide the level of detail for contract requirements, the designer should refer to these as needed, edit for the specific project, and include the detail for completeness. The Navy specification has some excellent drawings/sketches that are useful. The goal is to create a truly unified Electrical Metering Specification in FY16.

h. Additional documentation noted below is available as separate electronic media files upon request. Contact the POC listed on last page.

1. Enterprise Energy Data Reporting System Security Functional Architecture Ver. 2.3.1
2. Advanced Meter Points List

3. I3A Technical Criteria Feb 2010

CONTENT OUTLINE

1.0 Installation Level Front End Computer
- 1.1 Open Protocol
- 1.2 Meter Data Storage and Point Naming Conventions
- 1.3 Meter Identification and Location Data
- 1.4 Storage of Metered Data
- 1.5 Workstation Display
- 1.6 Energy Reports

2.0 Communications
- 2.1 Between Meters and Installation Level Front End
- 2.2 Between Installation Level Front End and Enterprise MDMS System
- 2.3 Cybersecurity Requirements

3.0 Meters
- 3.1 Environmental Tolerances of Metering Devices
- 3.2 Advanced Meter Capability
  - 3.2.1 Communication Protocol and Methods
  - 3.2.2 Pulse Input Data Port Interface
  - 3.2.3 Data Storage and Trend Logs
  - 3.2.4 Meter Display
- 3.3 Electric Meter
  - 3.3.1 Power Systems
  - 3.3.2 Measured Values (mandatory and optional)
  - 3.3.3 Accuracy
  - 3.3.4 Surge Protection
  - 3.3.5 Instrumentation (CTs and PTs)
  - 3.3.6 Disconnects and Shorting Blocks
- 3.4 Gas Meter
  - 3.4.1 Requirements
  - 3.4.2 Gas Meter Types
  - 3.4.3 Valves and Regulators
  - 3.4.4 Gas Meter Installation
  - 3.4.5 Connections
  - 3.4.6 Pressure and Leak Tests
- 3.5 Water Meter
  - 3.5.1 Requirements
  - 3.5.2 Water Meter Types
  - 3.5.3 Water Meter Installation
  - 3.5.4 Valves

3.5.5 Connections
3.5.6 Disinfection
3.5.7 Tests and Inspections
3.6 Steam Meter
3.6.1 Requirements
3.6.2 Steam Meter Types
3.6.3 Steam Meter Installation
3.6.4 Piping Tests
4.0 Execution
4.1 Installation
4.2 Drawings
4.3 Scheduling of Work and Outages
4.4 Field Applied Painting
4.5 Cleanup
5.0 Testing and Checkout
5.1 Performance Verification Test (PVT)
5.2 Contractor's Field Tests (CFT)
6.0 Training

1.0 INSTALLATION LEVEL FRONT END COMPUTER

1.1 Open Protocol. Where no existing UMCS/EMCS can satisfy the Advanced Metering Data Management System Installation Level requirements, the design shall include a LonWorks based, BACnet based, or Niagara Framework (Tridium) based Open System Host for the front end data management system. The Open System Host shall be installed in accordance with UFGS 25 10 10, Utility Monitoring and Control System (UMCS) Front End and Integration. There are new open protocol building level specifications published at wbdg.org:

a. UFGS 23 09 00, Instrumentation and Control for HVAC;

b. UFGS 23 09 23.01, LonWorks Direct Digital Control for HVAC and Other Building Control Systems; and

c. UFGS 23 09 23.02, BACnet Direct Digital Control for HVAC and Other Building Control Systems.

These will all provide guidance on their specific communication media.

1.2 Meter Data Storage and Point Naming Conventions. The meter data shall be stored per the defined convention shown below in a full version Microsoft SQL data base for future retrieval by others. The future site Meter Data Management System (MDMS) Gateway will retrieve and re-transmit the meter data to an Enterprise Army Meter Data Management System. The contractor supplied Microsoft SQL database may be native to the Host UMCS/Metering Front-End or an entirely separate SQL database

dedicated to SQL data storage. The Contractor must follow the applicable Security Configuration Guide for SQL partitioning and hardening procedures.

a. Existing UMCS systems point names vary by system capabilities and site conventions. The site naming convention must be followed where possible. Approval is required from HNC prior to alternative point name creation. This is to ensure there are no conflicts with the MDMS gateway requirements.

b. Primary equipment names:

- Servers are named EEDRS. However, the local data center server naming convention takes priority.

- Building/Facility Point of Connection (BPOC/FPOC). Name is by site and building. Use no space, period or dash unless system constraints dictate otherwise: SiteBuilding#. Example: FTBRAGG3720

- LON TP/FT10 channel names. Name in this order: Protocol Site Building#. Example: LON Bragg 100. Note that here a space is used to separate.

c. The following point naming conventions are approved for new system installations:

SiteName is the Post name.

Building# - is the building number containing the meter; it is always the number of the building, although that building number may include a letter.

Meter - is the meter type within the building: electric, gas, water, steam; use the word METER for electric meters and the words GAS, WATER, STEAM, BTU for the other types of meters.

Meter # - is the meter number (the nth number) within the building.

Parameter - is the name of the measured variable

For single site systems:
Building#_Meter_Meter#_Parameter
Building#.Meter_Meter#.Parameter

BLDG_2315_METER_2_VOLTS_A_B
BLDG_2315.METER_2.VOLTS_A_B

For multi-site systems, where a regional host exists:
SiteName_Building#_Meter_Meter#_Parameter
Sitename.Building#.Meter_Meter#.Parameter

Example:
HOOD_2315_METER_2_KW
HOOD_2315.METER_2.KW

Where a site area designator is required:
SiteName_Area_Building#_METER_Meter#_Parameter

Example:
Hood_A_2315_METER_2_KW
Hood_A.2315.METER_2.KW

Note: Some UMCS host software may automatically attach the Building/Facility Point of Connection (JACEx or NAE) to the point name.

d. Provide the following meter data:

PWR_TOT	Real Power (Total of Phases)	KW
KWH_TOT	Total KWH (Total Energy)	KWH
PWR_DEMAND	Demand Power	KW
PWR_DEMAND_PEAK	Historical Peak Demand Power	KW
VOLT_A_B	Rms Voltage For Phase A	VOLTS
VOLT_B_C	Rms Voltage For Phase B	VOLTS
VOLT_C_A	Rms Voltage For Phase C	VOLTS
AMP_A	Rms Current For Phase A	AMPS
AMP_B	Rms Current For Phase B	AMPS
AMP_C	Rms Current For Phase C	AMPS
PF_A	Power Factor Phase A	PF
PF_B	Power Factor Phase B	PF
PF_C	Power Factor Phase C	PF
PF_Total	Power Factor Total	PF
VAR or KVAR	Reactive Power	Power
CF	Cubic Feet	
GAL	Gallons	

1.3 Meter Identification and Location Data. Contractor shall populate the sample information document shown in the table below and display and store at Installation Level Front End Computer.

Fort Sample Electric Meter Information							
Bldg No.	**Bldg Name**	**Bldg Sqft**	**Cat Code**	**Meter Name**	**Commodity Type**	**Area served by meter (sqft)**	**Reimburs-able (Y/N)**
71	EXCH MAIN STORE	74,053	74053	BLDG_0071_METER_1_VOLTS_A_B	Electricity	74,053	y
01440 HAAF	HEALTH CLINIC	49,679	55010	BLDG_1440_METER_2_VOLTS_A_B	Electricity	49,679	N
2905	OPEN STR INST	40,264	45210	BLDG_2905_METER_1_VOLTS_A_B	Electricity	40,264	N
4541	VEH MAINT SHOP	32,648	21410	BLDG_4541_METER_3_VOLTS_A_B	Electricity	32,648	N
06007 HAAF	ARMY LODGING	43,732	72010	BLDG_6007_METER_1_VOLTS_A_B	Electricity	43,732	N
7560	DEPENDENT SCH	31,040	73046	BLDG_7560_METER_1_VOLTS_A_B	Electricity	31,040	y
7742	CO HQ BLDG	30,000	14185	BLDG_7742_METER_1_VOLTS_A_B	Electricity	30,000	N
10501	CSMS/MATES	31,093	21419	BLDG_10501_METER_2_VOLTS_A_B	Electricity	31,093	y
10531	CSMS/MATES	34,843	21419	BLDG_10531_METER_1_VOLTS_A_B	Electricity	34,843	Y

1.4 Storage of Metered Data. The Advanced Metering Data Management System Installation Level Front End shall store all required meter data for a minimum of two years. If data exceeds allotted space, storage shall grow automatically through database configuration changes without operator intervention.

1.5 Workstation Display

a. System shall display all mandatory metering data (electricity, water, gas and steam) upon request in an organized and easily readable format. Data shall be displayed in no less than 15 minutes intervals.

b. Final install of front end equipment shall, at minimum, display accurate data readings for each meter in a text format. Display capability shall include multiple graphical formats such as data vs. time (minutes, hours, days, weeks, months, and year) comparison between metered data from two or more meters and other standard meter data. Site specific graphics shall be created that display the required metered value, meter location, meter serial number and building square footage served by that meter.

In addition, contractor shall differentiate by an asterisk on the graphic display those meters that were not installed by the Army Metering Program.

c. Contractor shall provide two hardcopies and two copies on electronic media (DVD or CD) of detailed instructions for customization and integration of additional display features that are not prepared at the time of final install.

1.6 Energy Reports. The Installation Level Front End Computer shall be configured to provide monthly energy reports that show:

a. Specific building kWh and max kW use and time and day the max occurred.

b. A building's monthly kWh and max monthly kW with history over the previous 24 months. Include Heating Degree-Days (HDD) and Cooling Degree-Days (CDD) for each month.

c. Summary of what all buildings are using on an installation relative to their square footage (energy consumption density) as a function of kWh and kW peak; when meters are available include the Natural Gas (NG) and water usage including their maximum rate of use for that month. Include HHD and CDD.

d. A bar chart showing the 24 month history of what the installation is using total (kWh, KW peak, NG, and water) and the energy density based on square footage of metered buildings. Include HDD and CDD for each month.

e. A bar chart showing dollar cost for the commodities from the chart above over a 24 month period. Include HDD and CDD for each month.

f. A dirty dozen list of the buildings using the highest energy based on square footage, occupancy rates, hours of use, and a factor coefficient to decrease the rating for high energy density demand type missions. This mission coefficient shall be the same for the same type of mission and applied the same on every installation.

2.0 COMMUNICATIONS

2.1 Between Meters and Installation Level Front End

a. The communications medium shall be compatible with the Installation Level Front End Computer and the Enterprise Energy Reporting Data System (EERDS) Security Functional Architecture available as separate electronic media: Enterprise Energy Data Reporting System Security Functional Architecture.doc (see POC on last page). The installation of wire, fiber optic cable, wireless network equipment, network switches, and/or media converters is required where existing communications

infrastructure is non-existent to support communications between the buildings to be metered and the nearest base network access point. If fiber optic cable is required, coordinate with the site NEC for installation guidance and sizing (minimum requirement: 2 single mode fibers). All IP, Ethernet, or wireless communication design and implementation plans shall be approved by the site NEC. The NETCOM Commander has directed NETCOM G3/4, G5, and G6 to support the use of all available means of communication available at sites to reduce the cost of implementing the Army's metering program across all theaters of operation. The use of DSL, existing copper, wireless 900 Mhz radios, existing wireless 802.11 infrastructure, and dark fiber should all be considered as options before installing new copper or fiber. Coordination with NETCOM is recommended before installing new fiber.

b. Coordinate with the Activity and provide specific requirements "to match existing systems" when necessary. Contractor shall verify that the electricity meter installed on any building site is compatible with the post-wide metering system with respect to the types of meters selected and the method used to program the meters for initial use. Software and meter programming tools are necessary to setup the meters described by this guidance. New software tools different from the meter programming methods currently used by post personnel shall require separate approval for use. Contractor shall verify that the metering system installed on any building site is compatible with the facility-wide or post-wide communication and meter reading protocol system.

2.2 Between Installation Level Front End and Enterprise MDMS System

See Paragraph 1.2. The MDMS Contractor shall execute a retrieval of the data in the Microsoft SQL data base. The MDMS Contractor shall format the meter data to include the site specific information that uniquely identifies the installation (Fort Carson, Fort Hood, etc.). IPSec tunneling may be used to securely transport data. There will likely be a gateway between the Installation Level Front End Computer and the Enterprise MDMS.

2.3 Cybersecurity Requirements

a. The process and related requirements to attain authorization for metering systems have been revised to Risk Management Framework. DoDI 8500.01, Cybersecurity and DoDI 8510.01, Risk Management Framework (RMF) for DoD Information Technology (IT) were published in March of 2014 and outline the Risk Management Framework processes. Commands should coordinate with their local NEC to ensure compliance with the assess and authorize approach outlined in RMF. Additionally, the MCX offers guidance to shape architectural templates and influence the design process for Army installations. This document is Technical Criteria for the Installation Information Infrastructure Architecture and is available upon request from the POC.

b. The Information Systems Engineering Command's (ISEC) Military Engineering Directorate (MED, formerly IASED) in Fort Huachuca, AZ, has conducted testing and hardening for a limited number of metering host configurations that may assist in the development of documentation towards favorable authorization decisions. As the documentation is created for individual systems there exist

opportunities to leverage this knowledge to engineer a metering system that will more easily be approved by the NEC. Currently, the Army Metering Program has five accredited front end systems, various BPOCs, and advanced meter options, to include enterprise system level Certificates of Networthiness.

c. Networthiness: The contractor shall provide and prepare documentation as required by AR 25-1 and submit a request for a Certificate of Networthiness (CoN). Networthiness certification is required before connecting hardware/software to the Army Enterprise Network. The selection of system and network components from the Defense Information Systems Agency (DISA) Approved Products List (APL) is encouraged, when available. There is also a list of preapproved software that identifies those that have CoNs. The Contractor shall coordinate all Networthiness efforts with the appropriate installation NEC as well as higher NETCOM headquarters. When issued and certified, the Contractor shall comply with the applicable IATO (Interim Authority to Operate) Security Configuration Guide.

d. In the eyes of some security engineers, IP meters have been regarded as vulnerable and assumed to create a higher risk to the defense in depth architecture. Take note to properly configure these devices so that they do not face the internet. The IP meter interface offers a more robust transfer of data and the ability to remotely reset counters and offer time stamps. This risk assessment is subject to change as testing is completed.

e. While in the design and planning stage, contact the UMCS-MCX for the most recent update on metering system configurations and their affect on cybersecurity (cybersecurity has replaced 'information assurance' under Risk Management Framework (RMF).

3.0 METERS

Note: Reimbursable facilities/customers that require metering devices which exceed the requirements detailed in this guidance shall be installed per written request as approved and provided in pre-proposal documentation.

3.1 Environmental Tolerances of Metering Devices

a. Power Meters:

(1) Outdoor/exterior devices shall be rated for operation and storage from minus 40 degrees C to plus 70 degrees C or better and 5 to 100% relative humidity (RH) (non-condensing). Exterior meters shall be provided with or installed within a NEMA 4 enclosure. Enclosures shall be NEMA 4X for coastal and corrosive environments. When ambient temperature extremes exceed the rating above, provide enclosures with heat strips to maintain operable temperatures. Enclosures shall be lockable (key lock) for information security issues.

(2) Indoor/interior devices shall be rated for operation and storage from 0 degrees C to plus 50 degrees C or better and 5 to 90% relative humidity (non-condensing). Interior meters or meters located in mechanical rooms shall be provided with or installed within a NEMA 12 lockable enclosure.

b. Water Meter Operating Temperatures: 0 degrees C to plus 50 degrees C or better. Water Meter Humidity Operating Range: 5% to 90% RH (non-condensing).

When above frost line and exterior mounting is required, consider the local ambient temperature extremes and protect from freezing with insulated, moisture proof enclosures and heat tracing as required.

c. Gas Meter Operating Temperatures: minus 40 degrees C to plus 70 degrees C.
Gas Meter Humidity Operating Range: 5% to 90% RH (non-condensing).

d. Steam Meter Ambient Operating Temperatures: minus 40 degrees C to plus 80 degrees C.
Steam Meter Medium Operating Temperatures: minus 40 degrees C to plus 240 degrees C.
Humidity Operating Range: 5% to 90% RH (non-condensing)

e. All interior meters and/or remote interface displays shall be provided with or installed within a NEMA 12 enclosure.

f. Wiring: All wiring shall be UL listed.

g. Manufacturer Recommendations: The Contractor shall adhere to all manufacturer recommendations regarding wire sizing, fuse sizing, and wire types.

3.2 Advanced Meter Capability

a. All meters as installed shall provide advanced meter capabilities, either as a single product, or as installed in conjunction and collocated with another product such that the combined installation provides advanced meter capabilities.

b. Meters that do not provide factory advanced capabilities shall provide a pulse output for interfacing to an advanced meter. The minimum and maximum pulse rate and pulse width of the receiving digital input device and software, i.e., electric meter, digital input card on the UMCS or any other accumulator shall be determined by the contractor. The contractor shall provide pulse rate convertors if required. Depending on the product used, relay isolation may be required when connecting to the Input/Output (I/O) device. In addition, the contractor shall determine and eliminate false triggers caused by distance or routing near other voltage sources. It is strongly advised to adhere to the manufacturers' recommendations and industry practices and install isolation relays as field conditions dictate.

3.2.1 Communication Protocol and Methods. Meters shall communicate via either Modbus RTU, ANSI/CEA-709.1-C (LonTalk), or ASHRAE-135 (BACnet) protocols to the existing or new Advanced Metering Data Management System Installation Level Front End (or UMCS/EMCS System Host). In locations where a legacy UMCS system currently exists utilizing a non-compliant communication protocol, additional protocols may be used if approved by the Government. In that case the designer should consider meters with changeable interface communication cards so that future UMCS upgrades can be accomplished with minor changes.

3.2.2 Pulse Input Data Port Interface

a. Meters shall have a data port connection compatible with the selected protocol which communicates to the existing or new Advanced Metering Data Management System Installation Level front end. The meter's interface must be compatible with the conditions at any given site. Analog current loops shall not be used.

b. Auxiliary data ports. Unless otherwise specified, advanced meters shall have a minimum of two pulse inputs for incorporation of other external meter data.

3.2.3 Data Storage and Trend Logs

a. Unless otherwise specified, the meter must be capable of providing and storing 15 minute interval data for 20 distinct points for minimum of 30 days to non-volatile memory. The measured energy consumption shall be retained in non-volatile memory. The maximum demand and time of maximum demand shall be stored in non-volatile memory and can be reset.

b. Field Interface Tool: Contractor shall provide a field interface tool with the compatible software to extract stored trend data and logs from meters. This is a separate hand-carried device that directly connects with the meter at the installed site.

3.2.4 Meter display. Meters that are required to display data shall provide face plate configurable menus to select the desired data for display. Display requirements may be met with the installation of a local display panel connected to the meter. All collected data shall be capable of display.

3.3 Electric Meter

3.3.1 Power Systems. Meter shall be designed for multifunction electrical measurement on either single or 3 phase power systems. Meter shall support the power configuration as identified at site specific government facilities: single phase (120 or 240 volt); 3 Phase, 3 Wire Delta; 3 Phase, 4 Wire Delta; 3 Phase, 4 Wire Wye (2.5 Element); 3 Phase, 4 Wire Wye (3.0 Element). For three phase

application voltage range is 208 – 600V. All meters shall be UL 508 Listed, CSA approved, have CE marking, and meet safety standards UL 1244 or UL 1010-1.

3.3.2 Measured Values: See Electric Meter points list: Advanced Meter Points List.xls for details and additional requirements. Points list assumes a 4 wire delta power configuration. Modify to match site specific requirements.

a. Mandatory Measured values

PWR-TOT	Real Power KW (Total Phases)
KWH-TOT	Total KWH (Total Energy)
PWR-DEMAND	Demand Power
PWR-DEMAND-PEAK	Historical Peak Demand Power
VOLT A-B	Rms Voltage For Phase A
VOLT B-C	Rms Voltage For Phase B
VOLT C-A	Rms Voltage For Phase C
AMP-A	Rms Current For Phase A
AMP-B	Rms Current For Phase B
AMP-C	Rms Current For Phase C
PF-A	Power Factor For Phase A
PF-B	Power Factor For Phase B
PF-C	Power Factor For Phase C
PF-Total	Power Factor Total
VAR or KVAR	Reactive Power

b. Optional Measured values:

PWR-A	Real Power For Phase A
PWR-B	Real Power For Phase B
PWR-C	Real Power For Phase C
HZ-A	Frequency For Phase A
HZ-B	Frequency For Phase B
HZ-C	Frequency For Phase C
KVA-TOT	Total Kva
KVA-A	Kva For Phase A
KVA-B	Kva For Phase B
KVA-C	Kva For Phase C
KVAR-TOT	Total Reactive Power
KVAR-A	Reactive Power For Phase A

KVAR-B	Reactive Power For Phase B
KVAR-C	Reactive Power For Phase C
KVARH-TOT	Total Kvarh (Total Reactive Energy)
KVARH-A	Kvarh (Total Reactive Energy) For Phase A
KVARH-B	Kvarh (Total Reactive Energy) For Phase B
KVARH-C	Kvarh (Total Reactive Energy) For Phase C

3.3.3 Accuracy

a. System Accuracy: System accuracy for the meter product devices including instrument transformers shall not exceed plus or minus 1.5% as calculated using the Root Sum Square (RSS) method and assuming normal distribution.

b. Meter Accuracy: Meter certification shall be IEEE/ANSI C12.20, Accuracy class 0.5% or the meter shall be calibrated with National Institute of Standards and Technology (NIST) traceable standards to an accuracy of 0.5% or better.

c. For reimbursable tenants meter certification shall be NEMA/ANSI C12.20, Accuracy class 0.2%. These meters shall include a Meter display that can display all recorded values.

3.3.4 Surge Protection: Meters shall comply with IEEE/ANSI C37.90.1, Standard surge withstand capability (SWC) tests for relays and relay systems associated with electric power apparatus and IEEE C62.41.

3.3.5 Instrumentation (CTs and PTs)

a. Current transformers (CTs) sized properly so that the meter secondary of the transformer shall output current to ensure at least a plus or minus 0.6% accuracy of current when measured between 10% and 90% of full amperage range.

b. CTs shall not exceed 5 amps on the secondary side.

c. Burden on CTs shall not exceed rated burden for the accuracy class.

d. CTs shall be provided in solid or split core configurations.

e. CTs shall be provided in the appropriate ranges to meet the service entrance amperage requirements (e.g. building service entrance of 800 Amps requires 800:5 CTs for metering).

f. CTs shall be revenue grade and certified per IEEE/ANSI C57.13 or IEC 185.

g. CTs shall be provided that are rated for the appropriate matching frequency of the power generation (60 Hertz CONUS and 50 Hertz OCONUS as applicable).

h. Current sensors shall be sized properly for the application and provide a voltage (normally 0-2 volts) to the meter that results in at least a plus or minus 0.6% accuracy of current when measured between 10% and 90% of full amperage range.

i. Voltage or Potential Transformers (PTs) sized properly so that the meter secondary of the transformer shall output voltage to ensure at least a plus or minus 0.6% accuracy of voltage when measured from zero to the IEEE/ANSI C57.13 or IEC 185 specified standard burden, at the specified standard burden power factor, and at any value from 90% to 110% of rated voltage.

j. PTs shall be revenue grade and certified per IEEE/ANSI C57.13 or IEC 185.

k. Burden on PTs shall not exceed rated burden for accuracy class.

3.3.6 Disconnects and Shorting Blocks

a. The appropriate metering accessories, terminal blocks, shorting blocks, and fuses shall be built into each enclosure and the enclosure shall have an appropriate grounding termination point per standard industry practices. Disconnect wiring blocks shall be provided between the current transformer and the meter where 5 AMP current transformers are used. A shorting mechanism shall be built into the wiring block to allow the current transformer wiring to be changed between shorting block and meter without removing power to the transformer. The wiring blocks shall be located where they are accessible without the necessity of disconnecting power to the transformer. For multi-ratio current transformers, provide a shorting block from each tap to the common lead. The shorting mechanism must be capable of carrying the current of each current transformer so that the electric meter can be safely removed from the circuit for testing or repair. Low voltage, 0-5 volt current sensors are exempt from the shorting block requirement.

b. Voltage-monitoring circuits shall be equipped with disconnect switches to isolate the meter base or socket from the voltage source.

c. Short circuit protection for each power supply circuit or measuring voltage circuit entering the enclosure must be included in the enclosure. This shall be appropriately sized to protect equipment and personnel should an accidental short occur during maintenance inside the enclosure. Fuses or breakers with appropriate UL ratings shall be used. Fuse type and rating shall be depicted on the As-Built drawings.

d. Switching mechanisms adequate to de-energize all power supply and voltage circuits entering the enclosure must be included in the enclosure. If a breaker is utilized for the short circuit protection that can fulfill this function, no additional hardware will be required.

3.4 Gas Meter

3.4.1 Requirements

a. In addition to the requirements listed below, Natural Gas Distribution and Monitoring Equipment shall be in accordance with UFGS SECTION 33 51 13.00 30. Gas meters measure a defined volume, regardless of the pressurized quantity or quality of the gas flowing through the meter. Temperature, pressure and heating value compensation must be made to measure actual amount and value of gas moving through a meter.

b. Gas distribution equipment shall be installed in accordance with all applicable federal, state and local codes and regulations. Gas distribution equipment shall be installed in conformance with the manufacturer's recommendations and applicable sections of American Society of Mechanical Engineers (ASME) B31.8, American Gas Association (AGA) XR0104 and 49 CFR 192. Gas distribution equipment installed in areas where they will be subject to damage shall be protected by appropriate physical barriers (i.e. bollards).

c. Natural Gas Meters shall be the Diaphragm, Rotary, or for high volume applications Turbine type with pulse output chosen to meet the specific application.

Quantity Measured: Cubic Feet of Natural Gas

Accuracy: plus or minus 1% of scale.

Resolution: minimum of 100 cubic feet of gas

Measurement Configuration: Natural Gas service to a building. For buildings that already have a gas meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a natural gas meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output to a data gathering device. If the existing gas meter will not accept a pulse kit or if no meter exists a new natural gas meter shall be installed, also requiring a pulse output to a data gathering device. Ensure the pulse frequency and electronic characteristics are compatible with the existing data gathering device, if any.

3.4.2 Gas Meter Types

a. Provide gas meters for the natural gas service line to the building. Natural gas meters shall be the Diaphragm, Rotary, or for high volume applications Turbine type with pulse output chosen to meet the specific application. Temperature, pressure and heating value compensation must be made to measure actual amount and value of gas moving through a meter.

b. Diaphragm Gas Meters with flow rates less than 500 cubic feet per hour shall conform to AGA B109.1. Diaphragm Gas Meters with flow rates of 500 cubic feet per hour and higher shall conform to AGA B109.2. Rotary Type Gas Meters shall conform to AGA B109.3. Turbine Type Gas Meters shall conform to ASME MFC-4M. Meters shall be pipe or pedestal mounted and be provided with a strainer immediately upstream. Meters shall be provided with over-pressure protection as specified in ASME B31.8. Include tamper-proof protection, frost protection and fungus-proof protection as applicable. Meters shall be suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates present. Meters shall have a pulse switch initiator capable of operating up to speeds of 500 pulses per minute with no false pulses and shall require no field adjustments or calibration. Initiators shall provide the maximum number of pulses up to 500 per minute that is obtainable from the manufacturer. The minimum pulse rate shall not be less than one pulse per 100 cubic feet of gas.

3.4.3 Valves and Regulators

a. Valves shall be suitable for shutoff or isolation service and shall conform to the following: Steel valves 1-1/2 inches and smaller installed above ground shall conform to ASME B16.34, carbon steel, socket weld or threaded ends with handwheel or wrench operator. Steel valves 2 inches and larger installed above ground shall conform to American Petroleum Institute (API) Spec 6D, carbon steel, butt-weld or flanged ends, with handwheel or wrench operator.

b. Valves and pressure regulators are necessary at all points where pressure reduction or regulation is required by the user. Install a shut-off valve upstream of the regulator and both upstream and downstream of the meter. Provide a gas meter bypass line with a lockable valve for buildings with critical service.

c. Service Line Regulators. Pressure regulators for individual service lines shall have ferrous bodies. Regulator shall be capable of reducing distribution line pressure to pressures required for users. Regulators shall be provided where gas will be distributed at pressures in excess of 10 inches of water column. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self-contained service regulator. Regulator pipe connections shall not exceed 2 inch size.

3.4.4 Gas Meter Installation

a. A shutoff valve, meter set assembly, and service regulator shall be installed on the service line outside the building, 18 inches above the ground on the riser. An insulating joint (dielectric connection)

shall be installed on the inlet side of the meter set assembly and service regulator and shall be constructed to prevent flow of electrical current. A 3/8 inch tapped fitting equipped with a plug shall be provided on both sides of the service regulator for installation of pressure gauges for adjusting the regulator. All service regulator vents and relief vents shall terminate in the outside air in rain and insect resistant fittings. The open end of the vent shall be located where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

b. Meters shall be installed in accordance with ASME B31.8. Permanent gas meters shall be installed with provisions for isolation and removal for calibration and maintenance, and shall be suitable for operation in conjunction with an energy monitoring and control system.

3.4.5 Connections

a. Connections to Publicly or Privately Operated Gas Utility Lines: The contractor shall include all materials for the connections to the existing gas lines. Final connections and the turning on of gas shall be made by the utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of gas lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new gas lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish to the Contracting Officer a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

b. Connection to Government Owned/Operated Gas Lines: Provide the name and location of the utility or operating agency of the existing gas lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing gas lines in accordance with approved procedures. Reactivation of any existing gas lines will only be done by the Government. The Contractor's Connection Plan shall be submitted to the Contracting Officer and approved prior to making any connections to existing gas lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made.

3.4.6 Pressure and Leak Tests

a. Prior to putting the gas line back to service, ensure that all pressure and leak testing has been completed per specification section 22 00 01 Plumbing Systems.

3.5 Water Meter

3.5.1 Requirements:

a. The water meters must comply with the applicable requirements of ASHRAE 189.1. Where conflicts occur between this guidance and the ASHRAE standard, ASHRAE 189.1 shall prevail.

b. In addition to the requirements listed below Water Meters shall be in accordance with UFGS SECTION 33 12 33.00 30. Water Meters shall be the turbine, propeller, or displacement type with pulse output chosen to meet the specific application (pipe size, flow, pressure, etc.). Water Meters shall be manufactured by Neptune, SeaMetrics, Badger Meter Inc., DLJ, or approved equal. The location of meters and meter boxes shall be shown on the as built drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

Quantities Measured: Gallons of Water (pulse for every 10 gallons)

Accuracy: 1.5% of scale.

Resolution: 1 Gallons per Minute (GPM)

Measurement Configuration: Water Supply to a building. For buildings that already have a water meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a water meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output into a data gathering device. If the existing meter will not accept a pulse kit or if no meter exists, a new water meter shall be installed, also requiring a pulse output to a data gathering device.

3.5.2 Water Meter Types

a. Turbine Type Meters: Turbine type meters shall conform to American Water Works Association (AWWA) C701 Class I or Class II depending on the application. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local UMCS. Meters shall comply with the accuracy and capacity requirements of AWWA C701.

b. Propeller Type Meters: Propeller type meters shall conform to AWWA C704. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register or an encoder-type remote register designed in accordance with AWWA C707 but must be compatible with the local UMCS. Meters shall comply with the accuracy and capacity requirements of AWWA C704.

c. Displacement Type Meters: Displacement type meters shall conform to AWWA C700. Registers shall be straight-reading and shall read in U.S. gallons. Meters in sizes 1/2 through 1 inches shall be frost-protection design as required by the local environmental conditions. Connections shall be

suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local UMCS. Meters shall comply with the accuracy and capacity requirements of AWWA C700.

d. Compound Type Meters: Compound type meters shall conform to AWWA C702 and shall be furnished with strainers. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. The main casing shall be tapped for field testing purposes. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local UMCS. Meters shall comply with the accuracy and capacity requirements of AWWA C702.

e. Fire Service Type Meters: Provide Fire Service Type Meters as required by the Installation. Fire service type meters shall be proportional type or turbine type conforming to AWWA C703 and shall be furnished with strainers. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local UMCS. Meters shall comply with the accuracy and capacity requirements of AWWA C703. When turbine type main line meters are used, the meter shall be supplied with a separate check valve, as a unit.

[NOTE: There is no published UFGS for the ultrasonic flow meter.]

f. Ultrasonic Flow Meter: The Ultrasonic Flow Meter must be furnished complete with matched transducers, self-aligning installation hardware and transducer cables. Ultrasonic transducers must be optimized for the specific pipe and process conditions for the application. The flow meter accuracy must +/- 1% of rate from 0 to 40 ft/sec (0.3 to 12 meters/sec). The flowmeter, must include either dry contact pulse outputs, 4-20mA, 0-10Vdc or 0-5Vdc output.

3.5.3 Water Meter Installation

a. Meter Boxes: Meter boxes shall be of cast iron, concrete, or plastic. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid and cast iron meter reader lid suitable for vehicle wheel loads. Boxes set in sidewalks, not subject to vehicular traffic, shall be concrete with cast iron lid and cast iron meter reader lid. Plastic boxes and lids can be used in unpaved areas or grass areas not subject to vehicular traffic. Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

b. Dielectric Fittings: Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

3.5.4 Valves

a. Gate Valves Smaller than 3 Inch in Size: Gate valves that are smaller than 3 inch in size shall meet Manufacturers Standardization Society (MSS) SP-80, Class 150 and have a solid wedge, non-rising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide hand wheel operators. Valves shall open by counterclockwise rotation of the valve stem.

b. Gate Valves 3 Inch Size and Larger: Gate valves 3 inch size and larger shall meet AWWA C500 or UL 262 and be of one manufacturer. Valves shall be AWWA C500, non-rising stem type with double-disc gates or UL 262, inside-screw type with operating nut, split wedge or double disc type gate, and designed for a hydraulic working pressure of 175 psi. Valves shall open by counterclockwise rotation of the valve stem.

3.5.5 Connections

a. Connections to Publicly or Privately Operated Water Utility Lines: Contractor shall provide materials for the connections to the existing water lines. Final connections and the turning on of water shall be made by the Utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of water lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new water lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

b. Connection to Government Owned/Operated Water Lines: Provide the name and location of the utility or operating agency of the existing water lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing water lines in accordance with approved procedures. The Contractor's Connection Plan shall be submitted to the Contracting Officer and approved prior to making any connections to existing water lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made. Reactivation of any existing water lines will only be done by the Government.

3.5.6 Disinfection: Prior to disinfection, obtain Contracting Officer approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect existing water piping

affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying non-potable water is not required. Chlorinating materials shall conform to the following: Chlorine, Liquid: AWWA B301, Hypochlorite, Calcium and Sodium: AWWA B300.

3.5.7 Tests and Inspections

a. Prior to putting the water line back to service, ensure that all pressure and leak testing has been completed per specification section 22 00 01 Plumbing Systems.

3.6 Steam Meter: NOT USED.

4.0 EXECUTION

4.1 Installation: Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise. Specific installation instructions are located in each meter section above.

a. All current, power, and voltage circuit wiring entering the meter or enclosure must be clearly marked, to avoid installation error and simplify future identification of wires for maintenance purposes. Unless prewired by manufacturer, use the following color code to mark the conductors:

(1) Red - Phase A CT - C1
(2) Orange - Phase B CT - C2
(3) Brown - Phase C CT - C3
(4) Gray with white stripe - neutral current return - C0
(5) Black - Phase A voltage - V1
(6) Yellow - Phase B voltage - V2
(7) Blue - Phase C voltage - V3
(8) White - Neutral voltage

b. Labels: The contractor shall install permanent labels identifying the installed components. Labels shall be lamacoid or similar, and shall be white on black. Approximate size: 1.5” x 3.5”. Information contained should include: Building #, Volts/#Phases/CT Ratio, Meter Type # of #. Example: Line 1 – Building 2415; Line 2 – 208/3/800; Line 3 – EM 1 of 2. Additional information may be required at the behest of the garrison’s Directorate of Public Works.

4.2 Drawings: These identifying markings shown above shall be reflected on the As-Built drawings. Documentation shall contain detailed design data, drawings, cut sheets on selected equipment, design documents, and building list as applicable. In addition to the requirements above, Contractor shall provide the following drawings:

a. plan view of building showing the outline and the approximate location of the meter with designation (i.e. room number), the voltage/# of phases/CT Ratio (i.e. 120/3/600) of the meter, BPOC, approximate conduit and cable routing, wire sizes, and number of conductors;

b. schematics displaying 3 phase 4 wire wye, 3 phase 3 wire delta, and 1 phase configurations, CT orientation/polarity markings;

c. connection drawings that show all wires, color codes of wires, wire sizes, and connection points;

d. general site overview drawing depicting locations of buildings being metered;

e. communications riser diagram containing as much information as is known at the time of the design.

4.3 Scheduling of Work and Outages

a. Installation of current transformers and potential transformers shall require that power be disconnected from the transformer and/or building. No "hot work" allowed unless prior Government approval is granted.

b. The Contract Clauses shall govern regarding permission for power outages, scheduling of work, coordination with Government personnel, and special working conditions.

c. Building Schedule Concurrence Agreement: The contractor shall submit to the Contracting Officer’s Representative (COR) a list of buildings with approved, scheduled utility outages prior to beginning any meter installation. The approval authority for outages is the local Public Works engineering office.

d. Monthly Status Report: The contractor shall report the number of installed meters and the associated building number by the tenth of each month to the Government Project Manager. Major equipment installation, servers, network installation, and software installation shall be included in the report.

4.4 Field Applied Painting

Where field painting of enclosures is required to correct damage to the manufacturer's factory-applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

4.5 Cleanup

Upon completion of the installation all debris and surplus materials resulting from the work shall be removed. Daily housekeeping site clean-up is required.

5.0 TESTING AND CHECKOUT

[Note: This section is not all inclusive of specific testing requirements. Additional testing requirements for proper installation of water, gas, and steam meters are above (piping test, pressure tests, etc.]

5.1 Performance Verification Test (PVT)

a. Perform all Testing, Adjusting, and Commissioning in accordance with UFGS 25 08 10, manufacturer's recommendations, and referenced contract specifications and requirements. Provide certification of compliance. Prepare testing procedures as defined by product manufacturer's standard published written testing procedures and in accordance with UFGS 25 08 10. All electrical meter product certifications shall be performed in accordance with the certification tests described in ANSI C12.20 for 0.5% accuracy class meters, unless noted otherwise below.

b. The Contractor shall complete a Performance Verification Test (PVT). The PVT shall demonstrate to the Government that the actual power utilized by the electrical service being metered is calculated and displayed on the meter display and/or software accurately. The services being verified will be a random sample selected by the Government. The PVT shall utilize suitable test equipment connected to the electrical service being metered that is capable of displaying instantaneous 3-Phase values of Voltage, Current, Phase Power Factor / Phase Angle, Volt Amperes, Watts, and Vars.

c. All safety measures for connectivity to an energized source shall be followed as outlined in Safety Manual EM 385-1-1, Section 11B (latest version). Connectivity to an energized source is contingent on approval from the Government Safety Officer and Government approval of PVT plan. Additionally, a compliance validation assessment will be completed by the Government at its discretion as part of the test and checkout process. Any deviations from the required configurations will require resolution or correction by the Contractor at no additional cost to the Government.

d. The PVT procedures shall encompass testing of the entire system: meter installation, operation, conduit and wiring, data collection at front end, etc. All meters (100%) may not be completely tested in the PVT; however, procedures should take into account the entire system for the meters that are tested.

e. Pre-determined electric meters will be chosen (based on the CFT data) to be fully tested during the PVT. The Contractor will dress out in protective clothing (as appropriate), connect power analyzer with rope or clamp on CTs to the feeds and compare the meter readings between the frontend and the power analyzer.

5.2 Contractor's Field Tests (CFT):

a. As part of the installation and prior to the PVT, the contractor shall perform a Contractor Field Test (CFT) on all meters installed by this work effort. The CFT shall be composed of various screen captures from the metering software which demonstrate proper installation and operation of the newly installed meters and front-end. The CFT documentation shall be provided to the Government for review and approval 30 days before the PVT is scheduled. The meters selected by the Government for inclusion in the PVT will be developed from the CFT. There is no set number limit of meters for PVT.

b. The Contactor shall provide all test equipment. Test equipment shall be calibrated, stickered and show last calibration date, next calibration date and prove capable of the required accuracy, linearity, and repeatability, and shall be traceable to a nationally recognized testing standard (i.e. NIST, ANSI, etc.). No testing shall be accomplished with un-calibrated test or measurement equipment.

c. Contractor shall test 100% of the meters, verify the accuracy, correct any problems, and submit a report to the Government for review. Testing shall include the front-end server and associated workstation. The CFT report shall only be submitted for approval after all issues have been addressed and corrected.

d. The Contractor shall review the CFT report before submission and correct any apparent and known issues. A CFT Report which indicates obvious installation errors will be rejected. The PVT will not be scheduled until an acceptable CFT report has been approved. The CFT shall serve as the Contractor's opportunity to identify any installation or wiring errors and solve any issues prior to the Government coming to the site to perform the PVT.

e. Provide the screen shots to display the following parameters, as applicable:

Front-End:

- Screen shot showing all connected meters along with data values listed below

Electric Meters: (all values shall be per phase where applicable)

- Line to Line voltages (volts)
- Line-to-neutral voltages (volts)
- Voltage phasor angles (degrees)

- Currents magnitudes (amps)
- Current phase angles (degrees)
- Power: Apparent (kVA), Reactive (kVAr), Real (kW)
- Phase Power Factors (pf)
- CT ratio (i.e. 400:5)
- Electrical Service rating and type (i.e. 277/480-volt, 3Ph, 4-wire, 3CTs, 3PTs,Wye Connected)
- Phasor Diagrams

Pulse Meters (Gas/Water):

- Initial reading of actual physical meter dial to obtain baseline data
- Initial screen shots of front end values for the meter for the same date/time the dials were read.
- Second reading of actual physical meter dial to obtain baseline data
- Second screen shot of front end values for the meter for the same date/time the dials were read.
- Pulse multiplier values (1 pulse = 100 cubic ft)
- Pulses per revolution
- Accumulator baseline or offset values (if applicable)
- BPOC (Building Point of Connection) information or BLC (Building Level Controller)
- The initial (or baseline readings) shall be compared against the second reading for verification of the pulse meter. The difference between the gas meter dial readings will be compared against the difference between the front end readings. The differences shall be within the resolution of 1 pulse count.

f. The data which is accumulated (pulses) should have baseline data to compare for the CFT and during the PVT. The values at the meter dial (e.g. gas, water, steam) and the front end shall be recorded and compared to the values at another point in time. The delta between the meter readings shall be compared to the delta between the front end values to insure the proper multiplier, Lon address mapping, and programming are all correct.

g. CFT Submittals will be rejected if they do not contain enough information to properly verify meter installation and operation. If there is sufficient data in the CFT that supports a properly installed and functioning meter, only a visual inspection of the meter may be necessary during the PVT instead of requiring the Contractor to suit up and connect a power analyzer; however, the Government reserves the right to test any and all meters during the PVT as deemed necessary.

6.0 TRAINING

The Contractor shall conduct a training course for meter configuration, operation, and maintenance of the system as specified. The training shall be oriented for all components and systems installed under

this contract. Training manuals shall be delivered for 10 trainees with two additional copies delivered for archiving at the project site. The Contractor shall furnish all audiovisual equipment and all other training materials and supplies. A training day is defined as eight hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the project site. For guidance in planning the required instruction, the Contractor shall assume that attendees have a high school education or equivalent, and are familiar with utility systems. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

Training: The course shall be taught at the project site within thirty days after completion of the installation period. Contractor shall coordinate with the Government POC to determine the number of trainees who will attend the course and the schedule at least 30 days in advance of the scheduled date. The training shall include:

a. Physical layout of each piece of hardware.
b. Meter configuration, troubleshooting and diagnostics procedures.
c. Repair instructions.
d. Preventive maintenance procedures and schedules.
e. Testing and calibration procedures.

For more information, please contact:

U.S. Army Engineering and Support Center, Huntsville
P.O. Box 1600
CEHNC-EDM-U (UMCS-MCX)
Huntsville, Alabama 35807-4301

Utility Monitoring and Control System
Mandatory Center of Expertise (UMCS-MCX)
Will.White@usace.army.mil
256 895-1739

END OF SECTION

32 31 13.53 HIGH-SECURITY CHAIN LINK FENCES AND GATES

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. High-security chain-link fences.

2. Gates: Horizontal top trolly cantilever slide and swing.

B. Related Sections include the following:

1. Section 31 00 00 “Earthwork” for excavation, filling, and grading work.

2. Section 03 30 00.01 “Cast-In-Place Concrete” for concrete post concrete fill and continuous concrete grade beam.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide chain-link fences and gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Line Post Design: Provide line posts of size and in spacing indicated but not less than sizes and spacings required to comply with ASTM F1916, Tables 1 through 5 inclusive in resisting the following wind-load criteria, based on fence height, mesh size, and pattern indicated:

a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed and exposure category indicated below and according to CLFMI WLG 2445:

1). Wind Speed: 90 mph.

2). Exposure Category: C.

b. Fence Height: 6 feet.

c. Fence Framework Material Group: IA, ASTM F1043, Schedule 40 steel pipe.

2. Provide framework for fences that comply with ASTM F1043, based on the following criteria:

    a. Fence Framework Material Group: IA, Schedule 40 round steel pipe.

    b. Fence Height: 6 feet.

    c. Line Post Spacing: 10 feet (3 m).

3. Fabric Tension: Provide fences in which fabric deflections do not exceed those indicated in Table X1.1 of ASTM F1916 when tested by applying a 30-lbf (133-N) force at midpoint between rails and horizontally between posts for every eighth lower panel along the fence line.

4. Fence Post Rigidity: Provide fences in which post deflections do not exceed 3/4 inch (19 mm) when tested according to ASTM F1916 by applying a 50-lbf (222-N) force at mid-height of every eighth post along the fence line.

B. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.04 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates:

1. Fence and gate posts, rails, and fittings.

2. Chain-link fabric, reinforcements, and attachments.

3. Gates and hardware.

4. Accessories: Barbed tape.

B. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Product Certificates: For each type of chain-link fence, and gate, signed by product manufacturer.

1. Strength test results for framing according to ASTM F1043.

D. Qualification Data: For Installer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1. Engineering Responsibility: Preparation of data for chain-link fences and gates, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Mockups: Build mockups to set quality standards for fabrication and installation.

1. Include 10-ft. (3-m) length of fence complying with requirements.

a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.

b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

B. Interruption of Existing Utility Services: Do not interrupt utility services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner no fewer than 2] days in advance of proposed interruption of utility services.

2. Do not proceed with interruption of utility services without Owner's written permission.

1.07 COORDINATION

A. Coordinate, schedule, and obtain Owner's written approval of interruptions to existing perimeter security fences and systems for installation of new Work.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of high-security chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of gate operators and controls.

b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

c. Deflection of fence fabric beyond design limits.

2. Warranty Period: 5 years from date of Substantial Completion.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Chain-Link Fences and Gates:

   a. Ameristar Fence

   b. Southwest wire

   c. Merchants metal

   d. General Wire and Supply Co.

2. Barbed Tape:

   a. Razor Ribbon

   b. Birmingham Barbed Tape

   c. Puma Barbed Tape Co.

   d. Jacksons Security.

2.02 CHAIN-LINK FENCE FABRIC

A. Chain-Link Fence Fabric: 6 foot. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage. Comply with ASTM A392, CLFMI CLF 2445, and with requirements indicated below:

1. Steel Wire Fabric: Metallic coated.

2. Fabric 6 feet (1.8 m) high.

   a. Wire Diameter: 0.148 inch (3.76 mm).

   b. Mesh Size: 2 inch (51 mm) with 1 inch at Personnel gate.

   c. Weight of Metallic (Zinc) Coating: ASTM A392, Type II, Class 1, 1.2 oz/sq. ft. (366 g/sq. m) with zinc coating applied before weaving.

   d. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

3. Selvage: Twisted and barbed top and bottom.

2.03 SECURITY FENCE FRAMING

A. Posts and Rails: Comply with ASTM F1043 for framing of the following material group and strength requirement for fences of height indicated:

1. Framework Material Group: IA, round steel pipe, Schedule 40.

2. Fence Height: 6 feet (1.8 m).

3. Strength Requirement: Heavy industrial fence.

4. Post Diameter and Thickness: Provide posts of sizes indicated below that comply with ASTM F1043.

a. Top Rail: 1.66-inch (42.2-mm) diameter, 0.140-inch (3.6-mm) thickness.

b. Line Post: 2.875-inch (73-mm) diameter, 0.203-inch (5.2-mm) thickness].

c. End, Corner, and Pull Post: 4-inch (102-mm) diameter, 0.237-inch (6.02-mm) thickness.

d. Swing Gate Post: According to ASTM F900

e. Horizontal-Slide Gate Post: According to ASTM F1184.

1). Openings width refer to drawings, Overhead Clearance up to 22 Feet (6.7 m): Steel post, 4-inch (102-mm) diameter, and 8.65-ft-lb (12.88-kg/m) weight.

2). Guide Posts for Class 1 horizontal-slide gates, equal gate post height, one size smaller, but weight is not less than 3.11 ft-lb (4.63-kg/m), installed adjacent to gate post to permit gate to slide in space between.

5. Metallic Coatings for Steel Framing:

a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A123/A123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating per ASTM A653/A653M.

2.04 TENSION WIRE

A. General: Provide horizontal tension wire at the following locations:

1. Location: Extended along bottom of fence fabric.

2. Location: Extended along top of barbed wire arms and top of fence fabric for supporting barbed tape.

B. Metallic-Coated Steel Wire: 0.177-inch (4.5-mm) diameter, marcelled tension wire complying with ASTM A824 and the following:

1. Metallic Coating: Type [II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:

a. Class 3: Not less than 2.0 oz./sq. ft. (610 g/sq. m) of uncoated wire surface.

2.05 SWING GATES

A. General: Comply with ASTM F900 for double swing gate types.

1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1043 and ASTM F1083 for materials and protective coatings.

2. Metal Pipe and Tubing: Steel. Comply with ASTM B429 and ASTM F1043 for materials and protective coatings.

B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F900 and the following:

1. Gate Fabric Height: 2 inches (51 mm) less than adjacent fence height.

2. Leaf Width: As indicated.

3. Frame Members:

a. Tubular Steel: 2.875 inches (73 mm) round.

C. Frame Corner Construction:

1. Welded and 3/8-inch (9.5-mm) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.

D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (305 mm)] [as indicated as required to attach barbed wire and tape assemblies.

E. Provide separate isolated gate frame according to ASTM F1916 and as indicated.

1. Group: IA, round steel pipe, Schedule 40].

2. Post: 4 inches (102 mm) and refer to drawings.

3. Separation between Hinge and Latch Post and Fence Termination Post: 2 inches (51 mm) minimum, 2-1/2 inches (63.5 mm) maximum.

F. Hardware:

1. Hinges: Offset type, malleable iron, 180-degree swing.

2. Latches permitting operation from both sides of gate. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.06 HORIZONTAL-SLIDE GATES

A. General: Comply with ASTM F1184 for single slide gate types and refer to drawings:

1. Classification: Type II Cantilever Slide, Class 2 with internal roller assemblies.

2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1184 for materials and protective coatings.

B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F1184 and the following:

1. Gate Fabric Height: 6 feet (1.8 m).

2. Gate Opening Width: **30** feet (1.2 m).

3. Frame Members:

a. Tubular Steel 1.90 inches (48.3 mm) round.

4. Bracing Members:

a. Tubular Steel 1.90 inches (48.3 mm) round.

C. Frame Corner Construction:

1. Welded frame with panels assembled with bolted or riveted corner fittings and 5/16-inch (7.9-mm) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.

D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (305 mm) as required to attach barbed tape assemblies.

E. Roller Guards: As required per ASTM F1184 for Type II, Class 1 gates.

F. Hardware:

1. Latches permitting operation from both sides of gate. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2. Padlocks and chains. Verify with owner’s keying requirements.

2.07 FITTINGS

A. General: Comply with ASTM F626.

1. Line post caps with loop to receive tension wire or top rail.

B. Rail and Brace Ends: Attach rails securely to each gate, corner, pull, and end post.

C. Rail Fittings: Provide the following:

1. Rail Clamps: Line and corner boulevard clamps for connecting intermediate rails in the fence line to line posts.

D. Tension and Brace Bands: Pressed steel, 0.105 inch (2.66 mm) thick, with 1.2-oz/sq. ft. (366-g/sq. m) metallic (zinc) coating.

E. Tension Bars: Steel, length not less than 2 inches (51 mm) shorter than full height of chain-link fabric with 1.2-oz/sq. ft. (366-g/sq. m) metallic (zinc) coating. Provide one bar for each gate and end post, and two for each corner and pull post unless fabric is integrally woven into post.

F. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

G. Barbed Wire Arms: Pressed steel or cast iron, with clips, slots, or other means for attaching strands of barbed wire , and means for attaching to posts , integral with post cap; for each post, unless otherwise indicated, and as follows:

1. Line posts with arms designed with opening to accommodate top rail or tension wire.

2. Corner arms at fence corner posts, unless extended posts are indicated.

3. Type I, single slanted arm.

4. Bolts or rivets for connection to post.

H. Tie Wires, Clips, and Fasteners: According to ASTM F626 and ASTM F1916.

1. High-Security Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

a. Weight of Metallic (Zinc) Coating: ASTM A641/A 641M, Class B, 2.0 oz./sq. ft. (610 g/sq. m).

2.08 BARBED WIRE

A. Zinc-Coated Steel Barbed Wire: Comply with ASTM A121, Chain-Link Fence grade for the following two-strand barbed wire:

1. Standard Size and Construction: 0.099-inch (2.51-mm) diameter line wire with 0.080-inch (2.03-mm) diameter, two-point round barbs spaced not more than 3 inches (76 mm) o.c.

2.09 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer for exterior applications.

2.10 FENCE GROUNDING

a. Not Used

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.

1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.03 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

3.04 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Exposed Concrete: Extend 2 inches (51 mm) above grade or to same elevation as concrete grade beam; shape and smooth to shed water.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.

D. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric 6 feet (1.8 m) or higher, on fences with top rail and at two-thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Barbed Wire Arms: Bolt or rivet to top of post. Angle single arms away from approach side of fence.

G. Tension Wire: Install according to ASTM F567 and ASTM F1916, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with

0.120-inch (3.05-mm) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric.

1. Bottom Tension Wire: Install tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.

H. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by fencing manufacturer.

I. Chain-Link Fabric: Apply fabric to inside of enclosing framework. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

1. Leave 1 inch (25.4 mm) between finish grade or surface and bottom selvage, unless otherwise indicated.

2. Overlapping Fabric: At or between post or rail according to ASTM F1916 with wire ties or steel strap method.

J. Concrete Grade Beams: Cast-in-place concrete, depth not less than 12 inches (305 mm) below grade and as indicated on Drawings; slope top surface to drain.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (381 mm) o.c.

L. Tie Wires: Power-fastened or manually fastened ties configured to wrap a full 360 degrees around rail or post and a minimum of one complete diamond of fabric. Twist ends one and one-half machine twists or three full manual twists, and cut-off protruding ends to preclude untwisting by hand.

1. Maximum Spacing: Tie fabric to line posts at 12 inches (305 mm) o.c. and to braces at 24 inches (610 mm) o.c.

2. Fasten fabric to line posts 12 inches (305 mm) o.c. and to braces 24 inches (610 mm) o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

N. Barbed Wire: Install barbed wire uniformly spaced as indicated on Drawings. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

O. Barbed Tape: Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement according to ASTM F1911.

P. Grounding Barrier Stakes: Stake coils at 10 feet (3 m) o.c., driven to full depth.

3.05 GATE INSTALLATION

A. Install gates according to manufacturer’s written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using

tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.06 GROUNDING AND BONDING

A. Not Used

3.07 FIELD QUALITY CONTROL

A. Fabric Testing: Test fabric tension according to ASTM F1916.

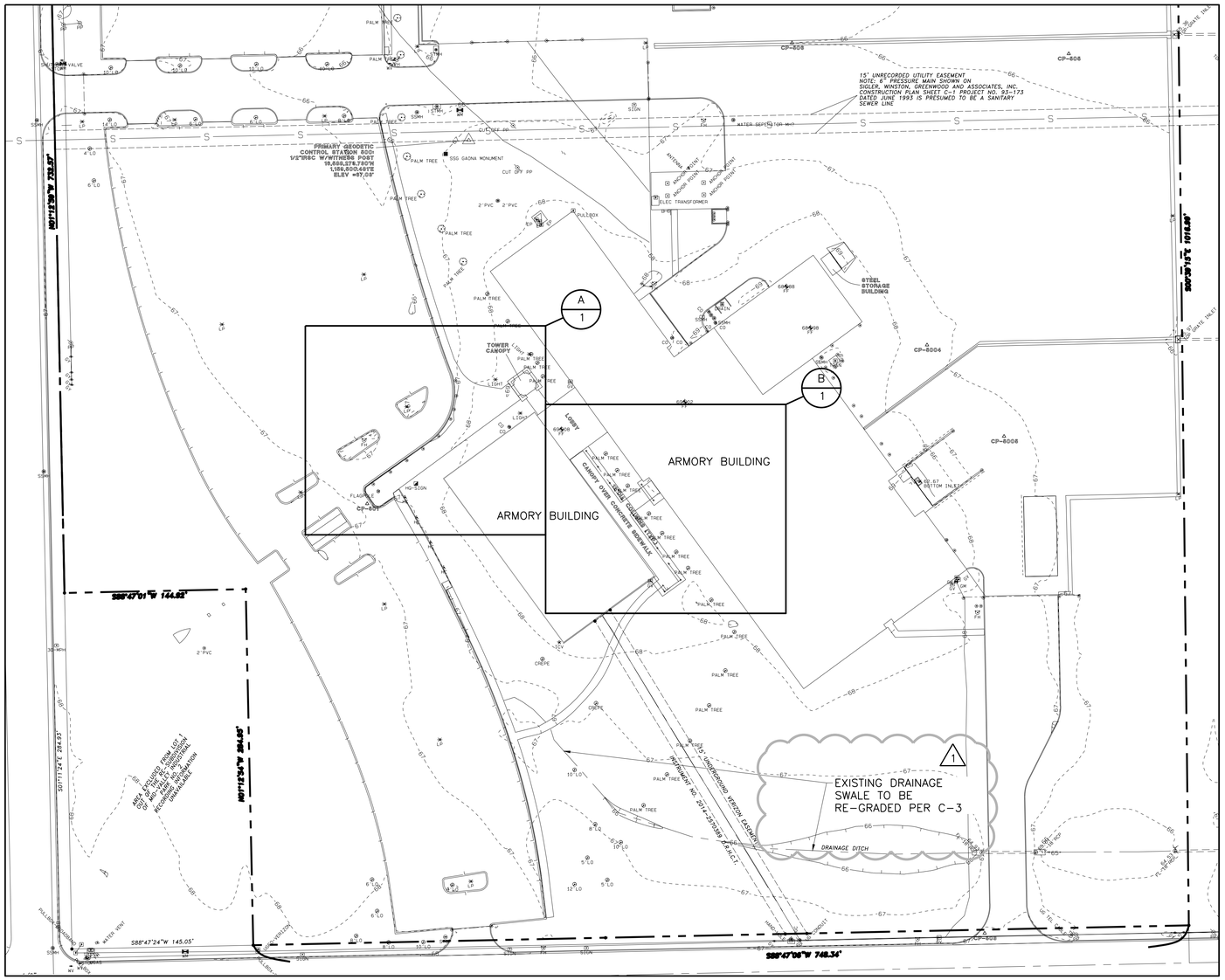
B. Fence Post Rigidity Testing: Test line posts for rigidity according to ASTM F1916.

C. Grounding-Resistance Testing: Not used

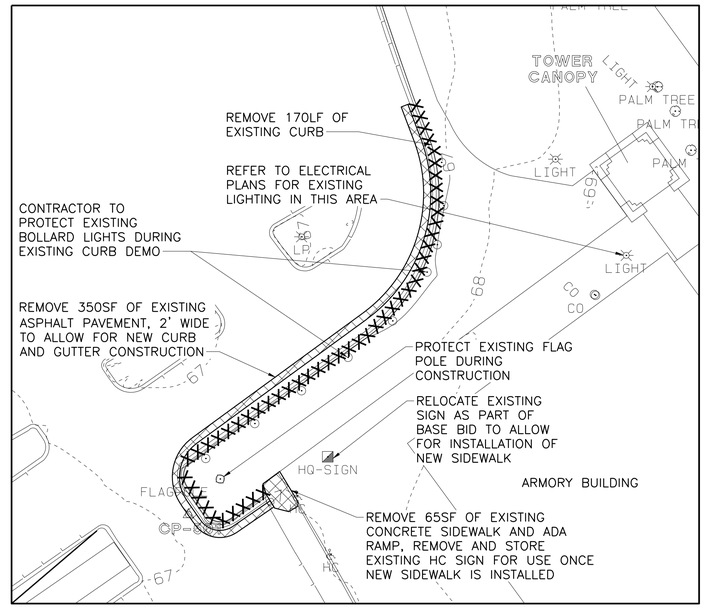
3.08 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

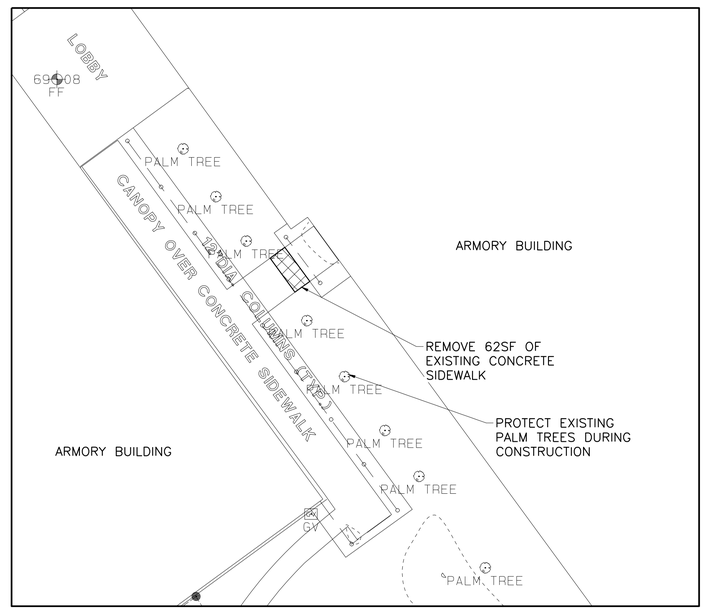
END OF SECTION



NORTH 1 — OVERALL DEMO PLAN
1" = 50'-0"



NORTH A 1 — DETAIL ENTRANCE DEMO BASE BID
1" = 20'-0"



NORTH B 1 — DETAIL BREEZEWAY DEMO BID OPTION (7)
1" = 20'-0"

0 10' 20' 40'
SCALE IN FEET

0 50' 100'
SCALE IN FEET

LEGEND

- EXISTING PAVEMENT DEMOLITION AS BASE AND BID OPTION 7
- XXXXXX — TO BE DEMOLISHED
- PROPERTY LINE

NOTES

1. SUMMARY OF CIVIL BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. CONTRACTOR SHALL CONSULT WITH OWNER FOR MATERIAL STORAGE AND LAY-DOWN AREAS.

BID OPTIONS "◯"

1
6. EXTERIOR BUILDING/EXISTING MOV PARKING MAINTENANCE EFFORT/BUILDING SIGN.
7. EXTERIOR EARTHWORK & DRAINAGE.
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.

STATE OF TEXAS
BRETT M. BRISTOW
101000
LICENSED
PROFESSIONAL ENGINEER
08/01/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: BMB
REVIEWED BY: THH

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDM #1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

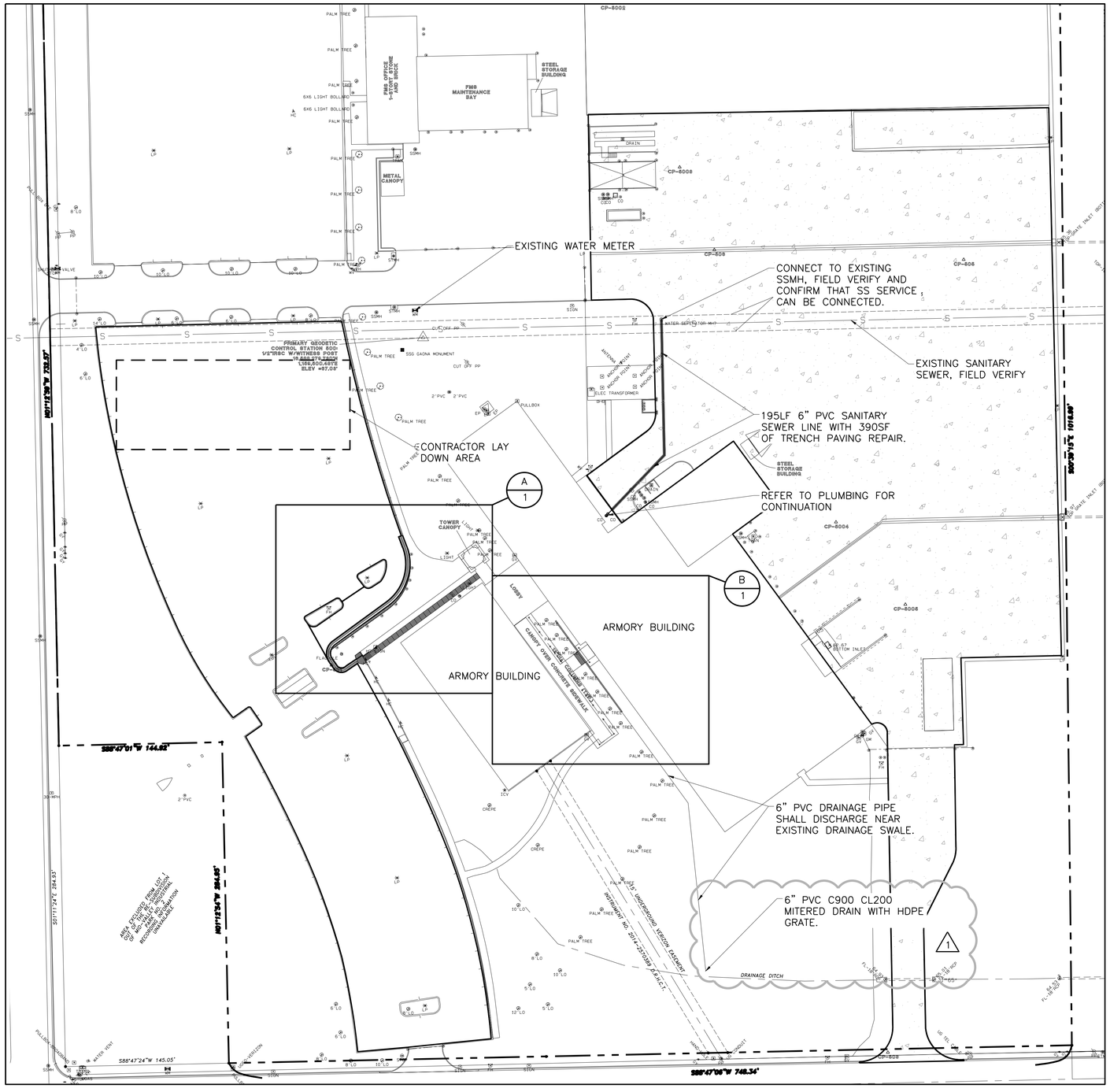
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

CIVIL DEMOLITION PLAN

C-1

SHT. 1 of 129



LEGEND

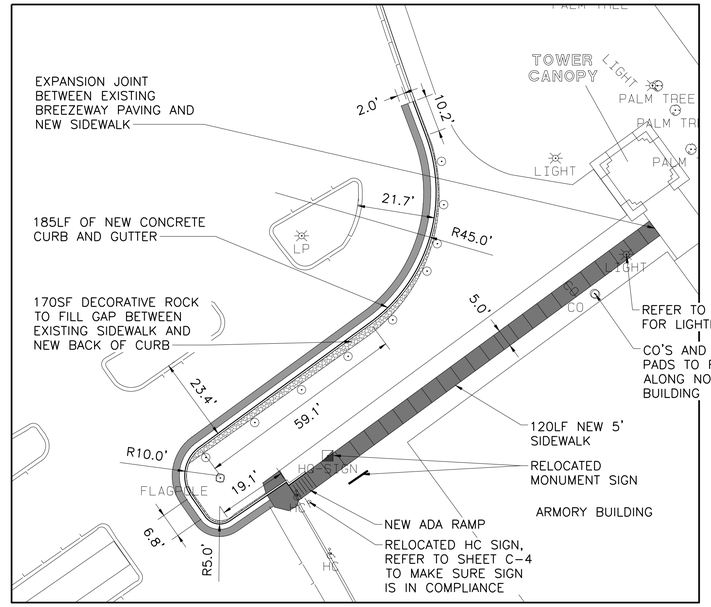
- EXISTING CONCRETE MAINTENANCE EFFORT, BID OPTION (6)
- NEW CONCRETE SIDEWALK FOR ADA COMPLIANCE, BASE BID
- 2' ASPHALT PAVING FOR INSTALLATION OF CURB AND GUTTER, BASE BID

OVERALL PAVING PLAN BASE AND BID OPTIONS 6&7

NORTH 1 — 1" = 50'-0"

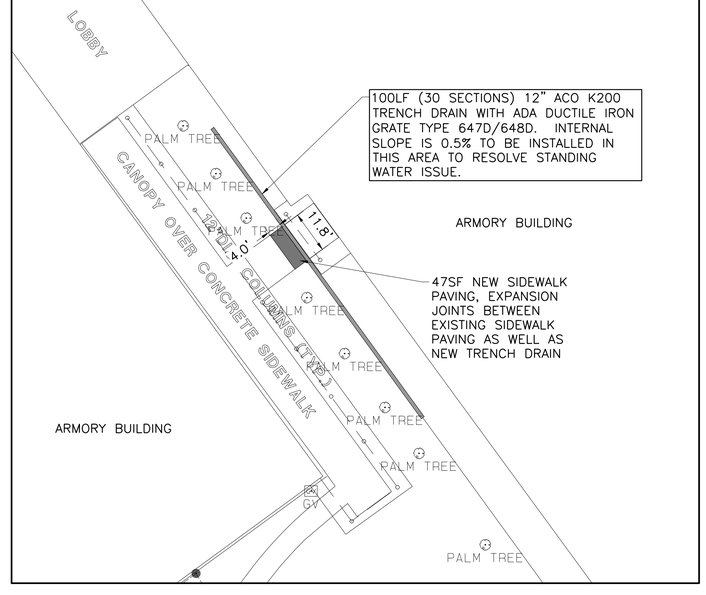
BID OPTIONS "◯"

6. EXTERIOR BUILDING/EXISTING MOV PARKING MAINTENANCE EFFORT/BUILDING SIGN. (1)
7. EXTERIOR EARTHWORK & DRAINAGE.
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.



DETAIL ENTRANCE PAVING BASE BID

NORTH A 1 — 1" = 20'-0"



DETAIL BREEZEWAY PAVING BID OPTION (7)

NORTH B 1 — 1" = 20'-0"

NOTES:

1. REFER TO ARCHITECTURE SHEETS FOR UPDATED SECURITY FENCING LOCATIONS.
2. SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
3. ALL DIMENSIONS AND COORDINATES ARE TO FACE OF CURB OR EDGE OF PAVEMENT UNLESS NOTED OTHERWISE.
4. SEE SHEET C-4 FOR PAVING DETAILS, PAVEMENT SECTIONS AND JOINTING NOTES.
5. ALL NEW SIDEWALKS AND RAMPS SHOWN ON DRAWINGS MUST BE IN COMPLIANCE WITH CURRENT TEXAS ACCESSIBILITY STANDARDS AND ADA.
6. IF ANY CURBS THAT ARE NOT PART OF THE BASE BID CONSTRUCTION ARE DAMAGED CONTRACTOR SHALL REPLACE CURB. (1)

0 10' 20' 40' SCALE IN FEET

0 50' 100' SCALE IN FEET

STATE OF TEXAS — BRETT M. BRISTOW — 101000 — LICENSED PROFESSIONAL ENGINEER — 08/01/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: BMB
REVIEWED BY: THH

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDM #1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6151 FAX (512) 782-1481

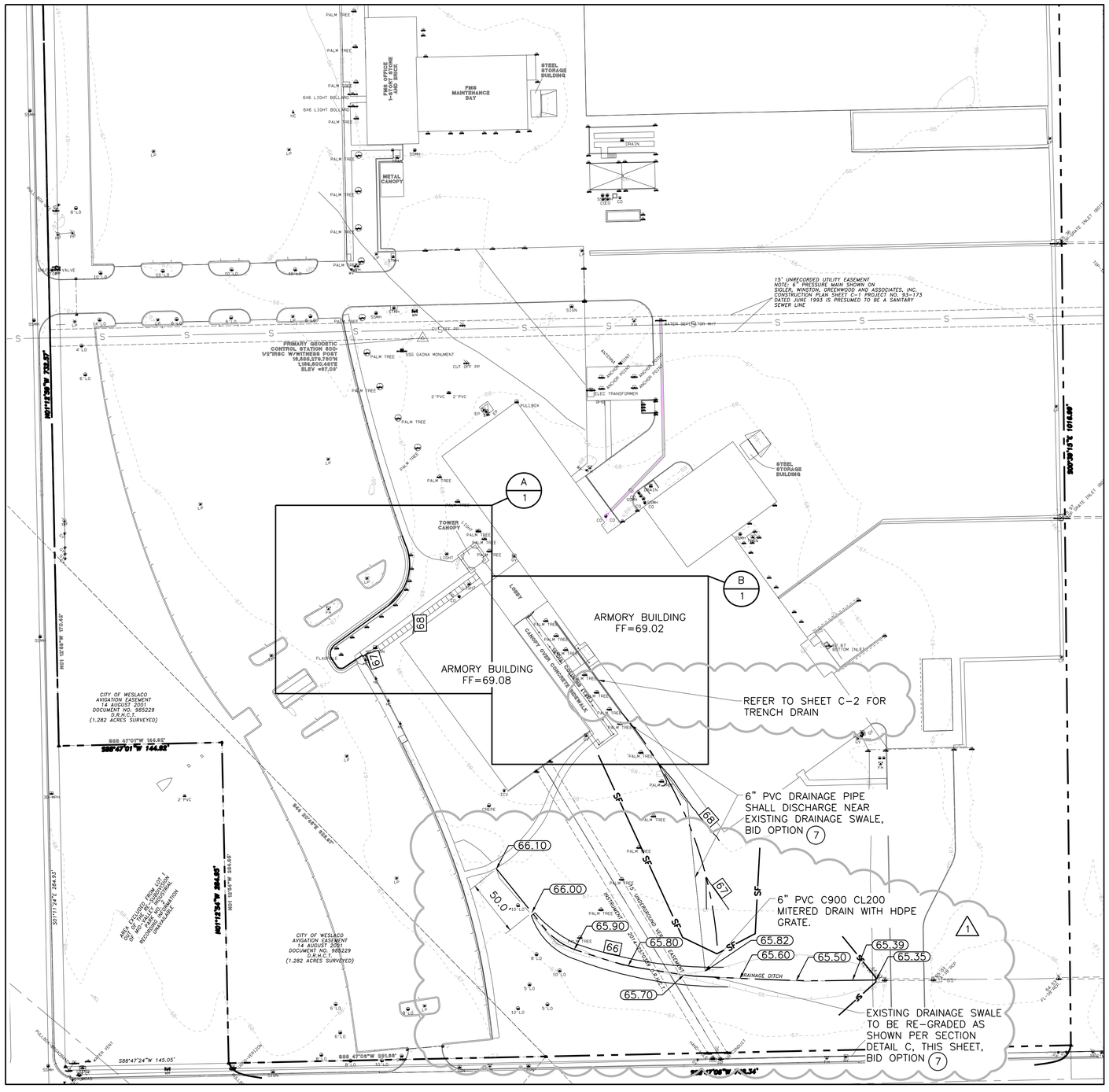
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

CIVIL PAVING PLAN

C-2

SHT. 3 of 129



LEGEND

- 65.00 — TOP OF PAVEMENT
- 65.00 — NATURAL GROUND
- 65.00 — EXISTING SHOT
- 65 — EXISTING CONTOURS
- 65 — PROPOSED CONTOURS
- SF — SILT FENCE, REFER TO DETAIL 1, SHEET C-5
- FLOW LINE

OVERALL GRADING PLAN BASE AND BID OPTIONS 6&7

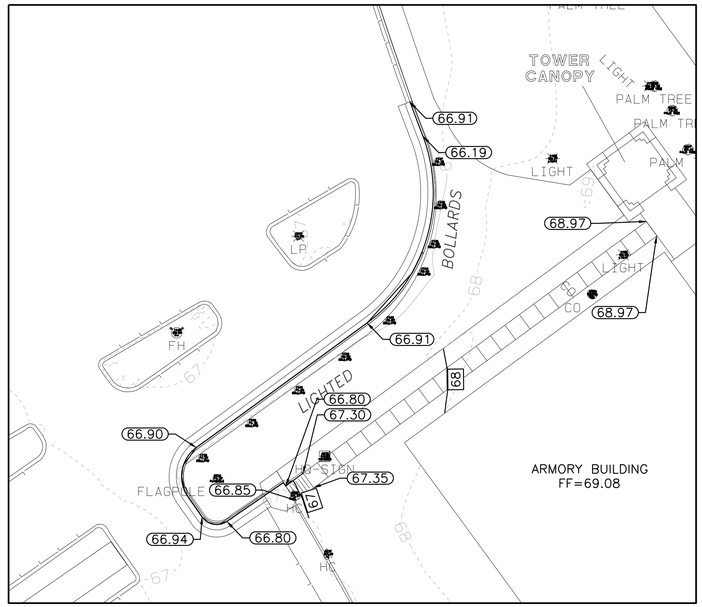
NORTH 1 – 1" = 50'-0"

BID OPTIONS "○"

6. EXTERIOR BUILDING/EXISTING MOV PARKING MAINTENANCE EFFORTS/BUILDING SIGN. (1)
7. EXTERIOR EARTHWORK & DRAINAGE.
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.

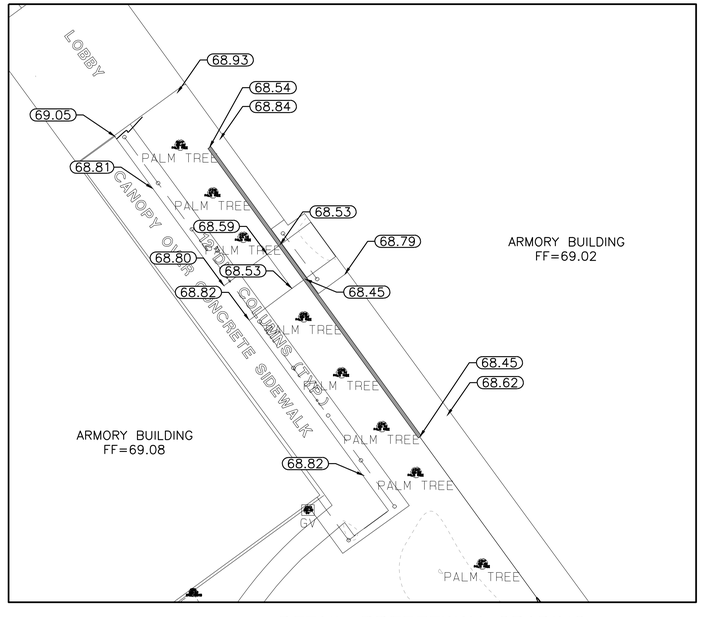
NOTES:

1. SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1.
2. ALL PROPOSED SIDEWALKS AND HANDICAP RAMPS MUST BE INSTALLED SO THEY ARE IN COMPLIANCE WITH CURRENT TEXAS ACCESSIBILITY STANDARDS AND ADA.
3. REFER TO SHEET C-5 FOR EROSION CONTROL DETAILS.
4. ALL DISTURBED AREAS AS A RESULT OF TRENCHING OR RE-GRADING SHALL BE SEEDED PER SPEC 31 25 13.13 (1)



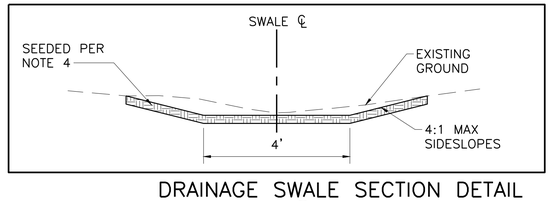
DETAIL ENTRANCE GRADING BASE BID

NORTH A 1 — 1" = 20'-0"



DETAIL BREEZEWAY GRADING BID OPTION (7)

NORTH B 1 — 1" = 20'-0"



DRAINAGE SWALE SECTION DETAIL BID OPTION (7)

NORTH B 1 — NOT TO SCALE (1)

0 10' 20' 40' SCALE IN FEET

0 50' 100' SCALE IN FEET

STATE OF TEXAS — BRETT M. BRISTOW — 101000 — LICENSED PROFESSIONAL ENGINEER — 08/01/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: BMB
REVIEWED BY: THH

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDM #1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6151 FAX (512) 782-1481

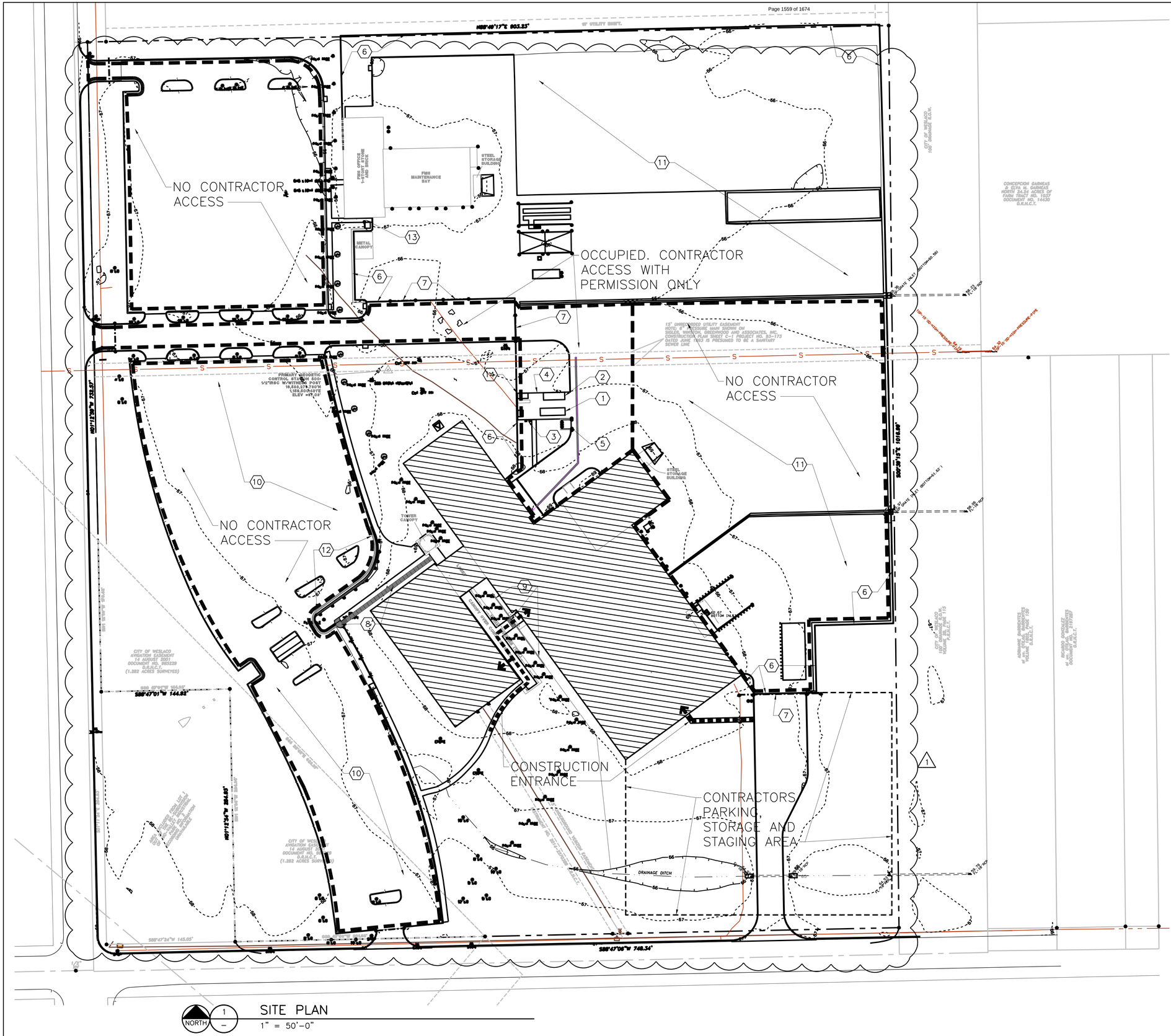
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

CIVIL
GRADING PLAN

C-3

SHT. 4 of 129



SITE PLAN
1" = 50'-0"

GENERAL NOTES

1. A SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. COORDINATE WITH OWNER TO DETERMINE LOCACTION(S) OF TEMPORARY FIELD OFFICES, STORAGE BUILDINGS, PARKING, TRAILERS, CONTAINTERS, STAGING AND STORAGE AREAS. PROVIDE TEMPORARY FENCING AND SIGNAGE. PROTECT FROM WEATHER, DAMAGE AND THEFT. PROVIDE TEMPORARY BARRICADES AND SIGNAGE AT WORK AREAS FOR UTILITY LINE INSTALLATIONS. PROVIDE TEMPORARY SIGNAGE AT MOV PARKING AREA TO LIMIT CONTRACTOR ACCESS WITH GOVERNMENT ESCORT.
3. DUE TO INCREASED SECURITY, DAILY ACCESS TO THE PROJECT SHALL GO THROUGH THE FRONT DOOR ENTRANCE AND SHALL BE COORDINATED WITH OWNER. NOTE THAT CERTAIN PARTS OF THE BUILDING AND THE SECURED MOV PARKING WILL BE OFF LIMITS.

NOTES BY SYMBOL "⬡"

1. LOCATIION OF TEMPORARY MODULAR RESTROOM BUILDING.
2. LOCATION OF TEMPORARY MODULAR SHOWER BUIDLING.
3. EXISTING ELECTRICAL SERVICE FOR TEMPORARY MODULAR BUILDING – G.C. TO FIELD VERIFY.
4. EXISTING CONCRETE PAD FOR TEMPORARY MODULAR BUILDINGS.
5. EXISTING DUMPSTER TO REMAIN.
6. NEW FENCE TO MEET ATFP REQUIREMENTS PER DETAILS ON SHEET A-5. EXISTING FENCE TO BE REMOVED AND DISPOSAL CONDUCTED BY THE GC WASTE MANAGEMENT PLAN. 1
7. NEW GATE TO MEET ATFP REQUIREMENTS PER DETAILS ON SHEET A-4. EXISTING GATE TO BE REMOVED AND DISPOSAL CONDUCTED BY THE GC WASTE MANAGEMENT PLAN. 1
8. NEW SIDEWALK – REFER DETAIL A ON SHEET C-2.
9. NEW TRENCH DRAIN AND PAVING – REFER DETAIL B ON SHEET C-2.
10. EXISTING POV PARKING – REFER CIVIL SHEET C-2.
11. EXISTING MOV PARKING AREA.
12. NEW CONCRETE CURB AND GUTTER AND ROCK INFILL – REFER DETAIL A ON SHEET C-2.
13. NEW PERSONNEL GATE TO MEET ATFP REQUIREMENTS PER DETAILS ON SHEET A-4. EXISTING PERSONNEL GATE TO BE REMOVED AND DISPOSAL CONDUCTED BY THE GC WASTE MANAGEMENT PLAN.
14. LOCATION OF ADA COMPLIANT TEMPORARY COMBINATION RESTROOM/SHOWER BUILDING. 1

BID OPTIONS "◯"

1. TEMPORARY RESTROOM PORTABLE UNIT AND ADA-COMPLIANT RESTROOM/SHOWER UNIT.
2. TEMPORARY SHOWER PORTABLE UNIT.
6. EXTERIOR BOLLIDS / PARKING IMPROVEMENTS/ BUILDING SIGN. 1
7. EXTERIOR EARTHWORK & DRAINAGE.
8. ELECTRICAL GENERATOR PROVISIONS.
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.

0 50' 100'
SCALE IN FEET

REGISTERED ARCHITECT ROMEO SAENZ 25041 STATE OF TEXAS
08/01/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDENDUM 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

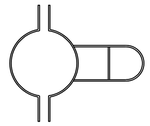
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

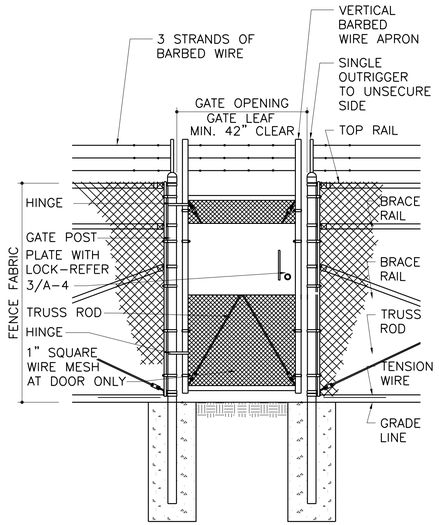
ARCHITECTURAL SITE PLAN

A-3

SHT. 10 of 129



STANDARD HINGE



GATE POSTS OUTSIDE DEIMENSION (NOMINAL) TO BE 2.875"

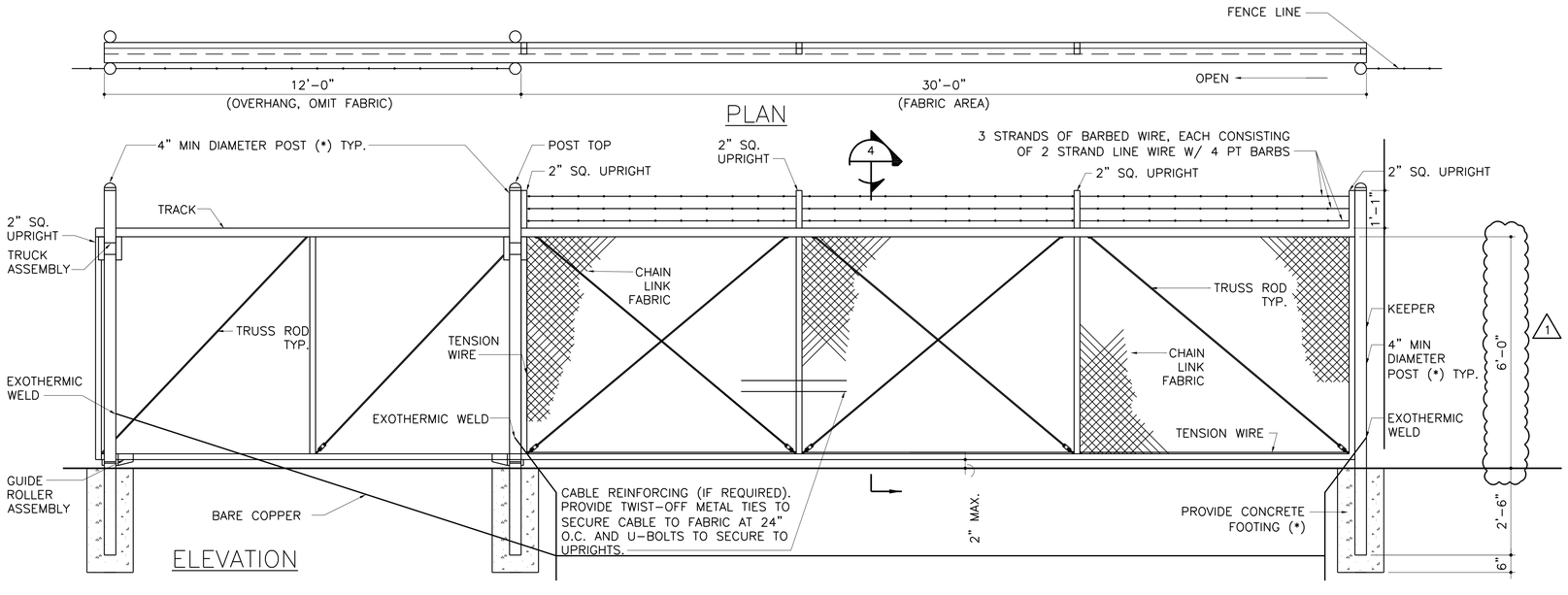
NOTES:

1. FOR NON-SENSORED FENCES, DETAILS SHOWN ARE TO CLARIFY REQUIREMENTS AND ARE NOT INTENDED TO LIMIT OTHER TYPE OF FENCE SECTIONS AND METHODS OF INSTALLATION WHICH COMPLY WITH THE SPECIFICATIONS.
2. SWING GATES SHALL BE CONSTRUCTED WITH DROP RODS, PADLOCKS, LATCH ASSEMBLY AND GATE KEEPERS EXCEPT AS NOTED.
3. ALL GATE FRAMES SHALL MEET THE
4. MINIMUM REQUIREMENTS OF ASTM F900 1.90" NOMINAL (ROUND) OR 2.00" NOMINAL (SQUARE). GATE FRAMES SHALL BE OF WELDED CONSTRUCTION OR SHALL BE ASSEMBLED USING HEAVY FITTINGS. AT CONTRACTOR'S OPTION A WELDED HORIZONTAL BRACE MAY BE USED IN LIEU OF TRUSS RODS TO BRACE ALL WELDED GATE FRAMES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER RIGID CONSTRUCTION OF ALL GATES SUPPLIED.
5. GATES SHALL BE DESIGNATED AS FOLLOWS:

FENCE TYPE	–	FE5, FE6, ETC.
FENCE HEIGHT	–	INCHES
TYPE OPENING	–	SO (SINGLE)
	–	DO (DOUBLE)
HINGE	–	RA (STANDARD)
	–	HO (OFFSET)
OPENING	–	FEET (CLEAR OPENING BETWEEN GATE POSTS)
EXAMPLES:		FE6-84-DO-RA-24
		FE5-48-SO-GO-6

6. UNLESS NOTED OTHERWISE, PROVIDE FE6-72-DO-HO-42.
7. SEE DRAWINGS PER NUMBER, WIDTH AND TYPE OF GATE OPENINGS.

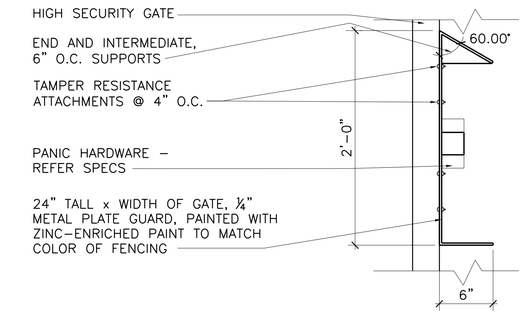
1 – PERSONNEL GATE TYPE FE-6 FENCE
NTS



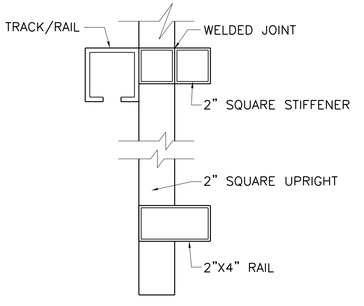
(*) POST SIZE AND ASSOCIATED FOOTING DIAMETER TO BE DETERMINED BY MANUFACTURER, BASED ON LEAF WEIGHT AND DIMENSION. MINIMUM FOOTING DIAMETERS (TO BE FILLED WITH 4000 PSI CONCRET: 40" DIAMETER FOR 8" POST; 36" DIAMETER FOR 6" POST; 24" DIAMETER FOR 4" POST; OTHER SIZES TO BE DESIGNED BY MANUFACTURER OR KTR. NO FOOTING WIDTH SHALL BE LESS THAN 4(X) THE POST WIDTH.

BARBED WIRE NOT SHOWN ON FENCE PORTION FOR CLARITY. SEE SHEET A-5 FOR FENCE DESIGN AND BARBED WIRE.

2 – SINGLE CANTILEVERED SLIDING GATE 3 FABRIC BAYS/2 WITHOUT
NTS



3 – PANIC HARDWARE GUARD AT PERSONNEL GATE
1 1/2" = 1'-0"



4 – SECTION (TYP)
NTS

BID OPTIONS "◯"

9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.

0 4" 8" 1'
1-1/2"=1'-0"

0 6" 1' 2'
3/4"=1'-0

0 1' 2' 4' 8'
1/4"=1'-0"



PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDENDUM 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

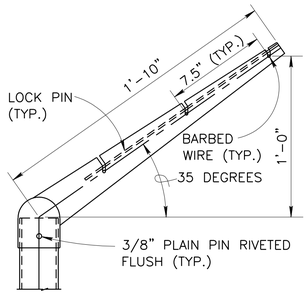
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

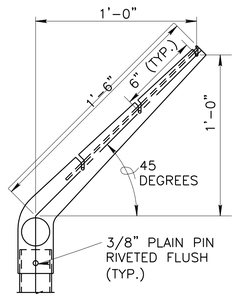
ARCHITECTURAL SITE DETAILS - BID OPTION 9

A-4

SHT. 11 of 129

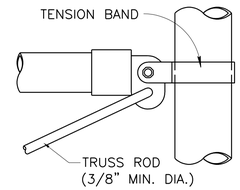


CORNER POST

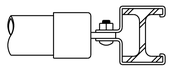


LINE POST

EXTENSION ARM DETAILS
NO SCALE

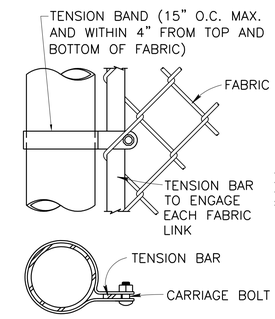


ROUND POST

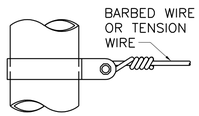


H-BEAM

BRACE RAIL CLAMP DETAILS

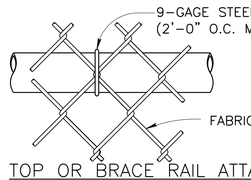


END OR GATE POST DETAIL

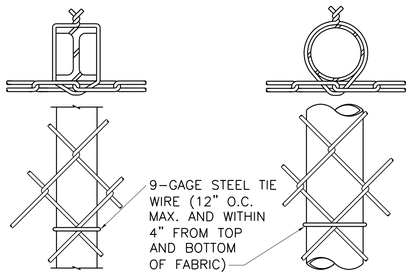


TENSION BAND DETAIL

FASTENING DETAILS
NO SCALE

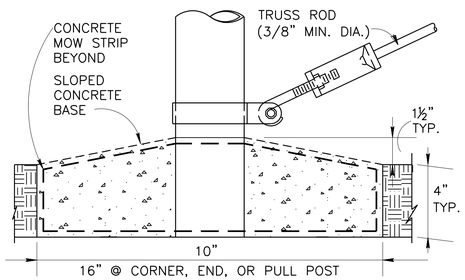


TOP OR BRACE RAIL ATTACHMENT

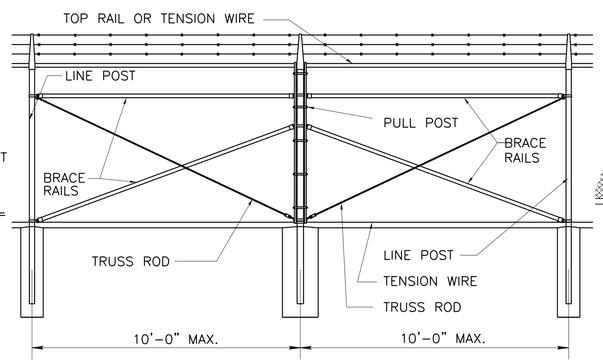


H-BEAM ROUND POST

LINE POST ATTACHMENTS
NO SCALE

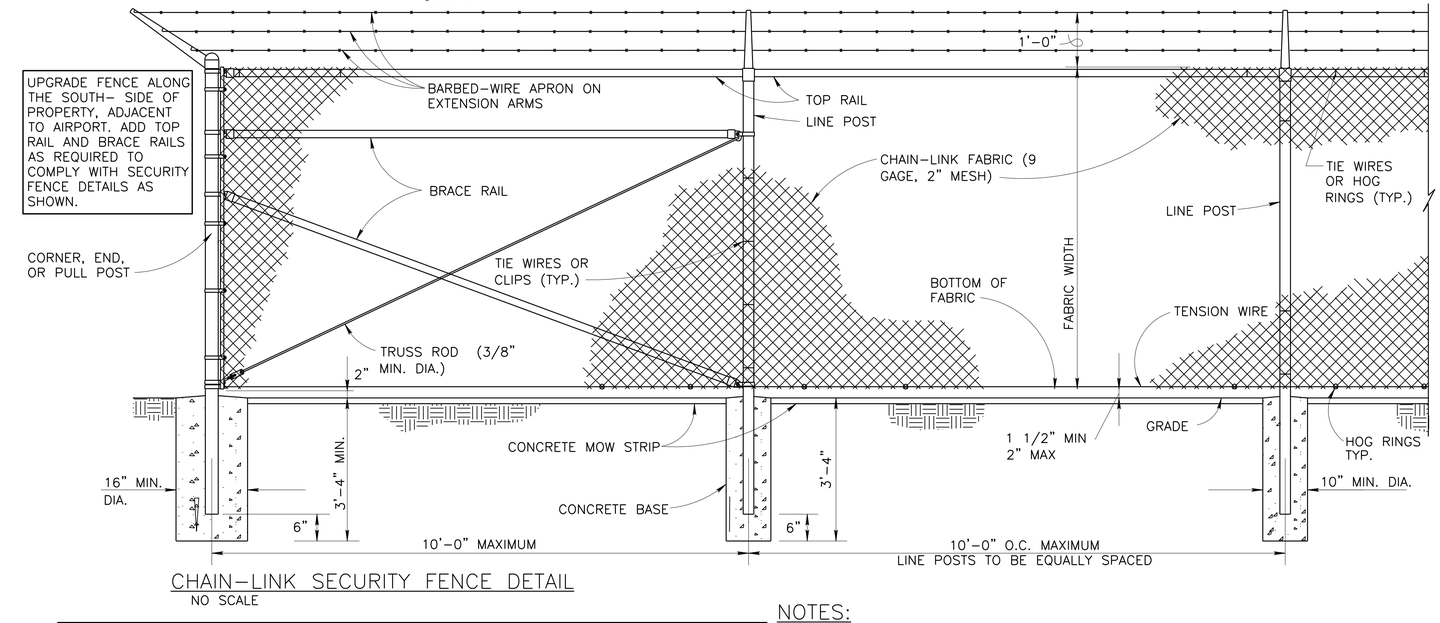


TRUSS ROD AND BAND
NO SCALE



BRACE PANEL DETAIL
NO SCALE

NOTE: PROVIDE BRACE PANEL WHENEVER STRAIGHT RUNS EXCEED 500 FEET.



CHAIN-LINK SECURITY FENCE DETAIL
NO SCALE

STEEL POST SCHEDULE

USE AND SECTION	MINIMUM OUTSIDE DIMENSIONS (NOMINAL)		
	FABRIC WIDTH < 72"	FABRIC WIDTH 84" TO 96"	FABRIC WIDTH >108"
CORNER, END & PULL POSTS			
TUBULAR – ROUND	4.00" O.D.		
TUBULAR – SQUARE	3.00" SQ.		
C-SECTION (ROLL-FORMED)			
LINE POSTS			
TUBULAR – ROUND	2.875" O.D.		
H-SECTION	2.25" X 1.70"		
C-SECTION (ROLL-FORMED)			
TOP, BOTTOM & BRACE RAILS			
TUBULAR – ROUND	1.66" O.D.		
TUBULAR – SQUARE	1.50" SQ.		
H-SECTION	1.625" X 1.50"		
C-SECTION (ROLL-FORMED)	1.625" X 1.25"		

1

NOTES:

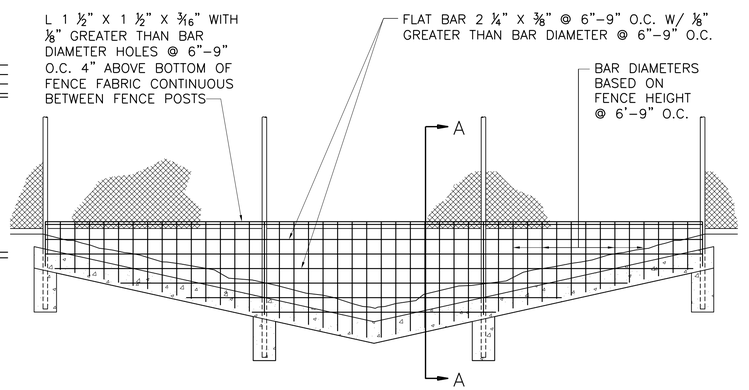
1. U.N.O. PROVIDE FENCE TYPE FE6, TR
2. DETAILS SHOWN ARE TO CLARIFY REQUIREMENTS AND ARE NOT INTENDED TO LIMIT OTHER TYPES OF FENCE SECTIONS AND METHODS OF INSTALLATION THAT COMPLY WITH THE SPECIFICATIONS.
3. WIRE TIES, RAILS, POSTS, AND BRACES SHALL BE CONSTRUCTED ON THE SECURE SIDE OF THE FENCE ALIGNMENT. CHAIN-LINK FABRIC SHALL BE PLACED ON THE SIDE OPPOSITE THE SECURE AREA.
4. UNLESS SPECIFICALLY SHOWN OR SPECIFIED, ALL FE6 FENCE SHALL HAVE AN APRON EXTENDED OUTWARD FROM THE AREA BEING PROTECTED.
5. C-SECTION POSTS SHALL BE INSTALLED SO THAT THE VOID INSIDE THE POST IS COMPLETELY FILLED WITH CONCRETE UP TO THE TOP OF THE FOUNDATION.
6. MODIFY FENCING AT SWALES AND GRADE DIPS PER UFC STANDARDS. COORDINATE WITH OWNER.

FENCE LEGEND:

TYPE FE5 – CHAIN-LINK FENCE WITHOUT BARBED-WIRE APRON
TYPE FE6 – CHAIN-LINK FENCE W/BARBED-WIRE ON SINGLE OUTRIGGER
TYPE FE7 – CHAIN-LINK FENCE W/BARBED WIRE ON DOUBLE OUTRIGGER
TYPE FE8 – CHAIN-LINK FENCE W/BARBED-WIRE AND BARBED-TAPE ON DOUBLE OUTRIGGER
TR – FENCE WITH TOP RAIL AND TENSION WIRE AT BOTTOM
TBR – FENCE WITH TOP AND BOTTOM RAILS
TWB – TENSION WIRE TOP AND BOTTOM
TWBR – FENCE WITH TOP TENSION WIRE AND BOTTOM RAIL
FINAL NUMBER IS FABRIC WIDTH IN INCHES.

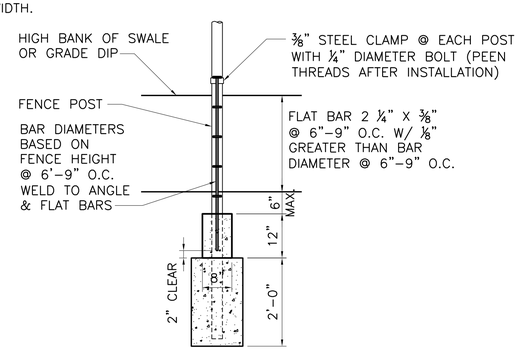
EXAMPLES

FE6-TR-72 – CHAIN-LINK SECURITY FENCE WITH BARBED-WIRE ON SINGLE OUTRIGGER, TOP RAIL, AND 72 INCH FABRIC WIDTH.
FE5-TWB-84 – CHAIN-LINK SECURITY FENCE WITH NO APRON, TOP AND BOTTOM TENSION WIRE, AND
84 INCH FABRIC WIDTH.



ELEVATION

FENCE SECURITY BARRIER AT SWALE OR GRADE DIP
NO SCALE



SECTION A-A

BID OPTIONS "◯"

9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.



THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDENDUM 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

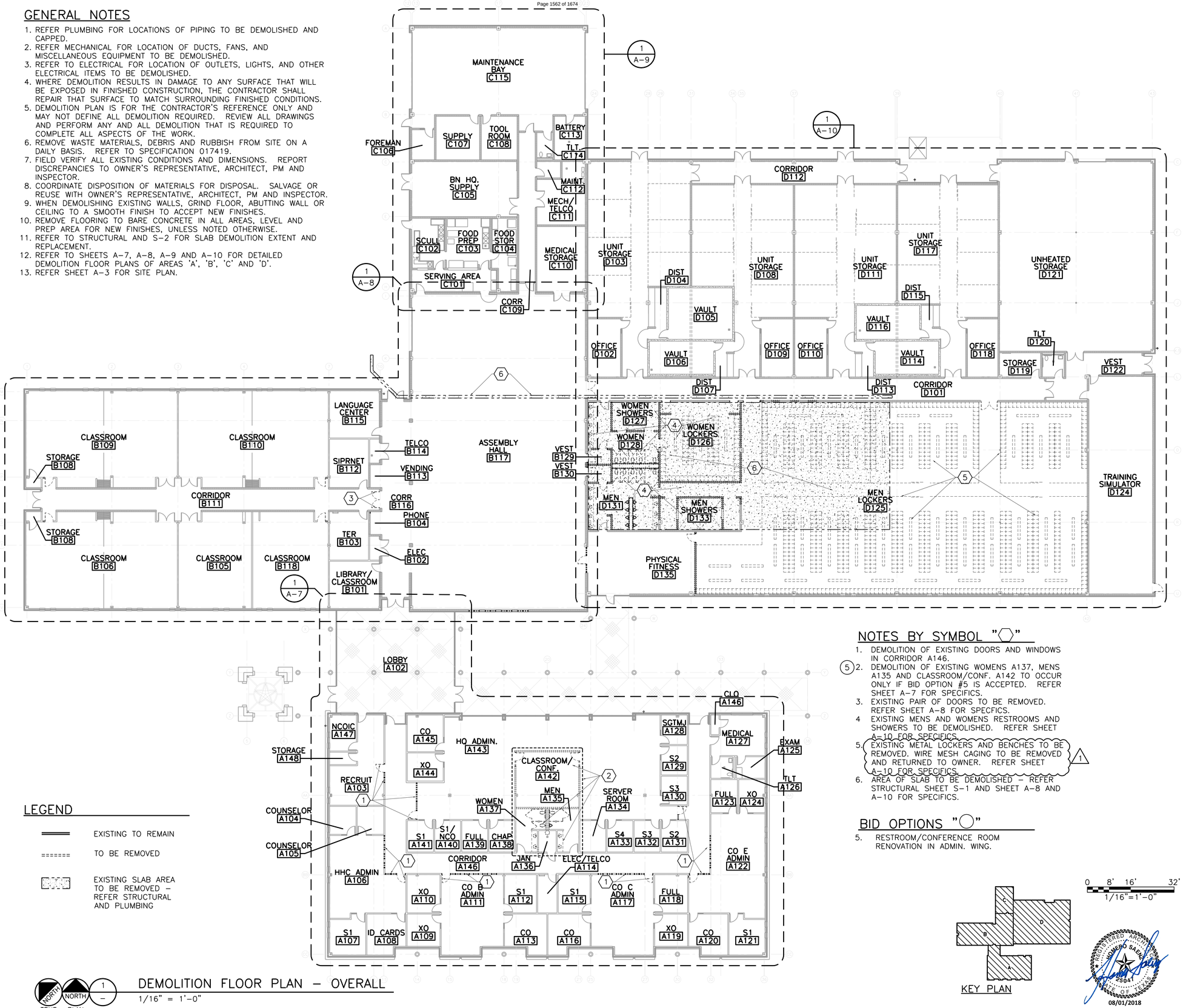
ARCHITECTURAL SECURITY FENCING DETAILS - BID OPTION 9

A-5

SHT. 12 of 129

GENERAL NOTES

1. REFER PLUMBING FOR LOCATIONS OF PIPING TO BE DEMOLISHED AND CAPPED.
2. REFER MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
3. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
4. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
5. DEMOLITION PLAN IS FOR THE CONTRACTOR'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS AND PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
6. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
7. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
9. WHEN DEMOLISHING EXISTING WALLS, GRIND FLOOR, ABUTTING WALL OR CEILING TO A SMOOTH FINISH TO ACCEPT NEW FINISHES.
10. REMOVE FLOORING TO BARE CONCRETE IN ALL AREAS, LEVEL AND PREP AREA FOR NEW FINISHES, UNLESS NOTED OTHERWISE.
11. REFER TO STRUCTURAL AND S-2 FOR SLAB DEMOLITION EXTENT AND REPLACEMENT.
12. REFER TO SHEETS A-7, A-8, A-9 AND A-10 FOR DETAILED DEMOLITION FLOOR PLANS OF AREAS 'A', 'B', 'C' AND 'D'.
13. REFER SHEET A-3 FOR SITE PLAN.



LEGEND

- EXISTING TO REMAIN
- TO BE REMOVED
- EXISTING SLAB AREA TO BE REMOVED – REFER STRUCTURAL AND PLUMBING

NOTES BY SYMBOL "⬡"

1. DEMOLITION OF EXISTING DOORS AND WINDOWS IN CORRIDOR A146.
2. DEMOLITION OF EXISTING WOMENS A137, MENS A135 AND CLASSROOM/CONF. A142 TO OCCUR ONLY IF BID OPTION #5 IS ACCEPTED. REFER SHEET A-7 FOR SPECIFICS.
3. EXISTING PAIR OF DOORS TO BE REMOVED. REFER SHEET A-8 FOR SPECFICS.
4. EXISTING MENS AND WOMENS RESTROOMS AND SHOWERS TO BE DEMOLISHED. REFER SHEET A-10 FOR SPECIFICS.
5. EXISTING METAL LOCKERS AND BENCHES TO BE REMOVED. WIRE MESH CAGING TO BE REMOVED AND RETURNED TO OWNER. REFER SHEET A-10 FOR SPECIFICS.
6. AREA OF SLAB TO BE DEMOLISHED – REFER STRUCTURAL SHEET S-1 AND SHEET A-8 AND A-10 FOR SPECIFICS.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN. WING.

KEY PLAN

0 8' 16' 32'
1/16"=1'-0"

08/01/2018

NORTH TRUE NORTH 1 – DEMOLITION FLOOR PLAN – OVERALL
1/16" = 1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT: HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDENDUM 1

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

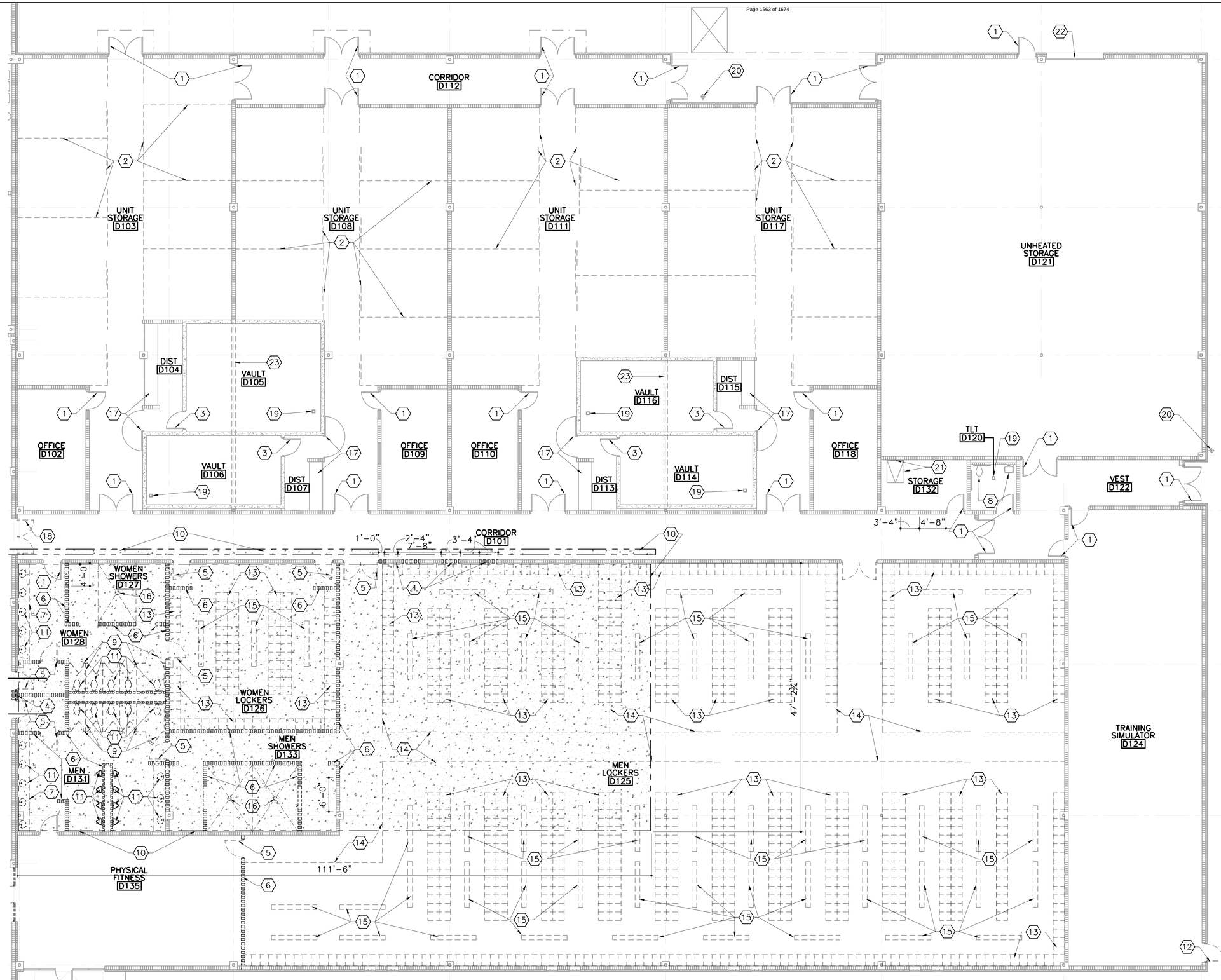
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL
OVERALL DEMOLITION FLOOR PLAN

A-6

SHT. 13 of 129

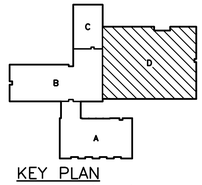


GENERAL NOTES

1. REFER PLUMBING FOR LOCATIONS OF PIPING TO BE DEMOLISHED AND CAPPED.
2. REFER MECHANICAL FOR LOCATION OF DUCTS, FANS, AND MISCELLANEOUS EQUIPMENT TO BE DEMOLISHED.
3. REFER TO ELECTRICAL FOR LOCATION OF OUTLETS, LIGHTS, AND OTHER ELECTRICAL ITEMS TO BE DEMOLISHED.
4. WHERE DEMOLITION RESULTS IN DAMAGE TO ANY SURFACE THAT WILL BE EXPOSED IN FINISHED CONSTRUCTION, THE CONTRACTOR SHALL REPAIR THAT SURFACE TO MATCH SURROUNDING FINISHED CONDITIONS.
5. DEMOLITION PLAN IS FOR THE CONTRACTOR'S REFERENCE ONLY AND MAY NOT DEFINE ALL DEMOLITION REQUIRED. REVIEW ALL DRAWINGS AND PERFORM ANY AND ALL DEMOLITION THAT IS REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK.
6. REMOVE WASTE MATERIALS, DEBRIS AND RUBBISH FROM SITE ON A DAILY BASIS. REFER TO SPECIFICATION 017419.
7. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. REPORT DISCREPANCIES TO OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
8. COORDINATE DISPOSITION OF MATERIALS FOR DISPOSAL. SALVAGE OR REUSE WITH OWNER'S REPRESENTATIVE, ARCHITECT, PM AND INSPECTOR.
9. WHEN DEMOLISHING EXISTING WALLS, GRIND FLOOR, ABUTTING WALL OR CEILING TO A SMOOTH FINISH TO ACCEPT NEW FINISHES.
10. REMOVE FLOORING TO BARE CONCRETE IN ALL AREAS, LEVEL AND PREP AREA FOR NEW FINISHES, UNLESS NOTED OTHERWISE.
11. REFER TO STRUCTURAL AND S-1 FOR SLAB DEMOLITION EXTENT AND REPLACEMENT.

NOTES BY SYMBOL "⬡"

1. EXISTING DOOR TO REMAIN.
2. EXISTING WIRE MESH, DOOR AND PANEL TO REMAIN.
3. EXISTING VAULT DOOR TO REMAIN.
4. REMOVE PORTION OF WALL FOR NEW OPENING. REF: STRUCTURAL.
5. REMOVE EXISTING DOOR AND FRAME.
6. REMOVE EXISTING CMU WALL.
7. REMOVE EXISTING COUNTERTOP.
8. EXISTING PLUMBING TO REMAIN. REF: PLUMBING.
9. REMOVE EXISTING TOILET PARTITIONS.
10. DEMOLISH FLOOR AS NOTED. REF: STRUCTURAL.
11. REMOVE EXISTING PLUMBING FIXTURE AND ASSOCIATED PIPING. REF: PLUMBING.
12. REMOVE EXISTING ACCESS DOOR AND FRAME.
13. REMOVE EXISTING METAL LOCKERS.
14. REMOVE EXISTING WIRE MESH PANELS AND DOORS AND RETURN TO OWNER.
15. REMOVE EXISTING FLOOR MOUNTED BENCH.
16. REMOVE EXISTING GANG SHOWER PEDESTAL.
17. ISSUE COUNTER AND GATE TO REMAIN.
18. REMOVE DOORS, FRAME TO REMAIN.
19. EXISTING FLOOR DRAIN TO REMAIN.
20. EXISTING HOSE BIB TO BE DEMOLISHED. REF: PLUMBING.
21. EXISTING ROOF ACCESS HATCH AND WALL MOUNTED LADDER TO REMAIN.
22. EXISTING OVERHEAD DOOR TO REMAIN.
23. EXISTING 8" CMU WALL CONTINUES ACROSS THE TOP OF VAULT AREA TO THE BOTTOM OF DECK.



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

DEMOLITION FLOOR PLAN – AREA "D"

1/8" = 1'-0"

NORTH TRUE NORTH PLAN

LEGEND

EXISTING TO REMAIN

TO BE REMOVED

EXISTING SLAB AREA TO BE REMOVED – REFER STRUCTURAL AND PLUMBING

REGISTERED ARCHITECT HOMERO SAENZ 25041 STATE OF TEXAS
08/01/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDENDUM 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

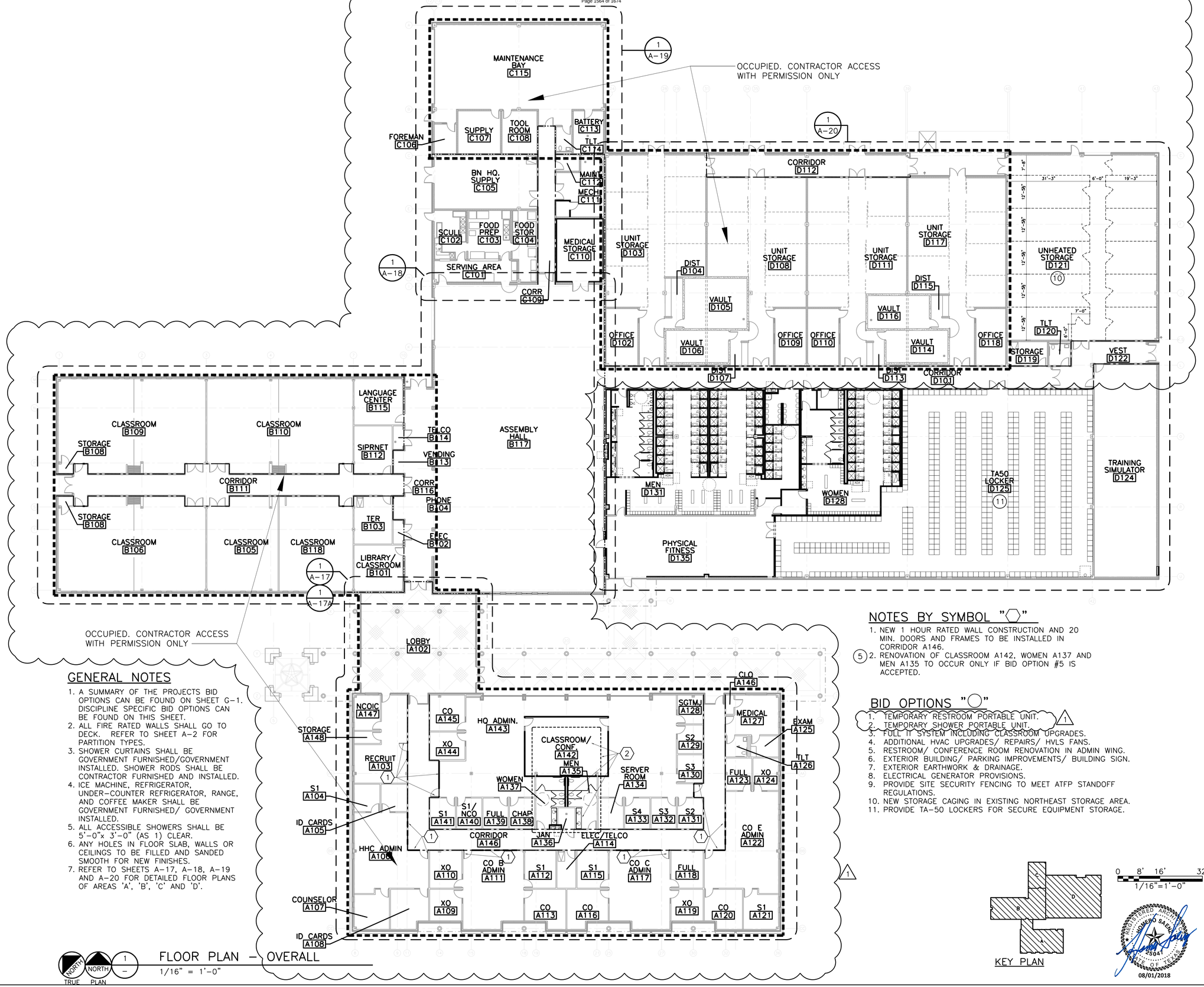
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL DEMOLITION FLOOR PLAN - AREA 'D'

A-10

SHT. 17 of 129



GENERAL NOTES

1. A SUMMARY OF THE PROJECTS BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. ALL FIRE RATED WALLS SHALL GO TO DECK. REFER TO SHEET A-2 FOR PARTITION TYPES.
3. SHOWER CURTAINS SHALL BE GOVERNMENT FURNISHED/GOVERNMENT INSTALLED. SHOWER RODS SHALL BE CONTRACTOR FURNISHED AND INSTALLED.
4. ICE MACHINE, REFRIGERATOR, UNDER-COUNTER REFRIGERATOR, RANGE, AND COFFEE MAKER SHALL BE GOVERNMENT FURNISHED/ GOVERNMENT INSTALLED.
5. ALL ACCESSIBLE SHOWERS SHALL BE 5'-0"x 3'-0" (AS 1) CLEAR.
6. ANY HOLES IN FLOOR SLAB, WALLS OR CEILINGS TO BE FILLED AND SANDED SMOOTH FOR NEW FINISHES.
7. REFER TO SHEETS A-17, A-18, A-19 AND A-20 FOR DETAILED FLOOR PLANS OF AREAS 'A', 'B', 'C' AND 'D'.

NOTES BY SYMBOL "⬡"

1. NEW 1 HOUR RATED WALL CONSTRUCTION AND 20 MIN. DOORS AND FRAMES TO BE INSTALLED IN CORRIDOR A146.
(5) 2. RENOVATION OF CLASSROOM A142, WOMEN A137 AND MEN A135 TO OCCUR ONLY IF BID OPTION #5 IS ACCEPTED.

BID OPTIONS "◯"

1. TEMPORARY RESTROOM PORTABLE UNIT. (1)
2. TEMPORARY SHOWER PORTABLE UNIT.
3. FULL IT SYSTEM INCLUDING CLASSROOM UPGRADES.
4. ADDITIONAL HVAC UPGRADES/ REPAIRS/ HVLS FANS.
5. RESTROOM/ CONFERENCE ROOM RENOVATION IN ADMIN WING.
6. EXTERIOR BUILDING/ PARKING IMPROVEMENTS/ BUILDING SIGN.
7. EXTERIOR EARTHWORK & DRAINAGE.
8. ELECTRICAL GENERATOR PROVISIONS.
9. PROVIDE SITE SECURITY FENCING TO MEET ATFP STANDOFF REGULATIONS.
10. NEW STORAGE CAGING IN EXISTING NORTHEAST STORAGE AREA.
11. PROVIDE TA-50 LOCKERS FOR SECURE EQUIPMENT STORAGE.

NORTH TRUE NORTH PLAN 1 — FLOOR PLAN – OVERALL

1/16" = 1'-0"

KEY PLAN

0 8' 16' 32'

1/16"=1'-0"

08/01/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDENDUM 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL OVERALL FLOOR PLAN

A-16

SHT. 23 of 129

ROOM FINISH SCHEDULE

ROOM NO.	ROOM NAME	FLOOR	BASE	WALLS				CEILING	HEIGHT	NOTES
				NORTH	EAST	SOUTH	WEST			
A102	LOBBY	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A103	RECRUIT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A104	COUNSELOR	CPT-1	RB-1	PT-1	PT-1	PT-1	PT-1	ACT-1	8'-8"	
A105	COUNSELOR	CPT-1	RB-1	PT-1	PT-1	PT-1	PT-1	ACT-1	8'-8"	
A106	HHC ADMIN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A107	S1	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A108	ID CARDS	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A109	XO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A110	XO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A111	CO B ADMIN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A112	S1	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A113	CO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A114	ELEC/ TELCO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A115	S1	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A116	CO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A117	CO C ADMIN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A118	FULL	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A119	ZO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A120	CO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A121	S1	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A122	CO E ADMIN	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A123	FULL	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A124	XO	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A125	EXAM	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A126	TLT	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A127	MEDICAL	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A127B	CLO	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A128	SGTMJ	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A129	S2	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A130	S3	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A131	S2	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A132	S3	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A133	S4	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A134	SERVER ROOM	CPT-1	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A135	MEN	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-2	8'-8"	
A136	JAN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A137	WOMEN	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-2	8'-8"	
A138	CHAP	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A139	FULL	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A140	S1/ NCO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A141	S1	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A142	CLASSROOM/ CONF.	CPT-1	RB-1	PT-1	PT-1	PT-1	PT-1	ACT-1	8'-8"	
A143	HQ ADMIN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A144	XO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A145	CO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A146	CLO	ETR	RB-1	ETR	ETR	ETR	ETR	ETR	8'-8"	
A147	NCOIC	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
A148	STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B101	LIBRARY/ CLASSROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B102	ELEC	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B103	TANG. AND STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B104	PHONE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B105	CLASSROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B106	CLASSROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B107	STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B108	STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B109	CLASSROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B110	CLASSROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B111	CORRIDOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B112	A/V STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B113	VENDING	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B114	TELCO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B115	LANGUAGE CENTER	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B116	CORRIDOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
B117	ASSEMBLY HALL	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	1
C101	SERVING AREA	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C102	SCULL	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C103	FOOD PREP	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C104	FOOD STOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C105	BN HQ. SUPPLY	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C106	FOREMAN	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C107	SUPPLY	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C108	TOOL ROOM	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C109	CORRIDOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C110	MEDICAL STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	3

1

1

1

NOTES:

1. STRIP EXISTING FLOOR. SAND SMOOTH, CLEAN AND RESEAL.
2. APPLY PT-1 FINISH AT DRYWALL PARTITIONS NEW AND EXISTING. CLEAN AND REPAINT EXISTING MASONRY PARTITIONS. APPLY BLOCK FILLER & PAINT NEW MASONRY PARTITIONS, PT-1 FINISH.
3. APPLY SPRAYED INSULATION AND INTUMESCENT COATING TO BOTTOM OF STRUCTURAL DECK AND EXPOSED STRUCTURAL MEMBERS ABOVE.

1

ROOM FINISH SCHEDULE

ROOM NO.	ROOM NAME	FLOOR	BASE	WALLS				CEILING	HEIGHT	NOTES
				NORTH	EAST	SOUTH	WEST			
C111	MECH/ TELCO	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C112	MAINT.	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C113	BATTERY	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C114	TLT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C115	MAINTENANCE BAY	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
C116	TER	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D101	CORRIDOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	1
D102	OFFICE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D103	UNIT STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D104	DIST	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D105	VAULT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D106	VAULT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D107	DIST	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D108	UNIT STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D109	OFFICE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D110	OFFICE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D111	UNIT STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D112	CORRIDOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D113	DIST	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D114	VAULT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D115	DIST	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D116	VAULT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D117	UNIT STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D118	OFFICE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D119	STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D120	TLT	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D121	UNHEATED STORAGE	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D122	VEST	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D124	TRAINING SIMULATOR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D125	TA50 LOCKERS	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	
D126	LACTATION	VCT-1	RB-1	PT-1	PT-1	PT-1	PT-1	ACT-1	8'-8"	3
D128	WOMEN	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-2	8'-8"	3
D128A	VESTIBULE	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-1	8'-8"	3
D128B	VESTIBULE	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-1	8'-8"	3
D129	WATER HTR	ETR	ETR	ETR	ETR	ETR	ETR	ETR	8'-8"	3
D131	MEN	CT-1	CTB-1	CT-2	CT-2	CT-2	CT-2	ACT-2	8'-8"	3
D135	PHYSICAL FITNESS	RAF/SC-1	RB-1	PT-1	PT-1	PT-1	PT-1	ESFP	8'-8"	2,3

1

1

INTERIOR MATERIAL SCHEDULE

MARK	ITEM	DESCRIPTION/COLOR	NOTES
ACT-1	CEILING TILE	ARMSTRONG FINE FISSURED 1729 2X2	
ACT-2	CEILING TILE, FRP	2x2 FIBERCORR BY NUDO, WHITE, SMOOTH	
CG-1	CORNER GUARD	2½"x2½" STAINLESS STEEL	
CPT-1	CARPET TILE	MOHAWK	
CT-1	CERAMIC TILE, 2x2	DALTILE, DESERT GRAY SPECKLE, D200	
CT-2	CERAMIC TILE, 4¼x4¼	DALTILE, DESERT GRAY, X114	
CTB-1	CERAMIC TILE BASE	DALTILE, DESERT GRAY 4x4 COVED	
ETR	EXISTING TO REMAIN		
ES	EXPOSED STRUCTURE	EXISTING TO REMAIN, PT-1 FINISH	
ESFP	EXPOSED STRUCTURE W/ SPRAYED ON FIREPROOFING	EXISTING TO REMAIN, SPRAYED ON FIREPROOFING	REPAIR/REPLACE SPRAY ON FIREPROOFING AS REQUIRED
FRP-1	FRP WAINSCOT	NUDO, FIBERLITE WHITE, SMOOTH	
GB-1	GYPSUM BOARD	PT-1 FINISH	
PL-1	PLASTIC LAMINATE	WILSONART, COSMIC STRANDZ, 4941K-18	CABINETS
PL-2	PLASTIC LAMINATE	WILSONART, NORTH SEA D90-60	RESTROOM APRONS
PT-1	ACRYLIC PAINT - SATIN	SHERWIN WILLIAMS, SW 7006, EXTRA WHITE	
PT-2	ACRYLIC PAINT - SEMI-GLOSS	SHERWIN WILLIAMS, SW 7065, ARGOS	METAL DOORS & FRAMES
PT-3	ACRYLIC PAINT - SEMI-GLOSS	SHERWIN WILLIAMS, SW 7061, NITE OWL	
PD-1	HDPE	AMPCO, NORTH SEA D90-60	TOILET, URINAL & SHOWER DRESS COMPARTMENT SCREENS
RB-1	RUBBER BASE	ROPPE, 150 DARK GREY, STANDARD TOE	
SC-1	SEALED CONCRETE	CHEM MASTERS SAFE CURE AND SEAL 309	
SS-1	SOLID SURFACE	DUPONT ZODIAC, MYSTIC BLACK	
SS-2	SOLID SURFACE	DUPONT ZODIAC, STORM GREY	LACTATION
VCT-1	VINYL COMPOSITION TILE	ARMSTRONG, 12X12 POLAR WHITE STANDARD EXCELON	
VCT-2	VCT-ANTI STATIC	ARMSTRONG, PEARL WHITE 51953	WITH GROUNDING WIRES AND MASTIC
QT	QUARRY TILE	MATCH EXISTING	
CMU	CONCRETE MASONRY UNITS	PT-1 FINISH	
OPW	OPERABLE WALL PARTITION		
RAF	RUBBER ATHLETIC FLOORING	ROPPE, RECOIL TILES 36"X36", 100 BLACK	

REGISTERED ARCHITECT HOMERO SAENZ 25041 STATE OF TEXAS

08/01/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HS
REVIEWED BY: JWW

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDENDUM 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

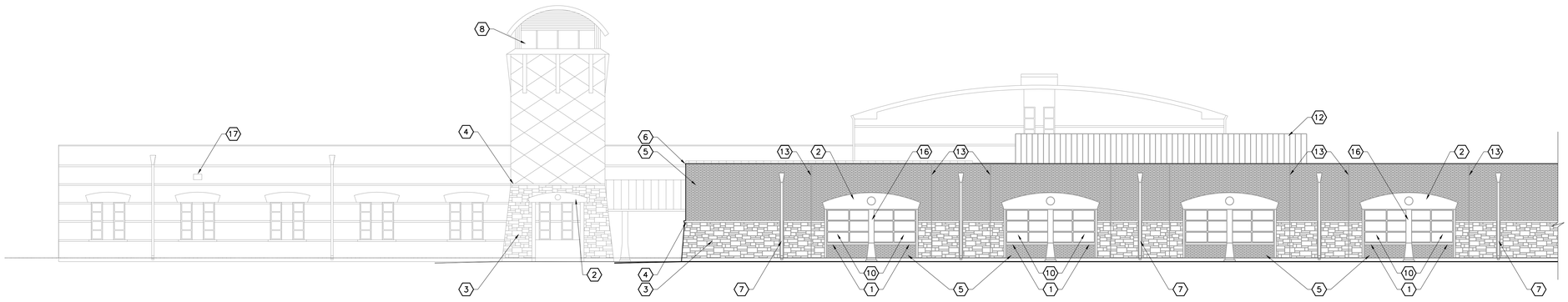
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

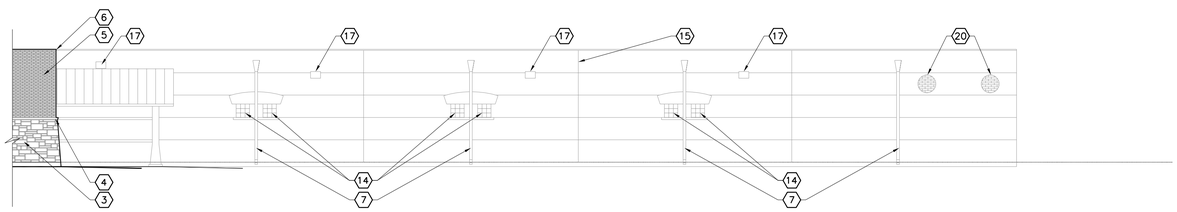
ARCHITECTURAL ROOM FINISH SCHEDULE

A-26

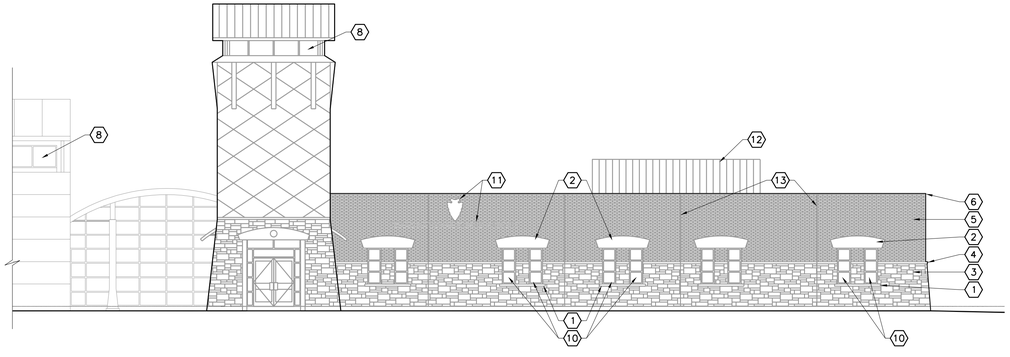
SHT. 34 of 129



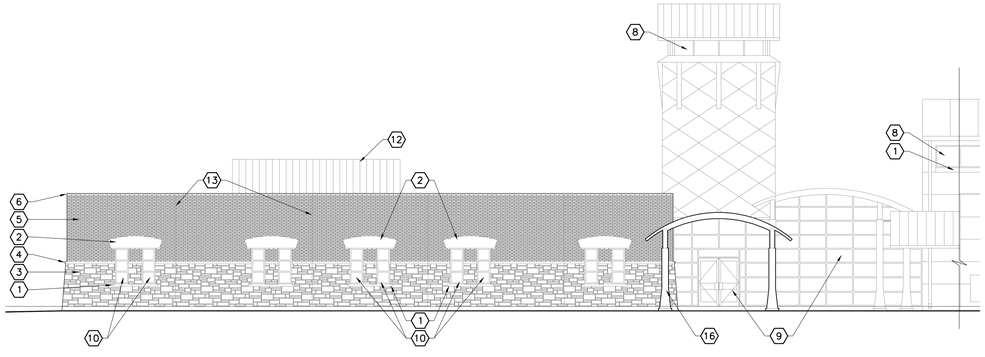
1 PARTIAL SOUTH ELEVATION
3/32" = 1'-0"



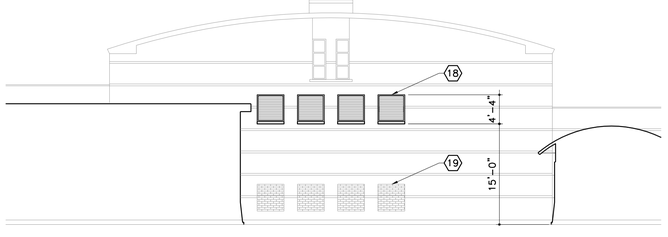
2 PARTIAL SOUTH ELEVATION
3/32" = 1'-0"



3 PARTIAL WEST ELEVATION
3/32" = 1'-0"



4 PARTIAL EAST ELEVATION
3/32" = 1'-0"



5 PARTIAL ELEVATION – DRILL HALL SOUTH WALL
3/32" = 1'-0"

GENERAL NOTES

1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THE COVER SHEET.
2. ELEVATIONS BASED ON PLAN NORTH ORIENTATION.

NOTES BY SYMBOL "⬡"

6 1. EXISTING CAST STONE SILL – CLEAN EXISTING STAINS AND SEAL.
6 2. EXISTING CAST STONE HEAD – CLEAN EXISTING STAINS AND SEAL.
6 3. EXSTING LIMESTONE VENEER – CLEAN EXISTING STAINS AND SEAL.
6 4. EXISTING CAST STONE WATERTABLE – CLEAN EXISTING STAINS AND SEAL.
5. EXISTING BRICK VENEER TO REMAIN.
6. EXISTING METAL COPING TO REMAIN.
7. EXISTING DOWNSPOUT.
8. EXISTING CLERESTORY WINDOW.
9. EXISTING STOREFRONT AND DOOR SYSTEM.
6 10. EXISTING WINDOWS TO REMAIN, CAULK AND RESEAL EXTERIOR. RE-CAULK AT INTERIOR.
11. EXISTING BUILDING SIGNAGE TO REMAIN. (1)
12. EXISTING METAL PANEL – HVAC SCREEN TO REMAIN.
13. EXISTING EXPANSION JOINT, REPLACE
6 ELASTOMERIC SEALANT – TYPICAL.
14. EXISTING GLASS BLOCK WINDOW TO
6 REMAIN, CAULK AND RESEAL EXTERIOR AND INTERIOR – TYPICAL.
15. EXISTING MASONRY CONTROL JOINT,
6 REPLACE ELASTOMERIC SEALANT – TYPICAL.
16. EXISTING COLUMN TO REMAIN.
17. NEW LIGHT FIXTURE – RE:
6 ELECTRICAL.
18. NEW ALUMINUM LOUVERS.
19. INFILL EXISTING LOUVER OPENINGS, RE: 1/A-2.
20. INFILL EXISTING EXHAUST FAN OPENINGS, RE: 1/A-2.

BID OPTIONS "◯"

6. EXTERIOR BUILDING IMPROVEMENTS.

0 4' 8' 16'
3/32"=1'-0"

REGISTERED ARCHITECT HOMERO SAENZ 25041 STATE OF TEXAS
08/01/2018

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: CT
REVIEWED BY: JWW

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADDENDUM 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

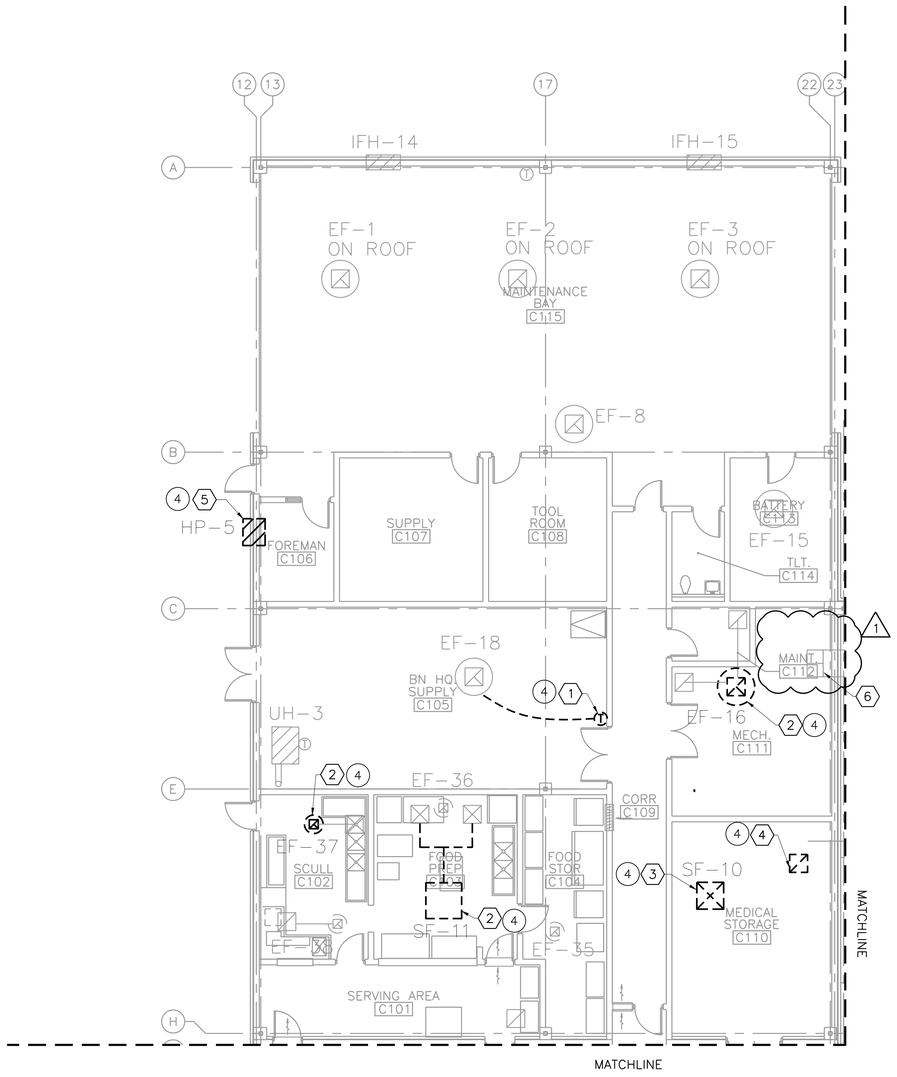
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

ARCHITECTURAL EXTERIOR ELEVATIONS

A-32

SHT. 40 of 129



1 M-3

DEMOLITION FLOOR PLAN – C

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.
2. REFER TO ELECTRICAL DRAWINGS FOR ADDITIONAL WORK RELATED TO HVAC EQUIPMENT.
3. REFER TO SHEET M-0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
4. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
5. PATCH OPENINGS IN WALL THAT RESULT FROM DUCT DEMOLITION TO MATCH ADJOINING WALL IN CONSTRUCTION AND FINISH.

NOTES BY SYMBOL "⬡"

(4) 1. IF BID OPTION #4 IS SELECTED, DEMOLISH EXISTING THERMOSTATS. RETAIN CONDUIT FOR REUSE TO EXTENT POSSIBLE.

(4) 2. IF BID OPTION #4 IS SELECTED, DEMOLISH EXISTING ROOF-MOUNTED FAN. RETAIN ROOF CURB, DUCTWORK, HOOD, WIRING, CONDUIT AND CONTROLS FOR REUSE TO EXTENT POSSIBLE.

(4) 3. IF BID OPTION #4 IS SELECTED, DEMOLISH ROOF-MOUNTED FAN AND ASSOCIATED DUCTWORK, DIFFUSERS, AND CONTROLS. CAP ROOF OPENING IN ACCORDANCE WITH ROOF WARRANTY.

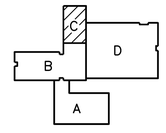
(4) 4. IF BID OPTION #4 IS SELECTED, DEMOLISH ROOF-MOUNTED INTAKE HOOD. CAP ROOF OPENING IN ACCORDANCE WITH ROOF WARRANTY.

(4) 5. IF BID OPTION #4 IS SELECTED, DEMOLISH EXISTING PACKAGED IN-WALL AC UNIT AND ASSOCIATED WIRING AND CONTROLS. RETAIN WALL OPENING.

6. INTAKE DUCTWORK TO REMAIN. (1)

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.



KEY PLAN



08/01/2018

0 4' 8' 16'

1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADD. 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

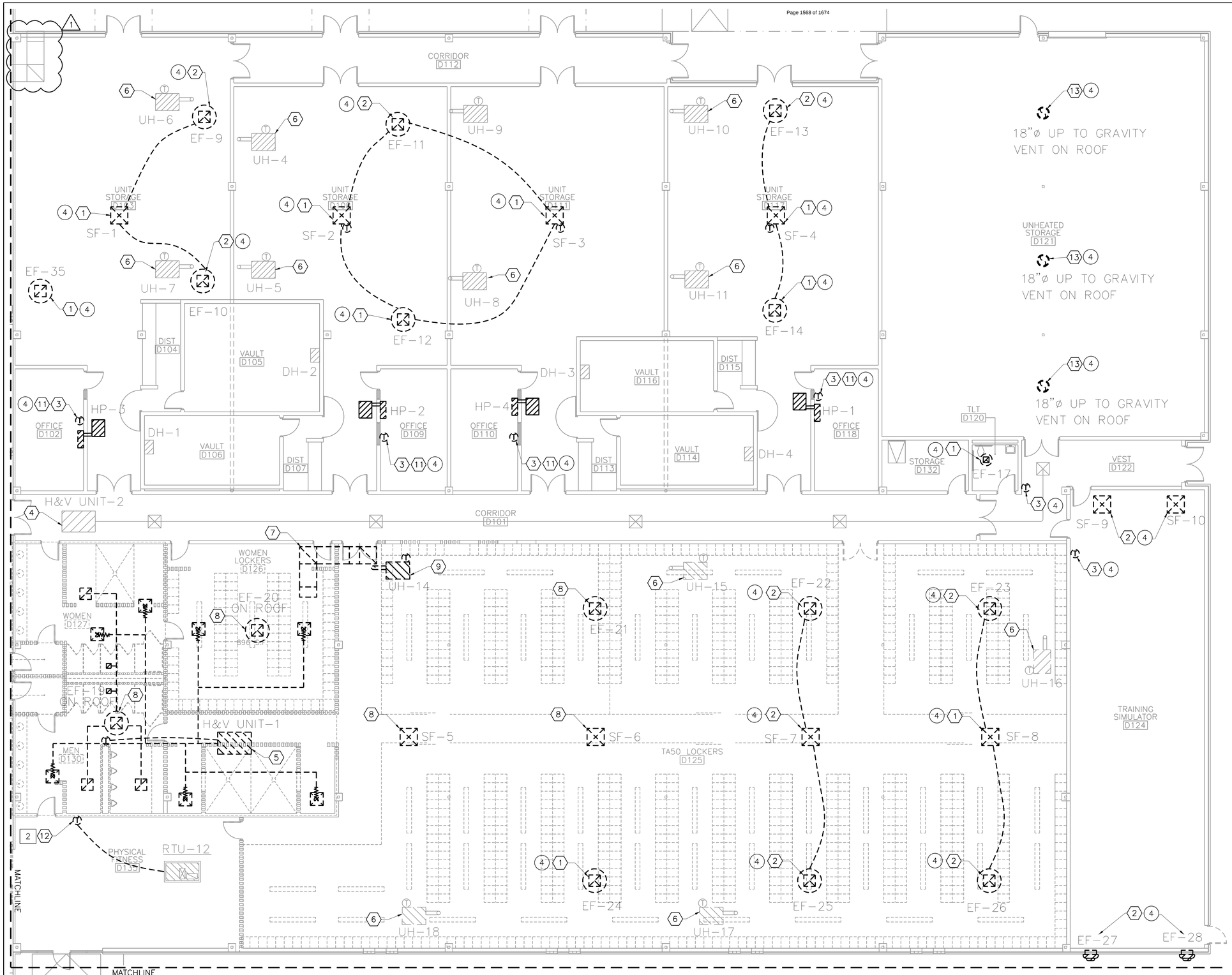
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
DEMOLITION PLAN - C

M-3 (4)

SHT. 50 of 129



NORTH TRUE / NORTH PLAN 1 M-4

DEMOLITION FLOOR PLAN – D

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.
2. REFER TO ELECTRICAL DRAWINGS FOR ADDITOINAL WORK RELATED TO HVAC EQUIPMENT.
3. REFER TO SHEET M-0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
4. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
5. PATCH OPENINGS IN WALL THAT RESULT FROM DUCT AND PIPING DEMOLITION TO MATCH ADJOINING WALL IN CONSTRUCTION AND FINISH.
6. CAP ALL ROOF PENETRATIONS RESULTING FROM HVAC DEMOLITION THAT ARE NOT BEING REUSED.

NOTES BY SYMBOL "⬡"

(4) 1. IF BID OPTION #4 IS SELECTED, DEMOLISH ROOF-MOUNTED FAN AND ASSOCIATED DUCTWORK, DIFFUSERS, WIRING AND CONTROLS. RETAIN CURB FOR REUSE.

(4) 2. IF BID OPTION #4 IS SELECTED, DEMOLISH ROOF-MOUNTED FANS AND ASSOCIATED DUCTWORK, DIFFUSERS WIRING, AND CONTROLS. PATCH ROOF OPENING PER ROOF MANUFACTURER'S WARRANTY AND ARCHITECTURAL DETAILS.

(4) 3. IF BID OPTION #4 IS SELECTED, DEMOLISH EXITING THERMOSTATS. RETAIN CONDUIT FOR REUSE TO EXTENT POSSIBLE.

4. EXISTING HEATING VENTILATOR UNIT TO REMAIN.
5. DEMOLISH EXISTING HEATING VENTILATOR UNIT AND ASSOCIATED DUCTWORK, DIFFUSERS, WIRING AND CONTROLS.CAP CURB PER MANUFACTURER'S WARRANTY.
6. EXISTING UNIT HEATER TO REMAIN.
7. DEMOLISH EXISTING TRANSFER DUCT AND CAP WALL PENETRATIONS IN WALLS TO REMAIN PER ARCH SHEETS.
8. DEMOLISH ROOF-MOUNTED FAN AND ASSOCIATED DUCTWORK, DIFFUSERS WIRING, AND CONTROLS. CAP CURB PER MANUFACTURER'S WARRANTY.
9. DEMOLISH EXISTING UNIT HEATER AND ASSOCIATED CONTROLS, WIRING, AND FLUE.
10. NOT USED. (1)

(4) 11. IF BID OPTION #4 IS SELECTED, DEMOLISH EXISTING MINI SPLIT HEAT PUMP AIR HANDLER, CONTROLS, REFRIGERANT PIPING, CONDENSER UNIT, AND ACCESSORIES. RETAIN AND REUSE ROOF PENETRATIONS FOR NEW EQUIPMENT.

[2] 12. IF SECO OPTION #2 IS SELECTED, DEMOLISH EXITING THERMOSTATS. RETAIN WIRING AND CONDUIT FOR REUSE TO EXTENT POSSIBLE.

(4) 13. IF BID OPTION #4 IS SELECTED, DEMOLISH 18"ø ROOF VENT; PATCH ROOF PENETRATION PER ROOF MANUFACTURER'S WARRANTY AND ARCHITECTURAL DETAILS.

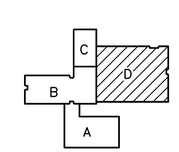
BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.

KEY PLAN





0 4' 8' 16'

1/8"=1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT: HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADD. 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

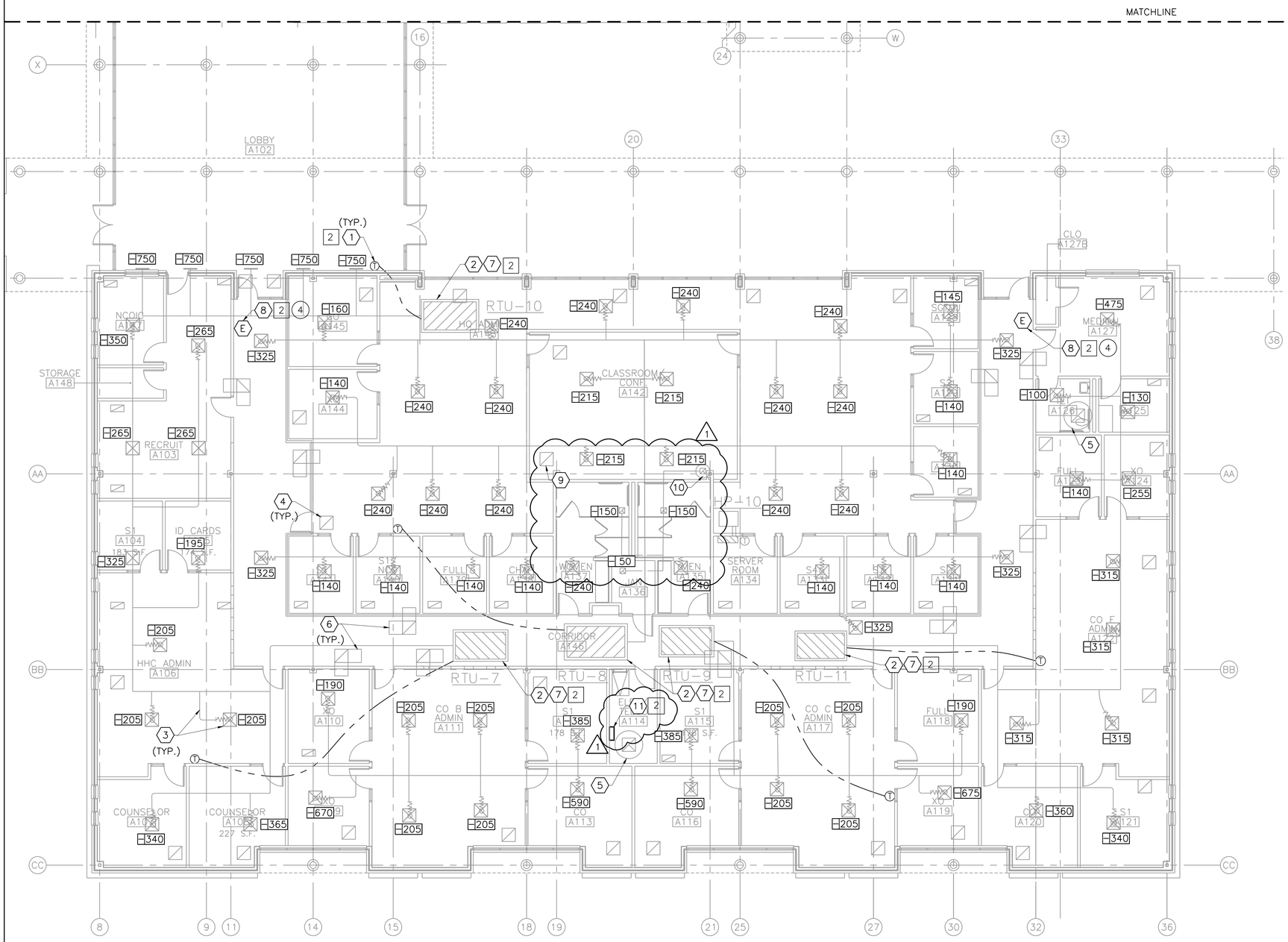
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
DEMOLITION PLAN - D

M-4 (4) [2]

SHT. 51 of 129



FLOOR PLAN – A

1/8"=1'–0"

GENERAL NOTES:

1. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.
2. REFER TO ELECTRICAL DRAWINGS FOR ADDITOINAL WORK RELATED TO HVAC EQUIPMENT.
3. REFER TO SHEET M–0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
4. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
(4) 5. IF BID OPTION #4 IS ACCEPTED, MODIFY EXISTING DUCT ROUTING AS NECESSARY TO ACCOMMODATE FLOWS INDICATED.
6. PROVIDE MANUAL BALANCING DAMPERS AS REQUIRED TO FACILITATE PROPER SYSTEM BALANCING.
7. REUSE EXISTING WALL PENETRATIONS FOR DUCT ROUTING WHERE POSSIBLE.

NOTES BY SYMBOL "⬡"

[2] 1. IF SECO OPTION #2 IS ACCEPTED, PROVIDE BAS–INTEGRATED ZONE TEMPERATURE SENSOR WITH ADJUSTABLE SETPOINT CONTROL.
2. EXISTING ROOF TOP UNITS TO REMAIN.
3. EXISTING DUCTWORK, DIFFUSERS, AND SUPPORTS TO REMAIN. CONTRACTOR TO FIELD VERIFY LOCATION OF BALANCING DAMPERS FOR EACH DIFFUSER AND RE–BALANCE FLOW RATES AS SPECIFIED ON THIS SHEET. IF EXISTING DUCTWORK IS INSUFFICIENT TO MEET DESIGN FLOWS, COORDINATE WITH ENGINEER FOR DIRECTION.
4. EXISTING RETURN AIR GRILLES TO REMAIN.
5. EXISTING EXHAUST FAN AND ASSOCIATED DUCTWORK TO REMAIN.
6. EXISTING TRANSFER DUCT TO REMAIN.
[2] 7. IF SECO OPTION #2 IS SELECTED, PROVIDE NEW BACNET CONTROLLER INTERFACED TO EXISTING RTU CONTROLLER PER 4/M–11.
(4) [2] 8. IF BID OPTION #4 AND SECO OPTION #2 ARE ACCEPTED, PROVIDE EMERGENCY SHUTDOWN SWITCH WITH NON–LOCKING CLEAR PLASTIC COVER TO SHUT DOWN ALL EQUIPMENT CONNECTED TO BAS.

(1)
(5) 9. IF BID OPTION 5 IS ACCEPTED, RELOCATE RETURN GRILL INTO NEW CONFERENCE ROOM CEILING.
10. REBALANCE EXISTING FAN AND DUCTWORK AS INDICATED.
[2] 11. IF SECO OPTION #2 IS ACCEPTED, PROVIDE BAS PANEL. RE: 1/M–10 FOR MORE DETAILS. COORDINATE LOCATION AND ROUTING WITH OTHER DISCIPLINES TO AVOID CONFLICT. MAINTAIN ALL CLEARANCES.

BID OPTIONS "◯"

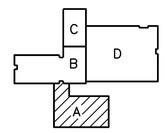
4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.
5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN WING.

(1)

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.

KEY PLAN





0 4' 8' 16'

1/8"=1'–0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE and NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1	08/01/18	ADD. 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763–5218
(512) 782–6131 FAX (512) 782–1481

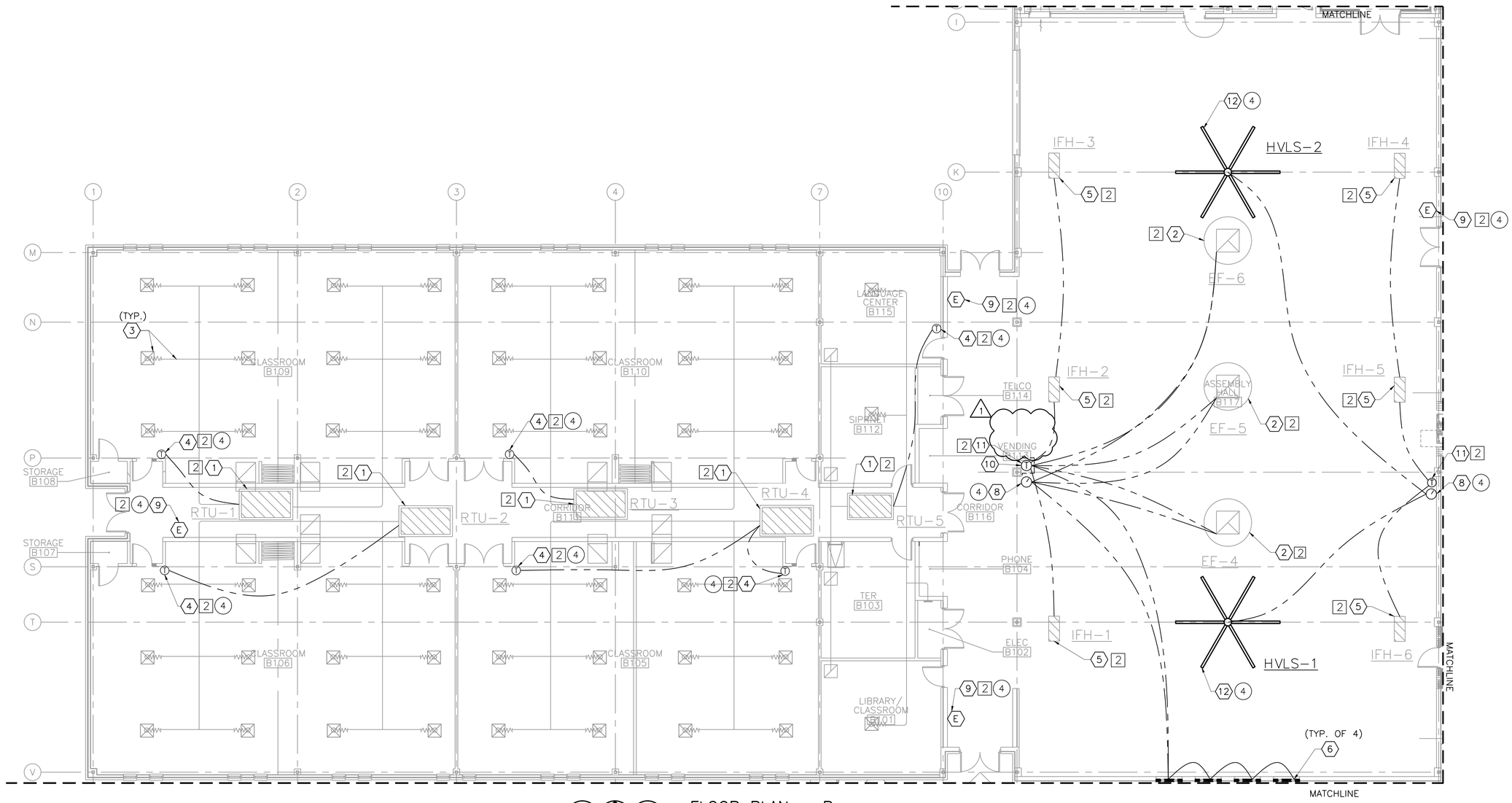
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
FLOOR PLAN - A

M-5 (4) [2]

SHT. 52 of 129



NORTH TRUE NORTH PLAN — 1 M-6

FLOOR PLAN – B

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO SHEET M-0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
2. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
3. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.

NOTES BY SYMBOL "⬡"

2 1. EXISTING ROOF TOP UNITS TO REMAIN. IF SECO OPTION #2 IS ACCEPTED, CONNECT TO BAS PER DETAILS ON 1/M-10.

2 2. EXISTING ROOF MOUNTED EXHAUST FANS TO REMAIN. IF BID OPTION #2 IS ACCEPTED, CONNECT TO BAS AND CONTROL PER 1/M-10.

3. EXISTING DUCTWORK, DIFFUSERS, SUPPORTS, AND CONTROLS TO REMAIN.

2 4 4. IF SECO OPTION #2 IS ACCEPTED, PROVIDE BAS-INTEGRATED ZONE TEMPERATURE SENSOR WITH ADJUSTABLE SETPOINT CONTROL.

2 5. EXISTING RADIANT GAS-FIRED HEATERS TO REMAIN. IF SECO OPTION #2 IS ACCEPTED, CONNECT TO BAS AND CONTROL PER 3/M-11.

6. PROVIDE NEW COMBINATION LOUVER/DAMPERS WITH MOTORIZED ACTUATORS INTERLOCKED WITH EXHAUST FANS; CONTROL PER 1/M-10.

1 7. NOT USED.

4 8. IF BID OPTION #4 IS ACCEPTED, PROVIDE 2 HOUR (ADJ.) TIMER TO CONTROL HVLS FANS.

4 2 9. IF BID OPTION #4 AND SECO OPTION #2 ARE ACCEPTED, PROVIDE EMERGENCY SHUTDOWN SWITCH WITH NON-LOCKING CLEAR PLASTIC COVER TO SHUT DOWN ALL EQUIPMENT CONNECTED TO BAS.

10. PROVIDE TIMER AND THERMOSTAT TO CONTROL EXHAUST FANS. RE: 2/M-10 FOR MORE DETAILS AND CONTROL INFORMATION.

2 11. PROVIDE NEW THERMOSTAT TO CONTROL EXISTING INFRARED HEATERS TO MAINTAIN A ROOM TEMPERATURE AT 45°F (ADJ.) IF SECO OPTION #2 IS SELECTED, PROVIDE BAS-COMPATABLE TEMPERATURE SENSOR AND CONTROL PER 3/M-11.

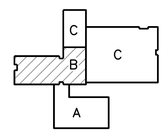
4 12. IF BID OPTION #4 IS SELECTED, PROVIDE NEW HIGH VOLUME LOW SPEED CIRCULATION FAN. MOUNT AT THE SAME LEVEL AS LIGHTS IN THIS ROOM.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.



KEY PLAN



0 4' 8' 16'

1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADD. 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

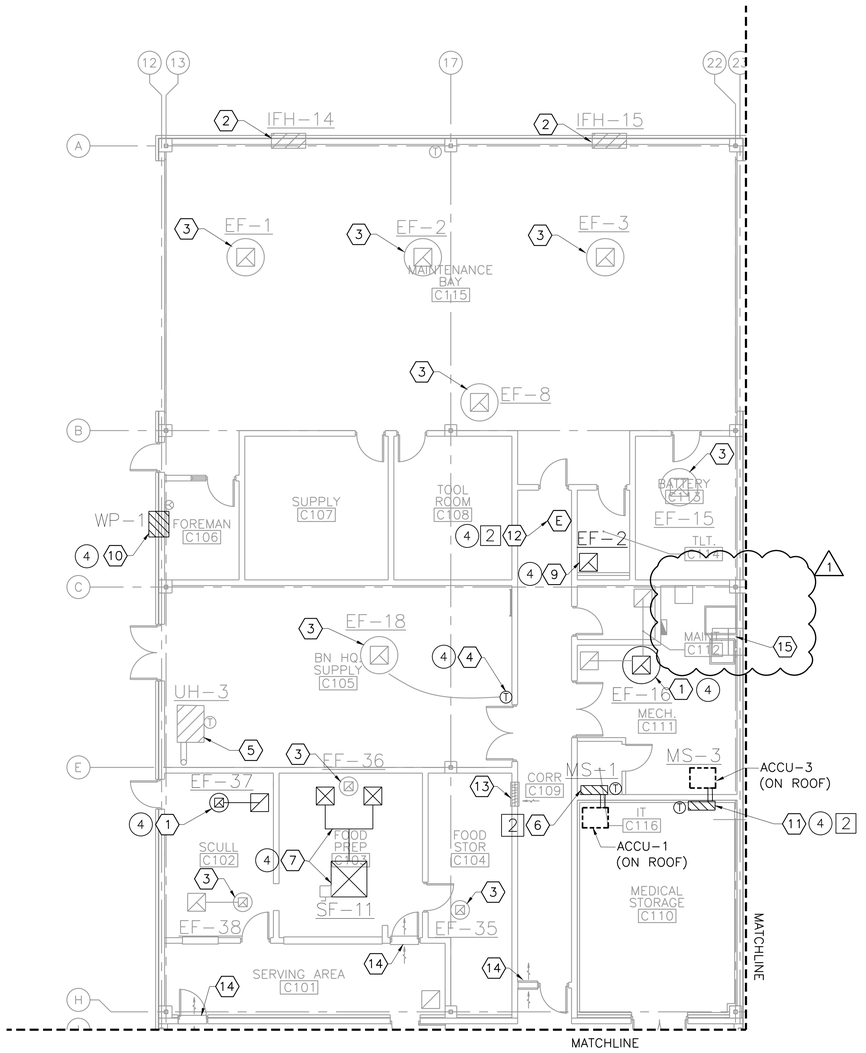
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
FLOOR PLAN - B

M-6 2 4

SHT. 53 of 129



NORTH TRUE NORTH PLAN 1 M-7

FLOOR PLAN – C

1/8"=1'-0"

GENERAL NOTES:

1. REFER TO SHEET M-0 FOR LEGEND, ABBREVIATIONS, AND GENERAL NOTES.
2. REFER TO ARCHITECTURAL DRAWINGS FOR WALL AND ROOF MODIFICATIONS ASSOCIATED WITH MECHANICAL DEMOLITION.
3. PATCH OPENINGS IN WALL THAT RESULT FROM DUCT DEMOLITION TO MATCH ADJOINING WALL IN CONSTRUCTION AND FINISH.
4. REFER TO DIVISION 23 SECTION AND OTHER RELATED PORTIONS OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL WORK RELATED TO HVAC SYSTEM.

NOTES BY SYMBOL "⬡"

(4) 1. IF BID OPTION #4 IS ACCEPTED, PROVIDE NEW FAN AS SCHEDULED ON EXISTING CURB. PROVIDE CURB ADAPTOR AS NECESSARY.

2. EXISTING INFRARED UNIT HEATERS TO REMAIN.

3. EXISTING ROOF MOUNTED EXHAUST FANS TO REMAIN.

(4) 4. IF BID OPTION #4 IS ACCEPTED, PROVIDE THERMOSTAT TO ENABLE EXHAUST FANS WHEN TEMPERATURE RISES ABOVE 85°F (ADJ.).

5. EXISTING UNIT HEATER TO REMAIN.

[2] 6. PROVIDE NEW MINI SPLIT AC UNIT. REFRIGERANT LINE TO BE ROUTED PER MANUFACTURER'S RECOMMENDATIONS. AIR-COOLED CONDENSING UNIT TO BE LOCATED ON ROOF. IF SECO OPTION #2 IS ACCEPTED, CONNECT TO BAS AND CONTROL PER 2/M-12.

(4) 7. IF BID OPTION #4 IS ACCEPTED, PROVIDE NEW MAKEUP AIR UNIT ON ROOF AS SCHEDULED. INTERCONNECT TO EF-36 SUCH THAT BOTH FANS OPERATE SIMULTANEOUSLY. BALANCE AS INDICATED ON MECHANICAL SCHEDULES ON M-9.

△1 8. NOT USED.

(4) 9. IF BID OPTION #4 IS ACCEPTED, PROVIDE CEILING MOUNTED EXHAUST FAN AS SCHEDULED; WIRE TO OPERATE IN CONJUNCTION WITH LIGHT SWITCH.

(4) 10. IF BID OPTION #4 IS ACCEPTED, PROVIDE PACKAGED WALL UNIT AS SCHEDULED. MODIFY EXISTING OPENING TO ACCOMMODATE NEW UNIT SIZE.

[2](4) 11. IF BID OPTION #4 IS ACCEPTED, PROVIDE NEW MINI SPLIT HEAT PUMP. REFRIGERANT LINE TO BE ROUTED PER MANUFACTURER'S RECOMMENDATIONS. AIR-COOLED CONDENSING UNIT TO BE LOCATED ON ROOF. IF SECO OPTION #2 IS ACCEPTED, CONNECT TO BAS AND CONTROL PER 1/M-12.

[2](4) 12. IF BID OPTION #4 AND SECO OPTION #2 ARE ACCEPTED, PROVIDE EMERGENCY SHUTDOWN SWITCH WITH NON-LOCKING CLEAR PLASTIC COVER TO SHUT DOWN ALL EQUIPMENT CONNECTED TO BAS.

13. EXISTING MOTORIZED DAMPER TO REMAIN.

14. EXISTING AIR TRANSFER DUCT TO REMAIN.

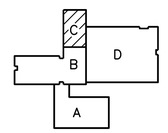
△1 15. MODIFY DUCTWORK AS NECESSARY TO AVOID ELECTRICAL PANELS.

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

SECO OPTIONS "□"

2. PROVIDE DDC CONTROL SYSTEM.



KEY PLAN



0 4' 8' 16'

1/8"=1'-0"

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AJS
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

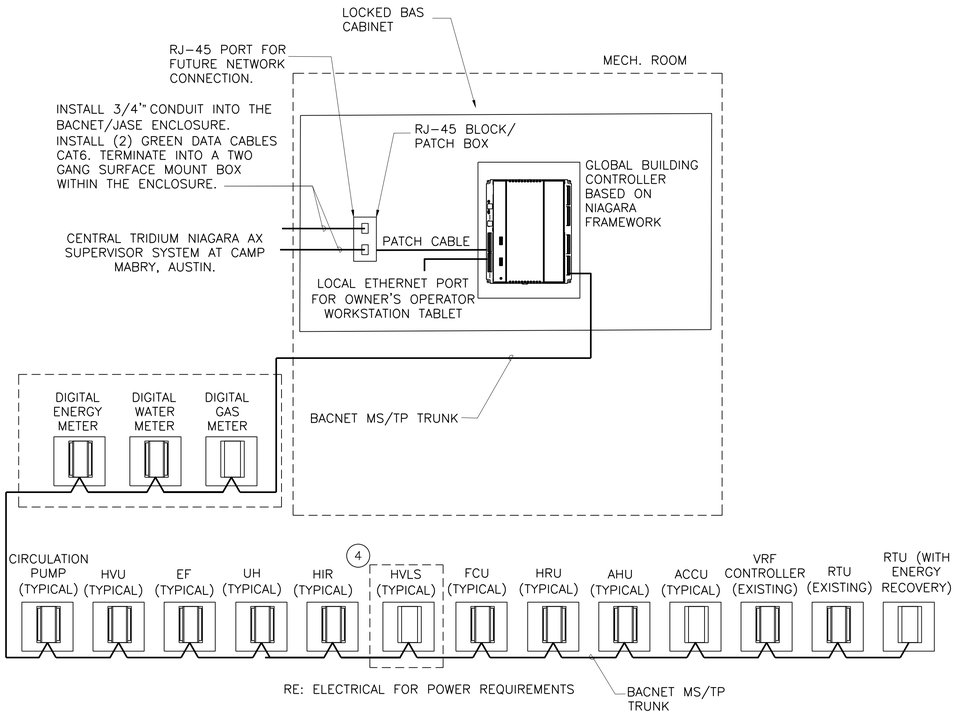
NO.	DATE	ISSUE
1	08/01/18	ADD. 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

MECHANICAL
FLOOR PLAN - C
M-7 [2](4)
SHT. 54 of 129



NOTE:

BASE BID: PROVIDE GLOBAL BUILDING CONTROLLER AND DIGITAL ENERGY METERS. METERS TO BE INTEGRATED TO GLOBAL CONTROLLER VIA BACNET MS/TP AS SHOWN.

SECO BID OPTION #2: UTILIZE THE NIAGARA GLOBAL BUILDING CONTROLLER FOR INTEGRATION OF ALL OTHER EQUIPMENT SHOWN ON DIAGRAM AND P&ID DETAILS.

2 — 1/M-10 NETWORK ARCHITECTURE DIAGRAM

NTS

BAS INPUT/OUTPUT POINT LIST

		HARDWARE POINTS				SOFTWARE POINTS					
TAG	POINT NAME	AI	AO	DI	DO	AV	BV	TREND	ALARM	ADJUSTABLE	SHOW ON GRAPHIC
1	WATER FLOW RATE	X						X			
2	DEMAND							X			X
3	PEAK MONTH-TO-DATE							X			X
4	PEAK TODAY							X			X
5	PEAK YEAR-TO-DATE							X			X
6	USAGE MONTH-TO-DATE							X			X
7	USAGE TODAY							X			X
8	USAGE YEAR-TO-DATE							X			X
9	GAS METER FAILURE								X		

WATER METER POINTS LIST

BAS INPUT/OUTPUT POINT LIST

		HARDWARE POINTS				SOFTWARE POINTS					
TAG	POINT NAME	AI	AO	DI	DO	AV	BV	TREND	ALARM	ADJUSTABLE	SHOW ON GRAPHIC
1	GAS FLOW RATE	X						X			
2	DEMAND							X			X
3	PEAK MONTH-TO-DATE							X			X
4	PEAK TODAY							X			X
5	PEAK YEAR-TO-DATE							X			X
6	USAGE MONTH-TO-DATE							X			X
7	USAGE TODAY							X			X
8	USAGE YEAR-TO-DATE							X			X
9	GAS METER FAILURE								X		

GAS METER POINTS LIST

BAS INPUT/OUTPUT POINT LIST

		HARDWARE POINTS				SOFTWARE POINTS					
TAG	POINT NAME	AI	AO	DI	DO	AV	BV	TREND	ALARM	ADJUSTABLE	SHOW ON GRAPHIC
1	REAL POWER - KW TOTAL					X		X			X
2	REAL ENERGY - KWH TOTAL					X		X			X
3	PWR-DEMAND					X		X			X
4	PWR-DEMAND-PEAK					X		X			X
5	VOLTAGE A-B					X		X			X
6	VOLTAGE A-N					X		X			X
7	VOLTAGE B-C					X		X			X
8	VOLTAGE B-N					X		X			X
9	VOLTAGE C-A					X		X			X
10	VOLTAGE C-N					X		X			X
11	AMP A					X		X			X
12	AMP B					X		X			X
13	AMP C					X		X			X
14	POWER FACTOR A					X		X			X
15	POWER FACTOR B					X		X			X
16	POWER FACTOR C					X		X			X
17	POWER FACTOR TOTAL					X		X			X
18	REACTIVE POWER - KVAR					X		X			X

ELEC. METER POINTS LIST

2

BAS GENERAL NOTES:

1. PROVIDE A TOTALLY NATIVE BACNET BASED DIRECT DIGITAL CONTROL (DDC) SYSTEM INCLUDING A COMPATIBLE OPERATOR WORKSTATION LAPTOP BASED ON THE NETWORK ARCHITECTURE DIAGRAM SHOWN IN DETAIL 1 ON THIS SHEET.
2. THE GLOBAL BUILDING CONTROLLER SHALL BE BASED ON THE TRIDIUM NIAGARA N4 FRAMEWORK AND SHALL BE ABLE TO ESTABLISH AND MAINTAIN TWO WAY COMMUNICATION AND CONTROL WITH THE EXISTING NIAGARA AX SUPERVISOR VIA THE OWNER – FURNISHED RCAS NETWORK. PROVIDE REQUIRED NIAGARA AX LICENSING FOR THE N4 CONTROLLER.
3. THE OWNER SHALL OWN AND SHALL HAVE FULL RIGHTS TO ALL FEATURES OF THE NIAGARA AX SOFTWARE.
4. THE LOCAL BUILDING CONTROLLER/JACE SHALL BE CONFIGURED WITH DCHP ADDRESSING.
5. CONTRACTOR SHALL CONTACT AND COORDINATE WITH TRIDIUM TO ACQUIRE THE STANDARD NIAGARA AX GRAPHICS AND SHALL MODIFY/ALTER THESE GRAPHICS TO MATCH SYSTEMS AND EQUIPMENT IN THIS PROJECT. REFER TO TECHNICAL SPECIFICATION SECTION 23 09 23 FOR MORE INFORMATION.
6. REFER TO TECHNICAL SPECIFICATION SECTION 23 09 23 FOR STANDARD NOMENCLATURE AND FILE NAMING CONVENTIONS.
7. REFER TO TECHNICAL SPECIFICATION SECTION 23 09 23 TO COMPLY WITH REQUIREMENTS OF UMCS-MCX ARMY METERING PROGRAM GUIDANCE FOR ADVANCED METERS.
8. ALL EQUIPMENT (EXISTING AND NEW) SHALL CONNECT TO THE GLOBAL BUILDING CONTROLLER VIA THE BACNET MS/TP TRUNK. PROVIDE REQUIRED CONTROLLERS TO INTERFACE EQUIPMENT

ZONE TEMPERATURE CONTROL:

1. THE BAS SHALL INCLUDE 7-DAY OCCUPANCY SCHEDULES FOR INDIVIDUAL EQUIPMENT AND A 7-DAY MASTER OCCUPANCY SCHEDULE FOR THE BUILDING. THE ZONE TEMPERATURE CONTROL SHALL BE BASED ON OCCUPANCY SCHEDULE AND THE OCCUPANCY STATUS OF THE ROOM (WHERE PROVIDED WITH OCCUPANCY SENSORS).
2. OCCUPIED MODE: THE BUILDING SHALL BE "OCCUPIED" FROM 8 A.M. (ADJ.) TO 6 P.M. (ADJ.), MONDAY THRU FRIDAY. TEMPERATURE SETPOINTS: COOLING: 75°F (ADJ.), HEATING 70°F (ADJ.).
3. UNOCCUPIED MODE: THE BUILDING SHALL BE "UNOCCUPIED" FROM 6 P.M. (ADJ.) TO 8 A.M. (ADJ.) MONDAY THRU FRIDAY AND ENTIRE DAY ON SATURDAY AND SUNDAY. TEMPERATURE SETPOINTS: COOLING: 85°F (ADJ.) AND HEATING: 60°F (ADJ).
4. ZONE SETPOINT ADJUST: THE OCCUPANT SHALL BE ABLE TO ADJUST THE ZONE TEMPERATURE HEATING AND COOLING SET POINTS AT THE ZONE SENSOR BY ±2°F.
5. ZONE UNOCCUPIED OVERRIDE: A TIMED LOCAL OVERRIDE CONTROL SHALL ALLOW AN OCCUPANT TO OVERRIDE THE SCHEDULE AND PLACE THE UNIT INTO AN OCCUPIED MODE FOR AN ADJUSTABLE (INITIALLY SET AT 2 HOURS) PERIOD OF TIME. AT THE EXPIRATION OF THIS TIME, CONTROL OF THE UNIT SHALL AUTOMATICALLY RETURN TO THE MASTER SCHEDULE.
6. ASSEMBLY HALL ZONE TEMPERATURE CONTROL: REFER TO 3/M-11 FOR TEMPERATURE SETPOINTS FOR THE ASSEMBLY HALL.
7. TEMPERATURE CONTROL DEVICES SHALL BE EQUIPPED WITH DEADBANDS THAT COMPLY WITH IECC 2015.

1

SECO OPTIONS "□"

1. PROVIDE OCCUPANCY SENSORS
2. PROVIDE DDC CONTROL SYSTEM

BID OPTIONS "◯"

4. ADDITIONAL HVAC UPGRADES/REPAIRS/HVLS FANS.

VAN CASHEN 118595 LICENSED PROFESSIONAL ENGINEER STATE OF TEXAS

08/01/2018

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: RWE
REVIEWED BY: VMC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADD. 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

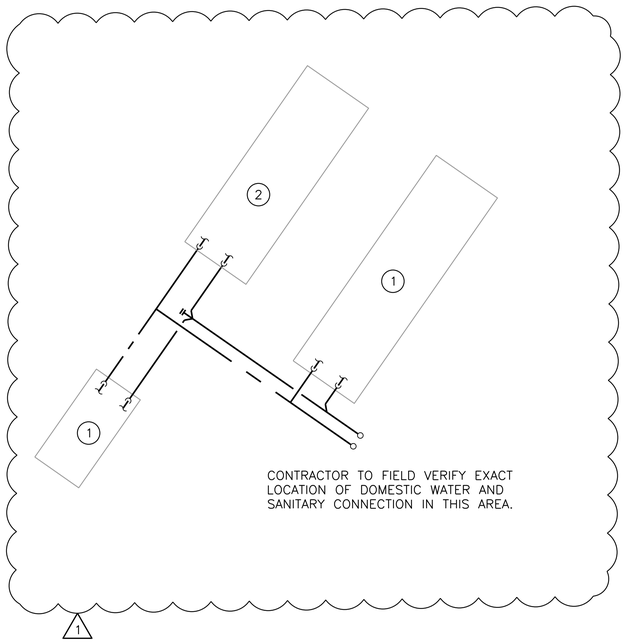
STAR CAMPAIGN FY18 - WESLACO RC MAJOR MAINTENANCE

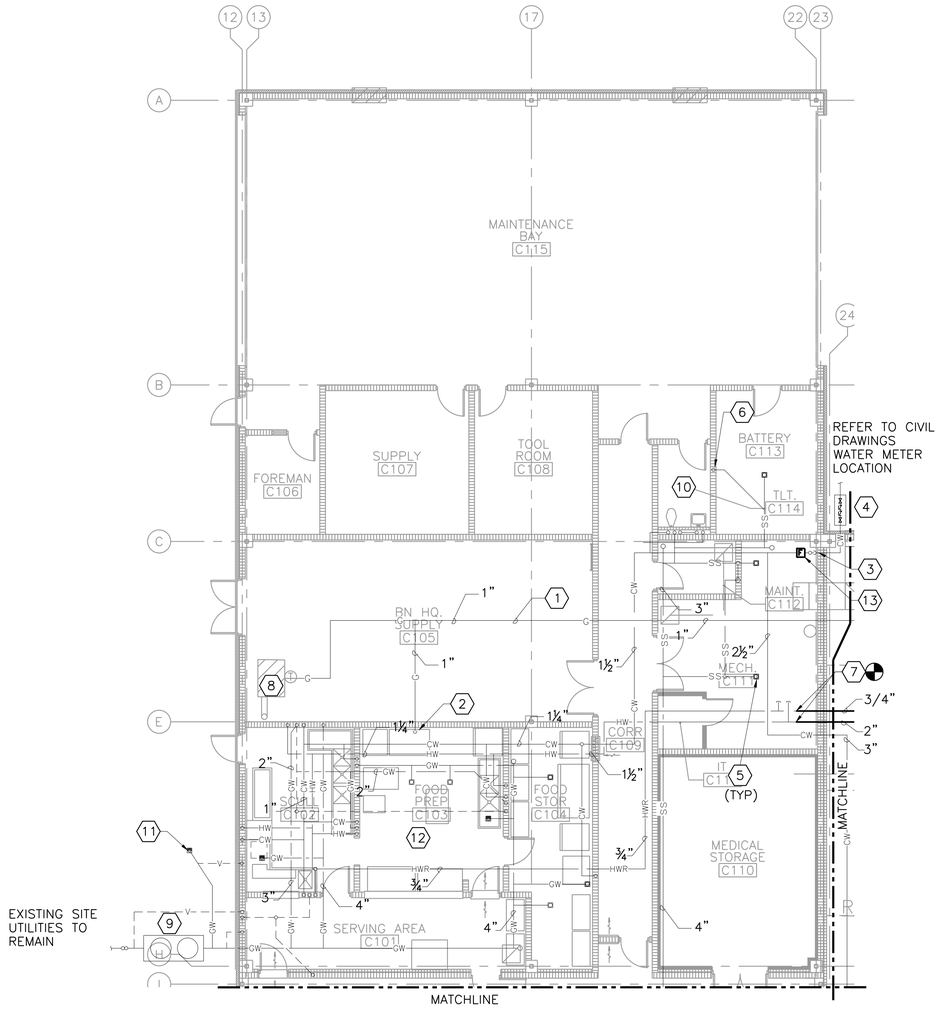
TXARNG CFMO

MECHANICAL NETWORK ARCHITECTURE DIAGRAM

M-10 2

SHT. 57 of 129





GENERAL NOTES:

1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM TO REMAIN AS IS UNLESS INDICATED OTHERWISE.
4. PROVIDE NEW TRAP SEAL DEVICE IN ALL EXISTING AND NEW FLOOR DRAINS, FLOOR SINKS, AND HUB DRAINS.
5. ALL EXTERIOR AND INTERIOR GAS PIPING TO BE PAINTED SAFETY YELLOW.

NOTES BY SYMBOL "⬡"

1. EXISTING GAS PIPING ON ROOF.
2. EXISTING GAS PIPE DOWN THROUGH ROOF.
3. EXISTING VALVED 3" DOMESTIC WATER RISER.
4. EXISTING 3" BACKFLOW PREVENTOR IN VAULT.
5. EXISTING FLOOR DRAIN.
6. EXISTING VENT THROUGH ROOF (VTR).
7. CONNECT NEW 2" HW AND 3/4" HWR PIPE AND EXTEND AS INDICATED.
8. EXISTING GAS FIRED HVAC EQUIPMENT.
9. EXISTING CONCRETE GREASE SEPARATOR TO REMAIN. PUMP OUT AND PROPERLY DISPOSE OF GREASE LADEN WASTE. AFTER SEPARATOR IS COMPLETELY EMPTY AND DRY, CLEAN SEPARATOR INTERIOR WITH ALKALINE DEGREASER AND PRESSURE WASH. PERMANENTLY INJECT ALL CRACKS WITH COMMERCIAL GRADE LOW PRESSURE CRACK SEALANT. SEAL INTERIOR CONCRETE SURFACES WITH SILICONATE MULTI-SURFACE SMOOTH WB PENETRATING SEALANT.
10. EXISTING PLUMBING FIXTURES TO REMAIN.
11. EXISTING 3" CAN WASH DRAIN.
12. ALL PIPING AND EQUIPMENT IN KITCHEN AREA TO REMAIN IN SERVICE.
13. PROVIDE NEW DIGITAL FLOW METER WITH VALVED BYPASS ASSEMBLY. WATER METER PROVIDED BY BUILDING AUTOMATION SYSTEM CONTRACTOR. RE: SPECIFICATION 230923.

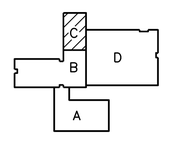
BID OPTIONS "◯"

1. CONTRACTOR TO CONNECT TEMPORARY RESTROOM BUILDING TO EXISTING DOMESTIC WATER. CONTRACTOR TO CONNECT TEMPORARY RESTROOM BUILDING TO EXISTING SANITARY WASTE CONNECTION.CONTRACTOR TO SIZE PIPE PER BUILDING MANUFACTURES RECOMMENDATIONS. CONTRACTOR TO FIELD VERIFY EXACT LOCATION OF EXISTING CONNECTIONS. UTILITY TO REMAIN IN OWNERS NAME AND PAID BY THE OWNER.
2. CONTRACTOR TO CONNECT TEMPORARY SHOWER BUILDING TO EXISTING DOMESTIC WATER. CONTRACTOR TO CONNECT TEMPORARY SHOWER BUILDING TO EXISTING SANITARY WASTE CONNECTION. CONTRACTOR TO SIZE PIPE PER BUILDING MANUFACTURES RECOMMENDATIONS. CONTRACTOR TO FIELD VERIFY EXACT LOCATION OF EXISTING CONNECTIONS. UTILITY TO REMAIN IN OWNERS NAME AND PAID BY THE OWNER.

1

NORTH PLAN NORTH / NORTH TRUE NORTH

1 — FLOOR PLAN – C
1/8"=1'-0"



KEY PLAN



0 4' 8' 16'
1/8"=1'-0"



PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	ADD1 07/30/18	
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

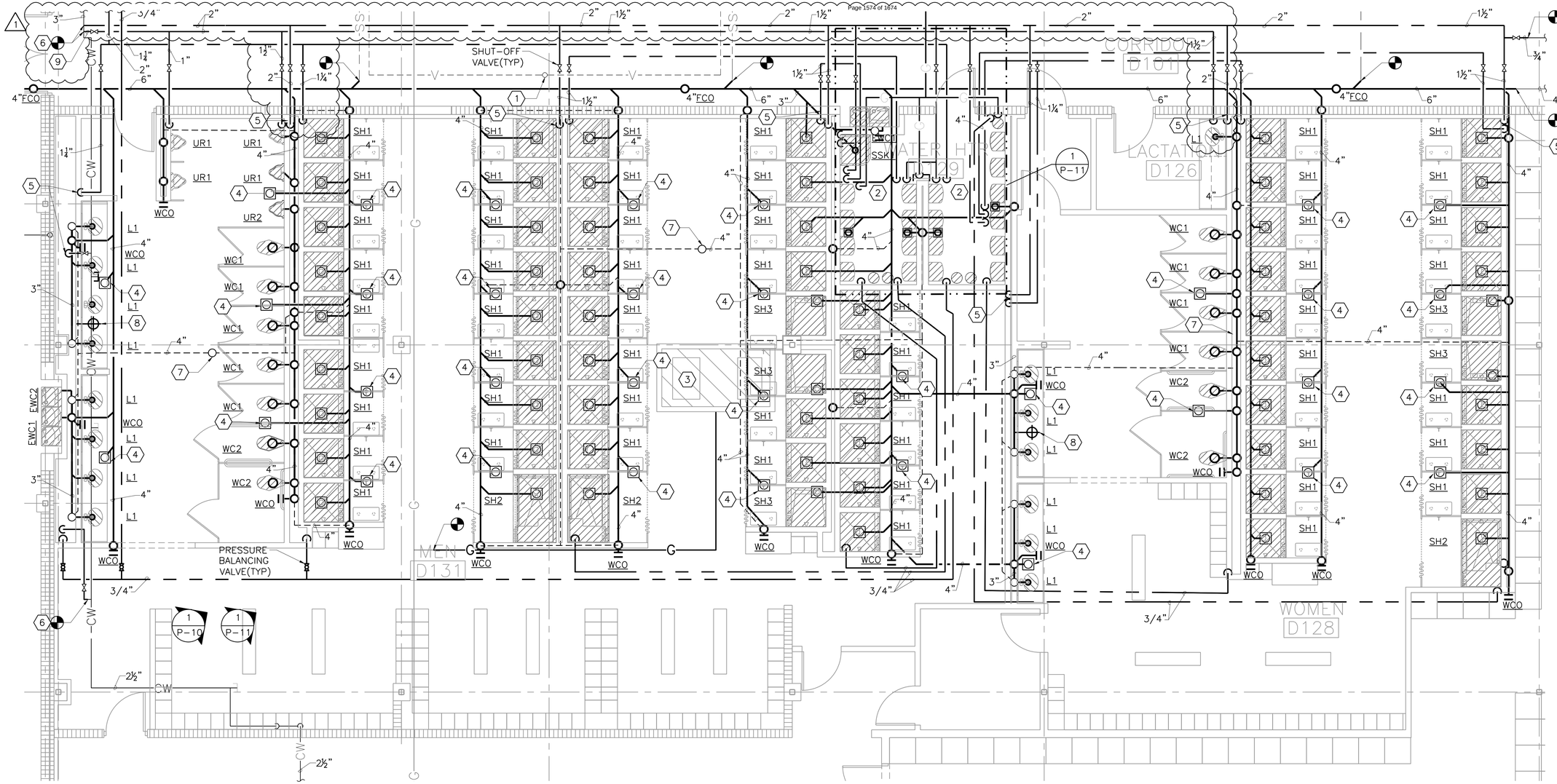
STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING
FLOOR PLAN - C

P-7

SHT. 69 of 129



NOTES BY SYMBOL "⬡"

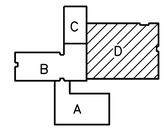
1. EXISTING VTR TO REMAIN.
2. NEW NATURAL GAS-FIRED INSTANTANEOUS TANKLESS WATER HEATERS. 200 CFH EACH AT 10" W.C. 18 REQUIRED FOR NEW LAYOUT. RE: 1, 2 & 3/P-12 AND SCHEDULE ON SHEET P-0.
3. NEW GAS FIRED HVAC UNIT.
4. NEW 2" FLOOR DRAIN WITH TRAP GUARD INSERT.
5. DROP HW AND CW FROM ABOVE INTO PLUMBING CHASE TO SERVE BATTERY OF PLUMBING FIXTURES.
6. EXISTING CW PIPE TO REMAIN IN SERVICE UNTIL CONSTRUCTION IS OF NEW RESTROOM AND SHOWER AREAS ARE COMPLETE. THE EXISTING CW PIPING IS TO BE REMOVED FOLLOWING THE INSTALLMENT OF ALL NEW CW PIPING SERVING THESE AREAS IS COMPLETED AND OPERATIONAL INCLUDING SERVICE SWITCH OVER.
7. NEW 4" VTR. COORDINATE ROOF PENETRATION WITH ROOFING WARRANTY.
8. NEW ½" HOSE BIBB UNDER COUNTER AT 12" AFF.
1. 9. NEW CW PIPE WITH SHUT-OFF VALVE TO SERVE WATER CLOSETS AND URINALS. CONTRACTOR TO PAINT PIPE INSULATION PURPLE DOWN STREAM OF THIS POINT FOR FUTURE RAIN WATER USE.

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT'S BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REFER TO SHEET P-0 FOR LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES.
3. EXISTING ROOF DRAINAGE SYSTEM NOT SHOWN FOR CLARITY.
4. PROVIDE NEW TRAP SEAL DEVICE IN ALL EXISTING AND NEW FLOOR DRAINS, FLOOR SINKS, AND HUB DRAINS.
5. ALL EXTERIOR AND INTERIOR NATURAL GAS PIPING TO BE PAINTED SAFETY YELLOW.

NOTE:
ENTIRE EXISTING CONCRETE FLOOR SLAB TO BE REMOVED/REPLACED IN RESTROOM, SHOWER AND LOCKER AREAS DURING CONSTRUCTION. COORDINATE NEW UNDER FLOOR SS PIPE INSTALLATION WITH NEW CONCRETE SLAB, GRADE BEAMS AND SLAB INSTALLATION. RE: STRUCTURAL DRAWINGS FOR CONCRETE SLAB REMOVAL, REPLACEMENT, TRENCHING AND BACKFILL.

NORTH PLAN NORTH / NORTH TRUE NORTH — 1 — ENLARGED FLOOR PLAN
1/4"=1'-0"



KEY PLAN



08/01/2018

0 1' 2' 4' 8'
1/4"=1'-0"

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MRB
REVIEWED BY: RJK

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

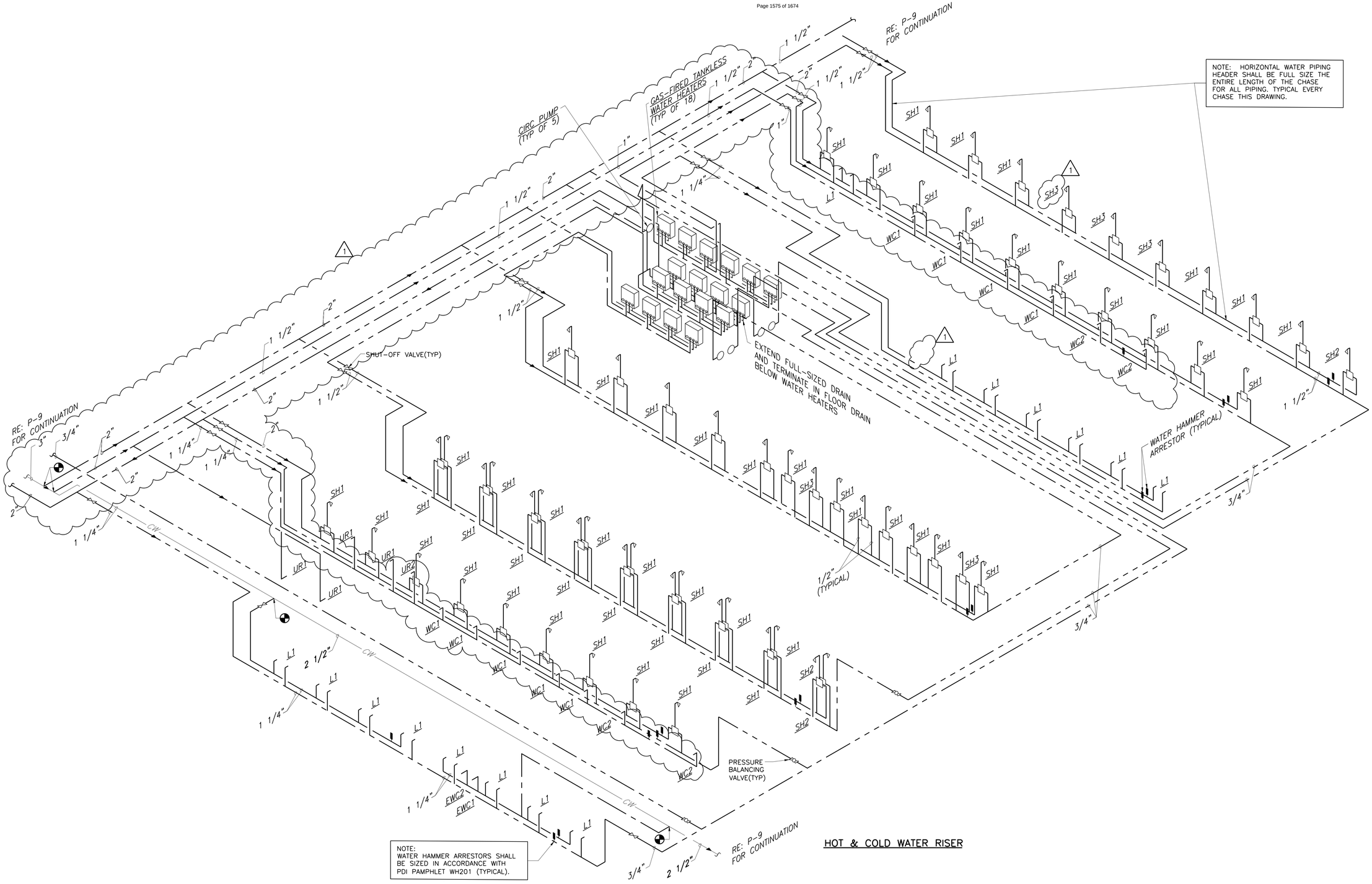
NO.	DATE	ISSUE
1	ADD1 07/30/18	

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

TXARNG CFMO

PLUMBING
ENLARGED FLOOR PLAN
P-9
SHT. 71 of 129



1 DOMESTIC WATER RISER DIAGRAM
NOT TO SCALE

THE STATE OF TEXAS

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: MB
REVIEWED BY: .

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone - (817) 735-7300
Fax - (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	ADD1 07/30/18	
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
AUSTIN, TEXAS 78763-5218
(512) 782-6131
FAX (512) 782-1481

STAR CAMPAIGN FY18 - WESLACO
RC MAJOR MAINTENANCE

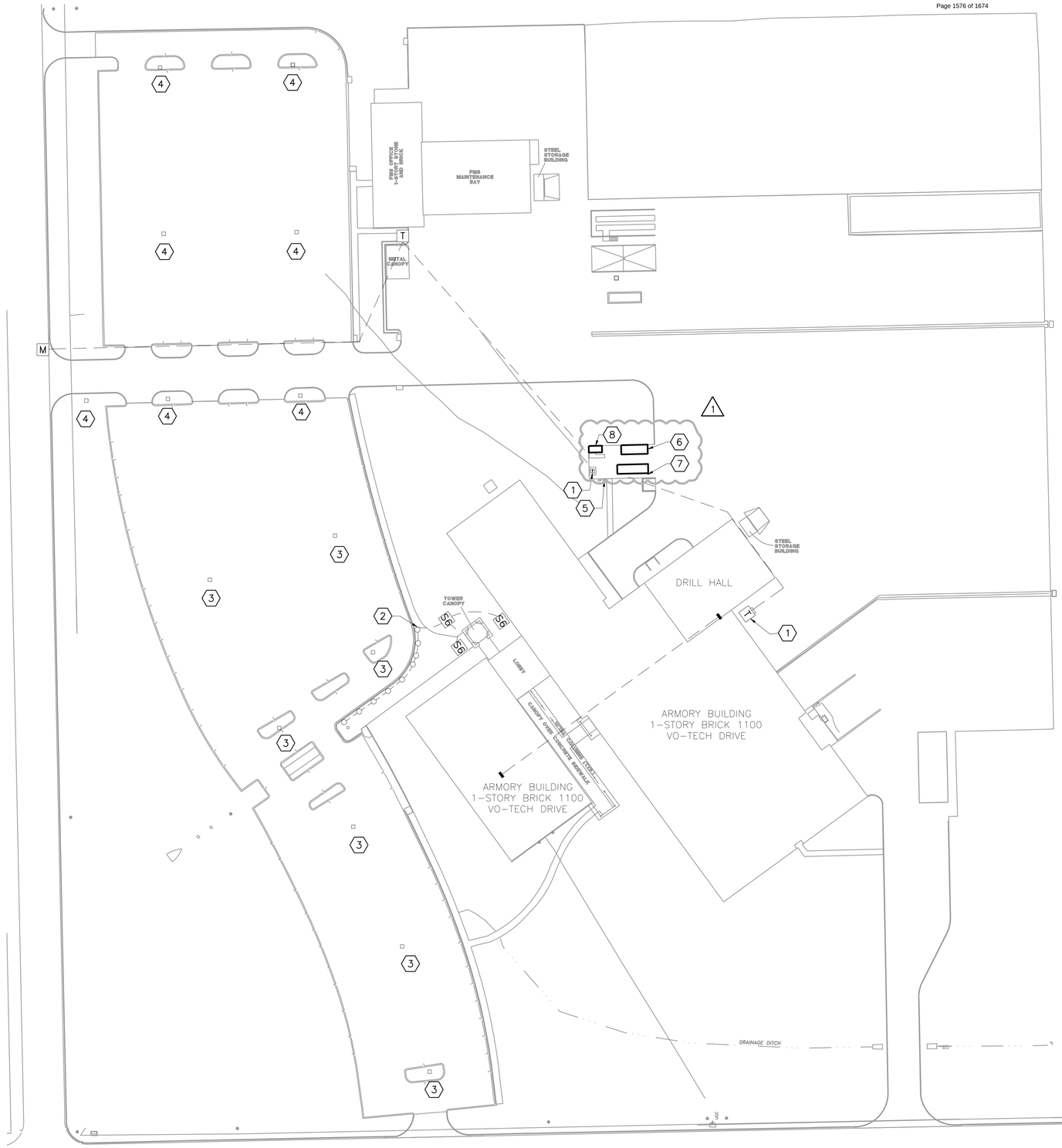
TXARNG CFMO

STATE OF TEXAS
VAN CASHEN
118595
LICENSED
PROFESSIONAL ENGINEER
08/01/2018

ELECTRICAL DOMESTIC WATER RISER DIAGRAMS

P-11

SHT. 73 of 129



NORTH TRUE

1 – ELECTRICAL SITE PLAN

1"= 50'-0"

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT BID OPTIONS CAN BE FOUND ON SHEET G–1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, SWITCHES, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
3. ALL EXISTING TO REMAIN CIRCUITS SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.

NOTES BY SYMBOL "⬡"

1. EXISTING UTILITY TRANSFORMER TO REMAIN.
2. BOLLARDS WITH 50W HPS LAMPS SHALL REMAIN.
3. LED LIGHT FIXTURES/POLES SHALL REMAIN.
4. EXISTING LIGHT POLES WITH 1000W HPS LAMPS SHALL REMAIN.

1 2 5. EXISTING ELECTRICAL SERVICE PANEL H1 AND ASSOCIATED APPLETON RECEPTACLES SHALL BE USED TO SERVE TEMPORARY BUILDINGS. CONTRACTOR SHALL MAKE FINAL CONNECTIONS FROM THE ELECTRICAL SERVICE TO THE TEMPORARY BUILDINGS BUT WILL NOT BE RESPONSIBLE FOR UTILITY COSTS. RE: 2/E–23 FOR ONE–LINE DIAGRAM.

2 6. TEMPORARY SHOWER BUILDING RE: 1/A–3. BUILDING REQUIRES THREE (3) 30A, 120V CIRCUIT BREAKERS OR A 3–PRONG SPECIAL RECEPTACLE. FIELD VERIFY THAT EXISTING APPLETON RECEPTACLE IS COMPATIBLE WITH THE BUILDING PLUG AND MAKE CONNECTION.

1 7. TEMPORARY RESTROOM BUILDING RE: 1/A–3. BUILDING REQUIRES THREE (3) 30A, 120V CIRCUIT BREAKERS OR A 3–PRONG SPECIAL RECEPTACLE. FIELD VERIFY THAT EXISTING APPLETON RECEPTACLE IS COMPATIBLE WITH THE BUILDING PLUG AND MAKE CONNECTION.

1 8. TEMPORARY ADA BUILDING RE: 1/A–3. BUILDING REQUIRES ONE (1) 30A, 120V CIRCUIT BREAKER OR A 3–PRONG SPECIAL RECEPTACLE. FIELD VERIFY THAT EXISTING APPLETON RECEPTACLE IS COMPATIBLE WITH THE BUILDING PLUG AND MAKE CONNECTION.

BID OPTIONS "◯"

1. TEMPORARY RESTROOM BUILDING.
2. TEMPORARY SHOWER BUILDING.

0 50' 100'
SCALE IN FEET

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
08/01/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109–4895
Phone – (817) 735–7300
Fax – (817) 735–7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F–2144

NO.	DATE	ISSUE
1	08/01/18	ADD. 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE–CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763–5218
(512) 782–6131 FAX (512) 782–1481
STAR CAMPAIGN FY□□ □WESLACO
RC MA□OR MAINTENANCE

TXARNG CFMO

ELECTRICAL
ELECTRICAL SITE PLAN
.
E-1
SHT. □□ □□□□□

GENERAL NOTES:

1. A SUMMARY OF THE PROJECT BID OPTIONS CAN BE FOUND ON SHEET G-1. DISCIPLINE SPECIFIC BID OPTIONS CAN BE FOUND ON THIS SHEET.
2. REMOVE ALL LIGHT FIXTURES, EXIT SIGNS, AND SWITCHES SHOWN HATCHED. REMOVE ASSOCIATED CIRCUITRY TO NEAREST JUNCTION BOX. SWITCH BACK BOXES MAY REMAIN WHERE SWITCHES WILL BE INSTALLED IN SAME LOCATION DURING THE CONSTRUCTION PHASE.
3. FIXTURES AND DEVICES SHOWN AT A LIGHT LINE WEIGHT SHALL REMAIN. RETAIN EXISTING CONDUCTORS AND CONDUITS FOR REUSE WHERE FEASIBLE.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ALL ABANDONED CONDUIT. FIELD VERIFY ALL REQUIREMENTS. INCLUDE ALL COSTS IN BASE BID.
5. THE OWNER SHALL BE GIVEN THE FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT BEING DEMOLISHED (FIXTURES, SWITCHES, ETC.). THE CONTRACTOR SHALL STORE ALL EQUIPMENT THAT THE OWNER ELECTS TO KEEP AT THE LOCATION ON SITE TO BE DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE DEMOLISHED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
6. THE ELECTRICAL DEMOLITION DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE PROVIDED TO CONVEY THE GENERAL SCOPE OF WORK. ALL EXISTING LIGHT FIXTURES, SWITCHES ETC. SHALL BE FIELD VERIFIED PRIOR TO BEGINNING WORK OR SUBMITTING PRICES. IT IS THE INTENT OF THESE DOCUMENTS THAT ALL EXISTING LIGHT FIXTURES, SWITCHES, AND ASSOCIATED RACEWAYS, CIRCUITRY, AND EQUIPMENT IN THIS AREA BE DEMOLISHED UNLESS OTHERWISE NOTED.
7. ALL EXISTING TO REMAIN CIRCUITS SHALL BE TRACED BY THE ELECTRICAL CONTRACTOR AND MARKED ACCORDINGLY BEFORE BEGINNING WORK.
8. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN BUILDING EXTERIOR WALLS SHALL BE SEALED WATER TIGHT. ALL VOIDS LEFT FROM CONDUIT/WIRING REMOVAL IN INTERIOR WALLS SHALL BE PATCHED AND FIREPROOFED AS REQUIRED TO MAINTAIN THE INTEGRITY OF THE PARTITION.
9. GROUT AND SEAL ALL PENETRATIONS WHERE CONDUIT HAS BEEN REMOVED.

NOTES BY SYMBOL "⬡"

(5) 1. IF BID OPTION NO. 5 IS SELECTED, REMOVE LIGHT FIXTURE AND SWITCH. RETAIN CONDUCTORS AND CONDUIT FOR REUSE AS MUCH AS PRACTICAL. . ENSURE THAT ADJACENT LIGHT FIXTURES TO REMAIN ARE CONNECTED BACK TO THE APPROPRIATE LIGHTING CIRCUIT. IF BID OPTION NO. 5 IS NOT SELECTED, LIGHT FIXTURES SHALL REMAIN AS THEY ARE.

(6) 2. IF BID OPTION NO. 6 IS SELECTED, REMOVE EXTERIOR LIGHT FIXTURES. RETAIN WIRING AND CONDUIT FOR REUSE AS MUCH AS PRACTICAL. IF BID OPTION NO. 6 IS NOT SELECTED, LIGHT FIXTURES ALL REMAIN AS THEY ARE.

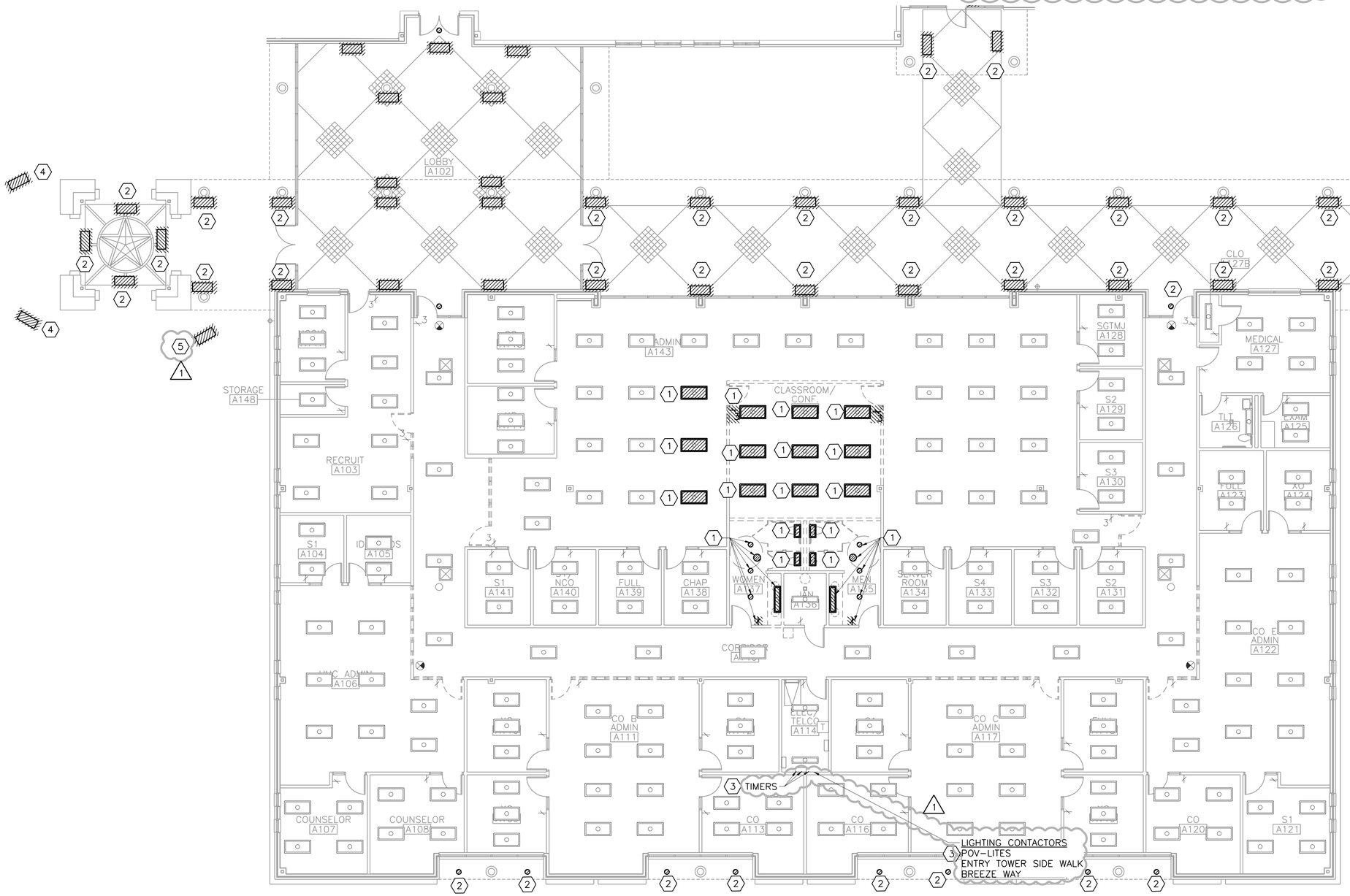
(6) 3. IF BID OPTION NO. 6 IS SELECTED, REMOVE LIGHTING CONTACTORS, TIMERS, AND ASSOCIATED CIRCUITRY BACK TO SOURCE. FIELD VERIFY EXISTING CONDITIONS AND REQUIREMENTS.

(6) 4. IF BID OPTION NO. 6 IS SELECTED, GROUND MOUNTED LIGHT FIXTURES. RETAIN WIRING AND CONDUIT FOR REUSE AS MUCH AS PRACTICAL. IF BID OPTION NO. 6 IS NOT SELECTED, LIGHT FIXTURES ALL REMAIN AS THEY ARE.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN WING.
6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/BUILDING SIGN.

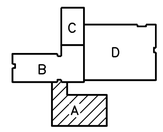
1 5. REMOVE LIGHT FIXTURE BASE TO ACCOMMODATE FOR NEW SIDEWALK.



NORTH TRUE / NORTH PLAN — 1/8"=1'-0"

LIGHTING DEMOLITION PLAN – AREA 'A'

1/8"=1'-0"



KEY PLAN

0 4' 8' 16'

1/8"=1'-0"

STATE OF TEXAS — TERESA CASTILLON — 111323 — LICENSED PROFESSIONAL ENGINEER — 08/01/18

PROJECT ARCHITECT:
HOMER SAENZ, AIA
PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADD. 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY□□ □WESLACO
RC MA□OR MAINTENANCE

TXARNG CFMO

ELECTRICAL LIGHTING DEMOLITION PLAN □AREA 'A'

E-2

SHT. □□ □□□□□

GENERAL NOTES:

1. ALL LIGHT FIXTURES SHOWN DARK AND WITH A LETTER DESIGNATION ARE TO BE PROVIDED UNDER BASE BID. LIGHT FIXTURES SHOWN AT A LIGHT LINE WEIGHT AND WITH NO DESIGNATION ARE EXISTING TO REMAIN.
2. ALL LIGHTING CIRCUITRY SHALL BE #12, WITH A #12G., IN A ¾"C. UNLESS NOTED OTHERWISE, FOR LIGHTING CIRCUITS GREATER THAN 100' PROVIDE #10, WITH A #10G., IN A ¾"C. FOR LIGHTING CIRCUITS GREATER THAN 250' PROVIDE #8, WITH A #8G., IN A ¾"C. PROVIDE ALL CONDUCTORS AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND PROVIDING ALL JUNCTION AND PULL BOXES IN ACCORDANCE WITH THE NEC.
4. CONDUIT SHALL NOT BE ROUTED ON THE OUTSIDE OF THE BUILDING FOR EXTERIOR LIGHTS.
5. ALL EXPOSED CONDUIT AND ASSOCIATED MOUNTING HARDWARE SHALL BE PAINTED TO MATCH THE SURFACE IT IS ATTACHED TO. FIELD VERIFY ALL REQUIREMENTS.
6. REFERENCE E-14 LIGHTING CONTROLS LEGEND FOR SWITCHES' AND SWITCH SENSOR'S.

NOTES BY SYMBOL "⬡"

(5) 1. IF BID OPTION NO. 5 IS SELECTED, PROVIDE LIGHT FIXTURES AND ASSOCIATED CIRCUITRY AS SHOWN IN THE CLASSROOM/CONFERENCE ROOM, WOMEN'S RESTROOM A137, AND MEN'S RESTROOM A135.

(6) 2. PROVIDE EXTERIOR LIGHT FIXTURE.

3. CONNECT BACK TO EXISTING CIRCUIT. PROVIDE ADDITIONAL WIRING AND CONDUIT AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.

(6) 4. LIGHT FIXTURE SHALL BE MOUNTED IN THE GROUND IN THE SAME LOCATION WHERE THE EXISTING FIXTURES WERE PREVIOUSLY LOCATED.

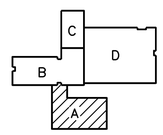
1 (6) 5. PROVIDE LIGHT FIXTURE NEAR THE ORIGINAL LOCATION OF THE DEMOLISHED FIXTURE AND OUTSIDE OF THE NEW SIDEWALK.

BID OPTIONS "◯"

5. RESTROOM/CONFERENCE ROOM RENOVATION IN ADMIN WING.
6. EXTERIOR BUILDING/PARKING IMPROVEMENTS/ BUILDING SIGN.



LIGHTING PLAN – AREA 'A'
1/8"=1'-0"



KEY PLAN

0 4' 8' 16'
1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
08/01/18

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218
(512) 782-6131
AUSTIN, TEXAS 78763-5218
FAX (512) 782-1481

STAR CAMPAIGN FY□□ □WESLACO
RC MA□OR MAINTENANCE

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: AT
REVIEWED BY: MTC

FREESE NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADD. 1
2		
3		
4		
5		
6		
7		
8		

TXARNG CFMO

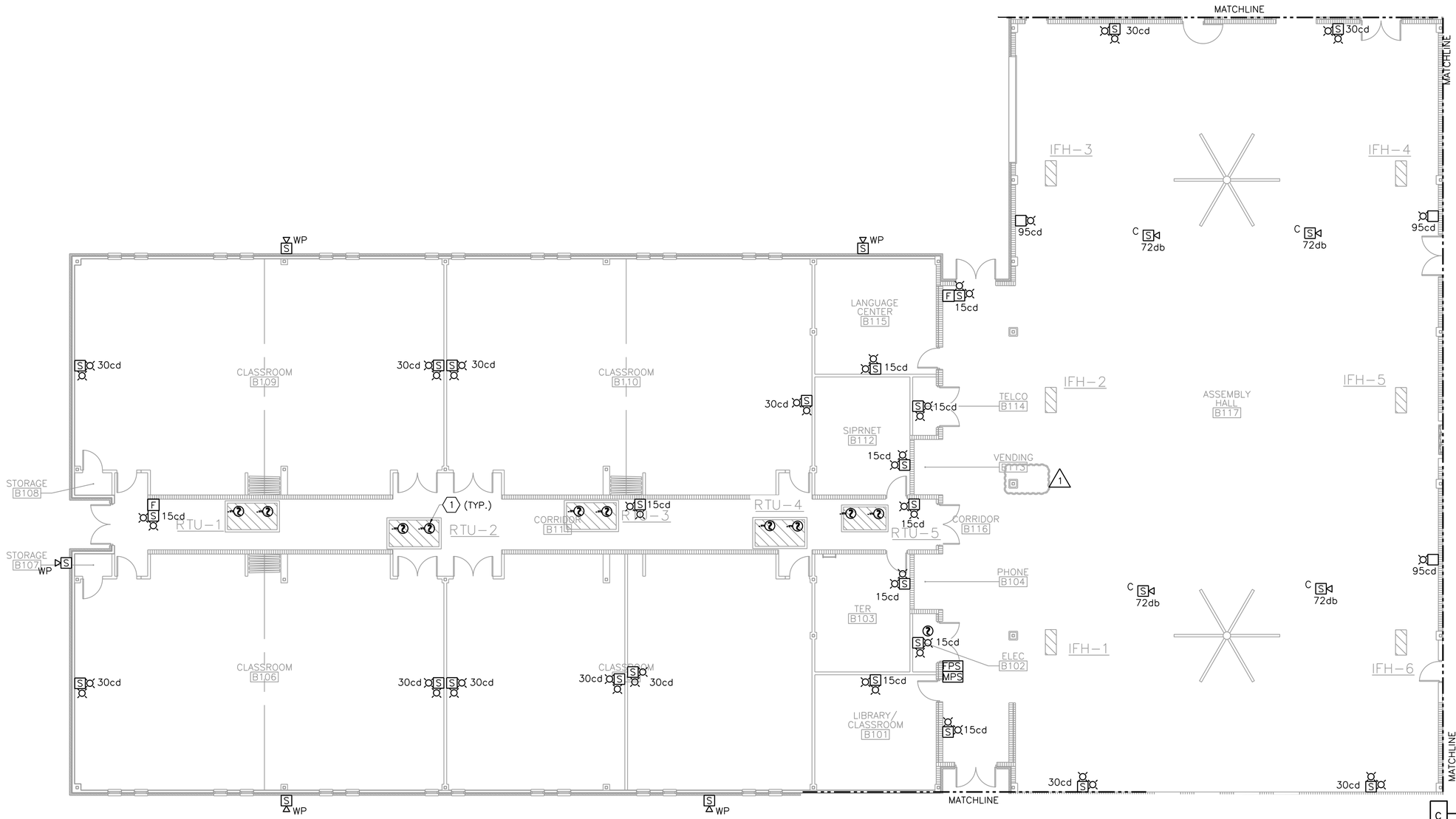
ELECTRICAL LIGHTING PLAN □AREA 'A'

E-10

SHT. □□ □□□□□

NOTES BY SYMBOL "⬡"

1. DUCT DETECORS TO BE PROVIDED BY OTHERS. PROVIDE CONNECTION TO FIRE ALARM/MASS NOTIFICATION SYSTEM. COORDINATE REQUIREMENTS WITH MECHANICAL CONTRACTOR.



NORTH TRUE NORTH PLAN 1 –

FIRE ALARM PLAN – AREA 'B'

1/8"=1'-0"

STATE OF TEXAS
TERESA CASTILLON
111323
LICENSED
PROFESSIONAL ENGINEER
08/01/18
Teresa Castillon

PROJECT ARCHITECT:
HOMER SAENZ, AIA

PROJECT NO. ADG17589A
ISSUE DATE: 04/20/18
DRAWN BY: HW
REVIEWED BY: MTC

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895
Phone – (817) 735-7300
Fax – (817) 735-7491

Freese and Nichols, Inc.
Texas Registered Engineering
Firm F-2144

NO.	DATE	ISSUE
1	08/01/18	ADD. 1
2		
3		
4		
5		
6		
7		
8		

TEXAS MILITARY FORCES
CONSTRUCTION & FACILITIES MANAGEMENT OFFICE-CFMO
CAMP MABRY P.O. BOX 5218 AUSTIN, TEXAS 78763-5218
(512) 782-6131 FAX (512) 782-1481

STAR CAMPAIGN FY□□ □WESLACO
RC MA□OR MAINTENANCE

TXARNG CFMO

FIRE ALARM PLAN □AREA 'B'

FA-7

SHT. □□□ □□□□□

Industrial Hygiene and Safety Technology, Inc.

2235 Keller Way
Carrollton, TX 75006
Phone: (972) 478-7415
Fax: (972) 478-7615

http://www.ihst.com

Leaders in Quality, Service and Innovation

Report of

Indoor Mold Assessment

Weslaco Readiness Center
100 Vo Tech Drive
Weslaco, Texas 78599

Prepared for:
Freese and Nichols, Inc.
4055 International Plaza, Suite 200
Fort Worth, TX 76109

Author: Tracy Bramlett, Industrial Hygienist, Mold Assessment Consultant

Report Date: December 6, 2017

Executive Summary

On November 28, 2017, Industrial Hygiene and Safety Technology, Inc. (IHST) performed a mold assessment at the Weslaco Readiness Center addressed at 100 Vo Tech Drive, Weslaco, Texas. The assessment was conducted by Tracy Bramlett, Certified Industrial Hygienist and Mold Assessment Consultant, representing IHST. The assessment was authorized by Freese and Nichols, Inc.

Bioaerosol sample analysis indicated no atypical mold species or unusually amplified spore counts of mold species detected in the occupied office areas of the Weslaco Readiness Center. Fungal spores detected indoors were representative of the species detected outdoors, and not at levels that constitute an unacceptable health risk to building occupants.

Multiple moisture stains from past water intrusions were identified on the interior walls and ceilings of the first and second floors with a majority of the intrusion stains located along the exterior window perimeters of the building. The moisture stains ranged from less than 1 square foot to 4 square feet and do not require licensed mold remediation for renovation and demolition activities.

Leaking windows at various locations on the exterior of the building may have hidden mold behind the walls which should be removed if the building is renovated.

Minor areas of mold growth were identified on metal HVAC supply registers where dust accumulation and surface condensation had occurred. The minor areas of mold were less than 25 contiguous square feet do not require licensed mold remediation for renovation and demolition activities.

Pigeon droppings were observed on the floor under a ceiling fan in the men’s locker room. A dead pigeon was also observed in the ceiling fan.

Recommendations

Stained ceiling tiles should be removed and replaced with new tiles until repairs to the roof or a new roof is installed on the south side of the building.

The exterior of the building should be power washed to remove the dark discoloration.

The coils on HVAC systems on the roof of the building should be cleaned.

The ceiling fan in the men’s locker room should sealed to prevent pigeons from access.

The floor of the men’s locker room should be cleaned and disinfected where the pigeon droppings were observed.

Contents

Recommendations 2
Purpose and Scope 4
Materials and Methods 4
Equipment and Methods for Bioaerosol Characterization 4
Equipment and Methods for Mold Tape Lift Sample Analysis 4
Results of Bioaerosol Sample Analyses 5
Results of Tape Lift Sample Analyses 7
Conclusions and Recommendations 8
Conclusions 8
Recommendations 8
Limitations 9
Appendix: Bioaerosol and Mold Tape Lift Laboratory Analysis Report 10
Appendix: Sample Locations and Site Diagram of Identified Mold and Water Damage 11
Appendix: Inspection Photographs 12

Purpose and Scope

On November 28, 2017, Industrial Hygiene and Safety Technology, Inc. (IHST) performed a mold assessment at the Weslaco Readiness Center addressed at 100 Vo Tech Drive, Weslaco, Texas. The assessment was conducted by Tracy Bramlett, Certified Industrial Hygienist and Mold Assessment Consultant, representing IHST. The assessment was authorized by Freese and Nichols, Inc.

The purpose was to assess for moisture damage, visible mold, and collect analytical samples as necessary to verify the presence of microbial contamination in the facility.

The scope of the assessment included measured substrate moisture readings, the collection of indoor bioaerosol samples and mold tape-lift samples, and a thorough visual inspection with photographic documentation throughout Building 1.

Materials and Methods

This section describes the methods, materials and equipment used for the assessment activities described in this report.

Equipment and Methods for Bioaerosol Characterization

Bioaerosol samples were collected to determine airborne mold concentrations in the building. Outdoor air samples were collected for reference evaluation to the indoor sample analysis prior to and following samples collected from the indoor air spaces. The air samples were collected on *Allergenco D* spore trap cassettes. The samples were collected over a five (5) minute period with the pumps calibrated at fifteen (15) liters of air per minute. Samples were analyzed by EMLab P&K, of Phoenix, Arizona (AIHA-LAP ID: 102297), using Phase Contrast Microscopy (PCM) methods.

No generally recognized standards have yet been codified for interpretation of bioaerosol sampling results. Unless otherwise noted, IHST applies the interpretations currently considered best industry practice, and classifies bioaerosol concentrations acceptable when the following conditions are met:

- The combined concentration of all spores in each indoor sample is less than the average combined concentration of spores in the outdoor samples;
- The concentration of each identified spore genus in each indoor sample is less than the average concentration of the same genus in the outdoor samples; and,
- The mold species or spore genera identified in the indoor samples are not identified in the outdoor samples or are present only at low concentrations.

Equipment and Methods for Mold Tape Lift Sample Analysis

Tape lift samples were collected at various locations in the building to identify suspect mold using a pre-sealed, adhesive Environmental Monitoring Systems Mold Tape Slide for sample collection. A clean pair of disposable lab exam gloves was worn prior to each tape lift sample collected to prevent cross-contamination interferences. The sealed adhesive side of the clear tape slide was exposed and pressed

gently on the surface of the sample substrate, re-sealed, and labeled. Samples were carefully packaged, and submitted to the laboratory for analysis.

The tape lift samples were analyzed by EM Lab P&K, of Phoenix, Arizona (AIHA-LAP ID: 102297). The laboratory analysis report of the tape lift sample is provided in the report appendix: *Bioaerosol and Mold Tape Lift Laboratory Analysis Report.*

Equipment and Methods for Indoor Environmental Quality Characterization

The mold assessment performed by IHST, Inc. included a visual / sensory inspection, as well as collection of tape samples. IHST used results of the visual / sensory inspection and analytical data to develop opinions regarding the various factors affecting environmental conditions of the area(s) assessed, as well as for development of appropriate corrective action recommendations. Unless otherwise noted in this section, IHST's inspection was limited to practical accessible areas, and the inspector used no destructive investigation techniques.

Industrial hygienists employed by IHST for microbial assessments are licensed by the Texas Department of State Health Services (TDSHS) as Mold Consultants. IHST, Inc. holds a company licensed from the TDHSH as a Mold Consulting Company, license ACO0161.

Visual / Sensory Inspection

IHST performed a thorough visual inspection of the areas to be assessed, with close attention to detection of unusual or unpleasant odors and sensations. This inspection included the following specific parameters:

- Assess for visible mold growth on building substrates or evidence of indoor building moisture intrusion damage (i.e., stains, wood rot, wet or damp substrates, plumbing leaks, standing water, etc.) on building materials;
- Assess for excessive dust buildup and areas of moisture condensation
- Assess condition of heating ventilation and air conditioning (HVAC) systems utilized for building occupancy.

Results of Bioaerosol Sample Analyses

The table *Bioaerosol Sample Evaluation Summary* presents the interpretation of the results of bioaerosol sampling for airborne mold spores. Full laboratory analysis data of the bioaerosol samples is provided in the report appendices: *Bioaerosol and Mold Tape Lift Laboratory Analysis Report.* This table provides a summarization of the indoor bioaerosol sample results compared to those collected outdoors.

- The ***Sample ID Number(s)*** column shows the sample(s) collected in each indoor space.
- The ***Spore Types Differ Compared to Outdoors?*** column indicates whether the types of spores detected inside differ appreciably from those in the outdoor environment. This column will contain a Yes if spore types

are detected indoors that are not present outdoors. A *Yes* may indicate a potential reservoir of indoor mold growth.

- The ***Spores Elevated Compared to Outdoors?*** column indicates whether counts of overall or individual spores are elevated in the indoor samples, compared to levels in the outdoor samples. A *Yes* may indicate a potential reservoir of indoor mold growth.
- The ***Atypical Spores Present Inside?*** column indicates whether water-loving or other unusual spore types are present in the indoor samples. A *Yes* may indicate a potential reservoir of indoor mold growth.
- The ***Overall Air Quality Impact*** column indicates whether the interpretation of the sample analysis results for the specified location is acceptable, or suggests a need for corrective action.

Outdoor samples collected for this assessment include:

- **2142232 – Outdoor, Pre-Survey Sample, 11/28/2017**
- **1956305 – Outdoor, Post-Survey Sample, 11/28/2017**

Table 2. Bioaerosol Sample Evaluation Summary

Sample Description		Summary of Sample Analyses and Evaluation			
Location/Time Sampled	Sample ID Number(s)	Spore Types Differ Compared to Outdoors?	Spores Elevated Compared to Outdoors?	Atypical Spores Present Indoors?	Overall Air Quality Impact
Headquarters, Administration Office	2142241	No	No	No	Acceptable
Classroom, Northwest Side of Building	2142618	No	No	No	Acceptable
HHC Administration Area	2142239	No	No	No	Acceptable

Results of Tape Lift Sample Analyses

The table *Tape Lift Sample Mold Analysis Summary* presents the interpretation of the results of sample collected for fungi identification. The laboratory analysis report is provided in the report appendices. This table summarizes the results of the tape lift sample analysis.

- The ***Sample ID Number(s)*** column shows the sample collected and particular location.
- The ***Mold Growth Present ?*** column indicates whether mold growth with mycelial and/or sporulating structures were present on the sampled surface . A *Yes* may indicate a potential indoor mold concern.
- The ***Species of Mold Present?*** column indicates the types of mold specie detected on the sampled surface.
- The ***Extensive Mold in Sample?*** column indicates whether excessive fungal colonies are present in the sample. A *Yes* may indicate unsanitary conditions or confirms the presence of mold growth on the substrate.

  The ***Overall Air Quality Impact*** column indicates whether the interpretation of the sample analysis results for the specified location is acceptable, or suggests a need for corrective action.

Table 1: Tape Lift Sample Mold Analysis Summary

Sample Description		Summary of Sample Analyses and Evaluation			
Location Sampled	**Sample ID Number(s)**	**Mold Growth Present?**	**Species of Mold Present?**	**Extensive Mold in Sample?**	**Overall Air Quality Impact**
Stained Ceiling Tile, Janitor's Closet	11281701	**Yes**	*Stachybotrys*	**No**	See WA-01 Footnote.
Stained Ceiling Tile, Hall Across From Janitor's Closet	11281702	**Yes**	*Stachybotrys*	**No**	See WA-01 Footnote.
Bulk Gypsum Wall Board on Exterior Wall in Recruiting Office	11281703	**No**	NA	**No**	See WA-02 Footnote.
Exterior of Building By Window	11281704	**Yes**	*Cladosporium*	**No**	See WA-03

Table 1 Footnotes:

- WA-01: Visible stains on ceiling tiles in the janitor's closet and adjacent hallway was observed. The surface area of the mold was determined to be less than 1 square foot. The source of the mold appear to be from roof leaks. The surface mold was not in excess of 25 contiguous square feet, which require a TDSHS-licensed mold remediation contractor to clean and remove the identified mold following a written Mold Assessment Remediation Protocol under the Texas Mold Assessment and Remediation Rules. Maintenance personnel in the building should replace the ceiling tile. The roof leaks in this area should be repaired or the roof replaced. In addition, water stains were observed on ceiling tiles at other locations in the building. See drawings for sample locations and water stained areas.
- WA-02: Visible stains were not observed in this area, however, the gypsum walls appear to have been wet at one time. Exterior walls under windows were observed to be buckling and possibly wet at one time. The walls have all been painted under the windows, however, it is hypothesized that because of the evidence of moisture intrusion that there may be mold behind the walls. The source of the water appears to be from leaking windows on the exterior of the building.

- WA-03: Black discoloration was observed on the exterior walls of the building around some windows. The dark discoloration was determined to be mold. It is recommended that the exterior of the building be pressure washed to clean the surfaces of the microbial growth.

Conclusions and Recommendations

Conclusions

Bioaerosol sample analysis indicated no atypical mold species or unusually amplified spore counts of mold species detected in the occupied office areas of the Weslaco Readiness Center. Fungal spores detected indoors were representative of the species detected outdoors, and not at levels that constitute an unacceptable health risk to building occupants.

Multiple moisture stains from past water intrusions were identified on the interior walls and ceilings of the first and second floors with a majority of the intrusion stains located along the exterior window perimeters of the building. The moisture stains ranged from less than 1 square foot to 4 square feet and do not require licensed mold remediation for renovation and demolition activities.

Leaking windows at various locations on the exterior of the building may have hidden mold behind the walls which should be removed if the building is renovated.

Minor areas of mold growth were identified on metal HVAC supply registers where dust accumulation and surface condensation had occurred. The minor areas of mold were less than 25 contiguous square feet do not require licensed mold remediation for renovation and demolition activities.

Pigeon droppings were observed on the floor under a ceiling fan in the men's locker room. A dead pigeon was also observed in the ceiling fan.

Recommendations

Stained ceiling tiles should be removed and replaced with new tiles until repairs to the roof or a new roof is installed on the south side of the building.

The exterior of the building should be power washed to remove the dark discoloration.

The coils on HVAC systems on the roof of the building should be cleaned.

The ceiling fan in the men's locker room should sealed to prevent pigeons from access.

The floor of the men's locker room should be cleaned and disinfected where the pigeon droppings were observed.

Limitations

The items observed and documented in this report are necessarily limited to the conditions of the subject properties on the survey date(s). Any samples or other data collected during this study provide information necessarily limited to specific materials or conditions observed on the survey date(s).

This document is the rendering of a professional service, the essence of which is the advice, judgment, opinion, or professional skill. In the event that additional information becomes available that could affect the conclusions reached in this investigation, IHST reserves the right to review and change if required, some or all of the opinions presented herein.

This report has been prepared for exclusive use of the client and their representatives. No unauthorized reuse of reproduction of this report, in part or whole, shall be permitted without prior written consent. If you have any questions concerning this report, please do not hesitate to contact our office.

Tracy K. Bramlett

Tracy K. Bramlett, CIH, CSP
President, IHST, Inc.



Appendix: Bioaerosol and Mold Tape Lift Laboratory Analysis Report

EMLab P&K
A TestAmerica Company

Report for:

Mr. Tracy Bramlett
IHST, Inc.
2235 Keller Way
Carrollton, TX 75006

Regarding: Project: 21816; Weslaco Readiness Center
EML ID: 1840647

Approved by:

Operations Manager
Joshua Cox

Dates of Analysis:
Spore trap analysis: 12-04-2017

Service SOPs: Spore trap analysis (EM-MY-S-1038)
AIHA-LAP, LLC accredited service, Lab ID #102297

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. Due to the nature of the analyses performed, field blank correction of results is not applied. The results relate only to the items tested.

EMLab P&K ("the Company") shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

EMLab P&K's LabServe® reporting system includes automated fail-safes to ensure that all AIHA-LAP, LLC quality requirements are met and notifications are added to reports when any quality steps remain pending.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

SPORE TRAP REPORT: NON-VIABLE METHODOLOGY

Location:	2142232: OD (Pre)			2142241: Headquarters Administration		
Comments (see below)	None			None		
Lab ID-Version‡:	8623806-1			8623807-1		
Analysis Date:	12/04/2017			12/04/2017		
	raw ct.	% read	spores/m3	raw ct.	% read	spores/m3
Alternaria	8	100	110			
Ascospores	19	25	1,000	1	25	53
Basidiospores	8	25	430	5	25	270
Bipolaris/Drechslera group	1	100	13	1	100	13
Cercospora	1	100	13			
Chaetomium						
Cladosporium	114	25	6,100	9	25	480
Curvularia						
Nigrospora	3	100	40			
Other brown				1	100	13
Other colorless						
Penicillium/Aspergillus types†	3	25	160	2	25	110
Pithomyces						
Rusts						
Smuts, Periconia, Myxomycetes	6	100	80	2	100	27
Stachybotrys						
Stemphylium						
Torula						
Ulocladium						
Zygomycetes						
Background debris (1-4+)††	3+			2+		
Hyphal fragments/m3	67			27		
Pollen/m3	13			< 13		
Skin cells (1-4+)	< 1+			1+		
Sample volume (liters)	75			75		
§ TOTAL SPORES/m3			7,900			960

Comments:

Spore types listed without a count or data entry were not detected during the course of the analysis for the respective sample, indicating a raw count of <1 spore.
† The spores of *Aspergillus* and *Penicillium* (and others such as *Acremonium, Paecilomyces*) are small and round with very few distinguishing characteristics. They cannot be differentiated by non-viable sampling methods. Also, some species with very small spores are easily missed, and may be undercounted.
††Background debris indicates the amount of non-biological particulate matter present on the trace (dust in the air) and the resulting visibility for the analyst. It is rated from 1+ (low) to 4+ (high). Counts from areas with 4+ background debris should be regarded as minimal counts and may be higher than reported. It is important to account for samples volumes when evaluating dust levels.

The analytical sensitivity is the spores/m^3 divided by the raw count, expressed in spores/m^3. The limit of detection is the analytical sensitivity (in spores/m^3) multiplied by the sample volume (in liters) divided by 1000 liters.

For more information regarding analytical sensitivity, please contact QA by calling the laboratory.
‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".
§ Total Spores/m3 has been rounded to two significant figures to reflect analytical precision.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

SPORE TRAP REPORT: NON-VIABLE METHODOLOGY

Location:	2142618: Classroom N.W. Side			2142239: HHC Administration		
Comments (see below)	None			None		
Lab ID-Version‡:	8623808-1			8623809-1		
Analysis Date:	12/04/2017			12/04/2017		
	raw ct.	% read	spores/m3	raw ct.	% read	spores/m3
Alternaria						
Ascospores	2	25	110			
Basidiospores	2	25	110	3	25	160
Bipolaris/Drechslera group						
Cercospora						
Chaetomium						
Cladosporium	4	25	210	5	25	270
Curvularia	1	100	13			
Nigrospora						
Other brown						
Other colorless						
Penicillium/Aspergillus types†	2	25	110	1	25	53
Pithomyces						
Rusts						
Smuts, Periconia, Myxomycetes						
Stachybotrys						
Stemphylium						
Torula						
Ulocladium						
Zygomycetes						
Background debris (1-4+)††	2+			2+		
Hyphal fragments/m3	< 13			< 13		
Pollen/m3	< 13			< 13		
Skin cells (1-4+)	< 1+			< 1+		
Sample volume (liters)	75			75		
§ TOTAL SPORES/m3			550			480

Comments:

Spore types listed without a count or data entry were not detected during the course of the analysis for the respective sample, indicating a raw count of <1 spore.
† The spores of *Aspergillus* and *Penicillium* (and others such as *Acremonium, Paecilomyces*) are small and round with very few distinguishing characteristics. They cannot be differentiated by non-viable sampling methods. Also, some species with very small spores are easily missed, and may be undercounted.
††Background debris indicates the amount of non-biological particulate matter present on the trace (dust in the air) and the resulting visibility for the analyst. It is rated from 1+ (low) to 4+ (high). Counts from areas with 4+ background debris should be regarded as minimal counts and may be higher than reported. It is important to account for samples volumes when evaluating dust levels.

The analytical sensitivity is the spores/m^3 divided by the raw count, expressed in spores/m^3. The limit of detection is the analytical sensitivity (in spores/m^3) multiplied by the sample volume (in liters) divided by 1000 liters.

For more information regarding analytical sensitivity, please contact QA by calling the laboratory.
‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".
§ Total Spores/m3 has been rounded to two significant figures to reflect analytical precision.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

SPORE TRAP REPORT: NON-VIABLE METHODOLOGY

Location:	1956305: OD (Post)		
Comments (see below)	None		
Lab ID-Version‡:	8623810-1		
Analysis Date:	12/04/2017		
	raw ct.	% read	spores/m3
Alternaria	1	100	13
Ascospores	5	25	270
Basidiospores	15	25	800
Bipolaris/Drechslera group	8	100	110
Cercospora			
Chaetomium			
Cladosporium	39	25	2,100
Curvularia			
Nigrospora	4	100	53
Other brown			
Other colorless			
Penicillium/Aspergillus types†	3	25	160
Pithomyces			
Rusts			
Smuts, Periconia, Myxomycetes	4	100	53
Stachybotrys			
Stemphylium			
Torula			
Ulocladium			
Zygomycetes			
Background debris (1-4+)††	3+		
Hyphal fragments/m3	67		
Pollen/m3	< 13		
Skin cells (1-4+)	< 1+		
Sample volume (liters)	75		
§ TOTAL SPORES/m3			3,500

Comments:

Spore types listed without a count or data entry were not detected during the course of the analysis for the respective sample, indicating a raw count of <1 spore.
† The spores of *Aspergillus* and *Penicillium* (and others such as *Acremonium, Paecilomyces*) are small and round with very few distinguishing characteristics. They cannot be differentiated by non-viable sampling methods. Also, some species with very small spores are easily missed, and may be undercounted.
††Background debris indicates the amount of non-biological particulate matter present on the trace (dust in the air) and the resulting visibility for the analyst. It is rated from 1+ (low) to 4+ (high). Counts from areas with 4+ background debris should be regarded as minimal counts and may be higher than reported. It is important to account for samples volumes when evaluating dust levels.

The analytical sensitivity is the spores/m^3 divided by the raw count, expressed in spores/m^3. The limit of detection is the analytical sensitivity (in spores/m^3) multiplied by the sample volume (in liters) divided by 1000 liters.

For more information regarding analytical sensitivity, please contact QA by calling the laboratory.
‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".
§ Total Spores/m3 has been rounded to two significant figures to reflect analytical precision.

EMLab P&K
A TestAmerica Company

Report for:

Mr. Tracy Bramlett
IHST, Inc.
2235 Keller Way
Carrollton, TX 75006

Regarding: Project: 21816; Weslaco Readiness Center
EML ID: 1840647

Approved by:



Operations Manager
Joshua Cox

Dates of Analysis:
Direct microscopic exam (Qualitative): 12-04-2017

Service SOPs: Direct microscopic exam (Qualitative) (EM-MY-S-1039)
AIHA-LAP, LLC accredited service, Lab ID #102297

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. Due to the nature of the analyses performed, field blank correction of results is not applied. The results relate only to the items tested.

EMLab P&K ("the Company") shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

EMLab P&K's LabServe® reporting system includes automated fail-safes to ensure that all AIHA-LAP, LLC quality requirements are met and notifications are added to reports when any quality steps remain pending.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

DIRECT MICROSCOPIC EXAMINATION REPORT

Background Debris and/or Description	Miscellaneous Spores Present*	MOLD GROWTH: Molds seen with underlying mycelial and/or sporulating structures†	Other Comments††	General Impression
Lab ID-Version‡: 8623831-1, Analysis Date: 12/04/2017: Tape sample 11281701: Janitors Closet				
Light	Very few	3+ *Stachybotrys* species (spores, hyphae, conidiophores)	None	Mold growth
Lab ID-Version: 8623832-1, Analysis Date: 12/04/2017: Tape sample 11281702: Hall By Janitors Closet				
Moderate	Very few	3+ *Stachybotrys* species (spores, hyphae, conidiophores)	None	Mold growth
Lab ID-Version: 8623830-1, Analysis Date: 12/04/2017: Bulk sample 11281703: Sheetrock In Recruiting				
Substrate unidentified	Very few	None	None	Normal trapping
Lab ID-Version: 8623833-1, Analysis Date: 12/04/2017: Tape sample 11281704: Exterior Wall				
Heavy	Very few	2+ *Cladosporium* species (spores, hyphae) 1+ brown spore type, ID unknown (spores)	None	Mold growth

* Indicative of normal conditions, i.e. seen on surfaces everywhere. Includes basidiospores (mushroom spores), myxomycetes, plant pathogens such as ascospores, rusts and smuts, and a mix of saprophytic genera with no particular spore type predominating. Distribution of spore types seen mirrors that usually seen outdoors.

† Quantities of molds seen growing are listed in the MOLD GROWTH column and are graded <1+ to 4+, with 4+ denoting the highest numbers.

†† Some comments may refer to the following: Most surfaces collect a mix of spores which are normally present in the outdoor environment. At times it is possible to note a skewing of the distribution of spore types, and also to note "marker" genera which may indicate indoor mold growth. Marker genera are those spore types which are present normally in very small numbers, but which multiply indoors when conditions are favorable for growth.

‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".
The limit of detection is < 1+ when mold growth is detected.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

MoldRANGE™: Extended Outdoor Comparison

Outdoor Location: 2142232, OD (Pre)

Fungi Identified	Outdoor data	Typical Outdoor Data for: November in Texas† (n‡=1626)						Typical Outdoor Data for: The entire year in Texas† (n‡=20974)					
	spores/m3	very low	low	med	high	very high	freq %	very low	low	med	high	very high	freq %
Generally able to grow indoors*													
Alternaria	110	13	13	40	120	190	71	13	20	53	160	290	72
Bipolaris/Drechslera group	13	13	13	27	53	93	47	13	13	27	67	120	45
Chaetomium	-	13	13	13	27	40	8	13	13	13	27	40	7
Cladosporium	6,100	190	370	1,300	4,200	7,100	98	150	320	1,200	3,900	6,900	96
Curvularia	-	13	13	27	67	130	46	13	13	27	80	160	40
Nigrospora	40	13	13	32	80	130	58	13	13	40	110	170	49
Other brown	-	13	13	27	67	93	21	13	13	27	53	80	19
Penicillium/Aspergillus types	160	53	110	360	910	1,500	84	53	110	360	1,000	1,700	83
Stachybotrys	-	13	13	27	41	110	2	13	13	13	40	67	2
Torula	-	13	13	13	40	67	16	13	13	20	53	80	16
Seldom found growing indoors**													
Ascospores	1,000	51	53	210	640	1,300	86	53	80	290	1,000	2,000	88
Basidiospores	430	53	130	480	2,200	4,400	94	67	150	530	2,500	5,400	94
Cercospora	13	13	13	40	110	190	33	13	13	40	150	270	38
Rusts	-	13	13	13	53	78	27	13	13	13	40	67	17
Smuts, Periconia, Myxomycetes	80	13	40	93	250	400	87	13	27	80	230	370	81
§ TOTAL SPORES/m3	7,900												

†The 'Typical Outdoor Data' represents the typical outdoor spore levels for the location and time frame indicated. The last column represents the frequency of occurrence. The very low, low, med, high, and very high values represent the 10, 20, 50, 80, and 90 percentile values of the spore type when it is detected. For example, if the frequency of occurrence is 63% and the low value is 53, it would mean that the given spore type is detected 63% of the time and, when detected, 20% of the time it is present in levels above the detection limit and below 53 spores/m3. These values are updated periodically, and if enough data is not available to make a statistically meaningful assessment, it is indicated with a dash.

§ Total Spores/m3 has been rounded to two significant figures to reflect analytical precision.

* The spores in this category are generally capable of growing on wet building materials in addition to growing outdoors. Building related growth is dependent upon the fungal type, moisture level, type of material, and other factors. *Cladosporium* is one of the predominant spore types worldwide and is frequently present in high numbers. *Penicillium/Aspergillus* species colonize both outdoor and indoor wet surfaces rapidly and are very easily dispersed. Other genera are usually present in lesser numbers.

** These fungi are generally not found growing on wet building materials. For example, the rusts and smuts are obligate plant pathogens. However, in each group there are notable exceptions. For example, agents of wood decay are members of the basidiomycetes and high counts of a single morphological type of basidiospore on an inside sample should be considered significant.

‡n = number of samples used to calculate data.

Interpretation of the data contained in this report is left to the client or the persons who conducted the field work. This report is provided for informational and comparative purposes only and should not be relied upon for any other purpose. "Typical outdoor data" are based on the results of the analysis of samples delivered to and analyzed by EMLab P&K and assumptions regarding the origins of those samples. Sampling techniques, contaminants infecting samples, unrepresentative samples and other similar or dissimilar factors may affect these results. In addition, EMLab P&K may not have received and tested a representative number of samples for every region or time period. EMLab P&K hereby disclaims any liability for any and all direct, indirect, punitive, incidental, special or consequential damages arising out of the use or interpretation of the data contained in, or any actions taken or omitted in reliance upon, this report.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

MoldRANGE™: Extended Outdoor Comparison

Outdoor Location: 1956305, OD (Post)

Fungi Identified	Outdoor data	Typical Outdoor Data for: November in Texas† (n‡=1626)						Typical Outdoor Data for: The entire year in Texas† (n‡=20974)					
	spores/m3	very low	low	med	high	very high	freq %	very low	low	med	high	very high	freq %
Generally able to grow indoors*													
Alternaria	13	13	13	40	120	190	71	13	20	53	160	290	72
Bipolaris/Drechslera group	110	13	13	27	53	93	47	13	13	27	67	120	45
Chaetomium	-	13	13	13	27	40	8	13	13	13	27	40	7
Cladosporium	2,100	190	370	1,300	4,200	7,100	98	150	320	1,200	3,900	6,900	96
Curvularia	-	13	13	27	67	130	46	13	13	27	80	160	40
Nigrospora	53	13	13	32	80	130	58	13	13	40	110	170	49
Other brown	-	13	13	27	67	93	21	13	13	27	53	80	19
Penicillium/Aspergillus types	160	53	110	360	910	1,500	84	53	110	360	1,000	1,700	83
Stachybotrys	-	13	13	27	41	110	2	13	13	13	40	67	2
Torula	-	13	13	13	40	67	16	13	13	20	53	80	16
Seldom found growing indoors**													
Ascospores	270	51	53	210	640	1,300	86	53	80	290	1,000	2,000	88
Basidiospores	800	53	130	480	2,200	4,400	94	67	150	530	2,500	5,400	94
Cercospora	-	13	13	40	110	190	33	13	13	40	150	270	38
Rusts	-	13	13	13	53	78	27	13	13	13	40	67	17
Smuts, Periconia, Myxomycetes	53	13	40	93	250	400	87	13	27	80	230	370	81
§ TOTAL SPORES/m3	3,500												

†The 'Typical Outdoor Data' represents the typical outdoor spore levels for the location and time frame indicated. The last column represents the frequency of occurrence. The very low, low, med, high, and very high values represent the 10, 20, 50, 80, and 90 percentile values of the spore type when it is detected. For example, if the frequency of occurrence is 63% and the low value is 53, it would mean that the given spore type is detected 63% of the time and, when detected, 20% of the time it is present in levels above the detection limit and below 53 spores/m3. These values are updated periodically, and if enough data is not available to make a statistically meaningful assessment, it is indicated with a dash.

§ Total Spores/m3 has been rounded to two significant figures to reflect analytical precision.

* The spores in this category are generally capable of growing on wet building materials in addition to growing outdoors. Building related growth is dependent upon the fungal type, moisture level, type of material, and other factors. *Cladosporium* is one of the predominant spore types worldwide and is frequently present in high numbers. *Penicillium/Aspergillus* species colonize both outdoor and indoor wet surfaces rapidly and are very easily dispersed. Other genera are usually present in lesser numbers.

** These fungi are generally not found growing on wet building materials. For example, the rusts and smuts are obligate plant pathogens. However, in each group there are notable exceptions. For example, agents of wood decay are members of the basidiomycetes and high counts of a single morphological type of basidiospore on an inside sample should be considered significant.

‡n = number of samples used to calculate data.

Interpretation of the data contained in this report is left to the client or the persons who conducted the field work. This report is provided for informational and comparative purposes only and should not be relied upon for any other purpose. "Typical outdoor data" are based on the results of the analysis of samples delivered to and analyzed by EMLab P&K and assumptions regarding the origins of those samples. Sampling techniques, contaminants infecting samples, unrepresentative samples and other similar or dissimilar factors may affect these results. In addition, EMLab P&K may not have received and tested a representative number of samples for every region or time period. EMLab P&K hereby disclaims any liability for any and all direct, indirect, punitive, incidental, special or consequential damages arising out of the use or interpretation of the data contained in, or any actions taken or omitted in reliance upon, this report.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

MoldSTAT™: Supplementary Statistical Spore Trap Report

Outdoor Summary: 2142232: OD (Pre)

Species detected	Outdoor sample spores/m3 <100 1K 10K >100K	Typical outdoor ranges (North America)	Freq. %
Alternaria	110	7 - 33 - 430	43
Ascospores	1,000	13 - 230 - 6,400	77
Basidiospores	430	13 - 480 - 23,000	91
Bipolaris/Drechslera group	13	7 - 13 - 240	16
Cercospora	13	7 - 40 - 560	14
Cladosporium	6,100	27 - 490 - 9,400	90
Nigrospora	40	7 - 20 - 270	17
Penicillium/Aspergillus types	160	13 - 190 - 2,600	67
Smuts, Periconia, Myxomycetes	80	7 - 53 - 1,100	65
Total	7,900		

The "Typical outdoor ranges" and "Freq. %" columns show the typical low, medium, and high spore counts per cubic meter and the frequency of occurrence for the given spore type. The low, medium, and high values represent the 2.5, 50, and 97.5 percentile values when the spore type is detected. For example, if the low value is 53 and the frequency of occurence is 63%, it would mean that we typically detect the given spore type on 63 percent of all outdoor samples and, when detected, 2.5% of the time it is present in levels below 53 spores/m3.

Indoor Samples

Location: 2142241: Headquarters Administration

% of outdoor total spores/m3	Friedman chi-square* (indoor variation)	Agreement ratio** (indoor/outdoor)	Spearman rank correlation*** (indoor/outdoor)	MoldSCORE**** (indoor/outdoor)
Result: 12%	dF: 2 Result: 5.2500 Critical value: 5.9915 Inside Similar: Yes	Result: 0.7500	dF: 10 Result: 0.7364 Critical value: 0.5515 Outside Similar: Yes	Score: 123 Result: Low

Species Detected	Spores/m3 <100 1K 10K >100K
Ascospores	53
Basidiospores	270
Bipolaris/Drechslera group	13
Cladosporium	480
Other brown	13
Penicillium/Aspergillus types	110
Smuts, Periconia, Myxomycetes	27
Total	960

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

MoldSTAT™: Supplementary Statistical Spore Trap Report

Location: 2142618: Classroom N.W. Side

% of outdoor total spores/m3	Friedman chi-square* (indoor variation)	Agreement ratio** (indoor/outdoor)	Spearman rank correlation*** (indoor/outdoor)	MoldSCORE**** (indoor/outdoor)
Result: 6%	dF: 2 Result: 5.2500 Critical value: 5.9915 Inside Similar: Yes	Result: 0.5714	dF: 10 Result: 0.7485 Critical value: 0.5515 Outside Similar: Yes	Score: 116 Result: Low

Species Detected	Spores/m3 (<100 / 1K / 10K / >100K)
Ascospores	110
Basidiospores	110
Cladosporium	210
Curvularia	13
Penicillium/Aspergillus types	110
Total	550

Location: 2142239: HHC Administration

% of outdoor total spores/m3	Friedman chi-square* (indoor variation)	Agreement ratio** (indoor/outdoor)	Spearman rank correlation*** (indoor/outdoor)	MoldSCORE**** (indoor/outdoor)
Result: 6%	dF: 2 Result: 5.2500 Critical value: 5.9915 Inside Similar: Yes	Result: 0.5000	dF: 9 Result: 0.7250 Critical value: 0.5833 Outside Similar: Yes	Score: 114 Result: Low

Species Detected	Spores/m3 (<100 / 1K / 10K / >100K)
Basidiospores	160
Cladosporium	270
Penicillium/Aspergillus types	53
Total	480

* The Friedman chi-square statistic is a non-parametric test that examines variation in a set of data (in this case, all indoor spore counts). The null hypothesis (H0) being tested is that there is no meaningful difference in the data for all indoor locations. The alternative hypothesis (used if the test disproves the null hypothesis) is that there is a difference between the indoor locations. The null hypothesis is rejected when the result of the test is greater than the critical value. The critical value that is displayed is based on the degrees of freedom (dF) of the test and a significance level of 0.05.

** An agreement ratio is a simple method for assessing the similarity of two samples (in this case the indoor sample and the outdoor summary) based on the spore types present. A score of one indicates that the types detected in one location are the same as that in the other. A score of zero indicates that none of the types detected indoors are present outdoors. Typically, an agreement of 0.8 or higher is considered high.

*** The Spearman rank correlation is a non-parametric test that examines correlation between two sets of data (in this case the indoor location and the outdoor summary). The null hypothesis (H0) being tested is that the indoor and outdoor samples are unrelated. The alternative hypothesis (used if the test disproves the null hypothesis) is that the samples are similar. The null hypothesis is rejected when the result of the test is greater than the critical value. The critical value that is displayed is based on the degrees of freedom (dF) of the test and a significance level of 0.05.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

MoldSTAT™: Supplementary Statistical Spore Trap Report

**** MoldSCORE™ is a specialized method for examining air sampling data. It is a score between 100 and 300, with 100 indicating a greater likelihood that the airborne indoor spores originated from the outside, and 300 indicating a greater likelihood that they originated from an inside source. The Result displayed is based on the numeric score given and will be either Low, Medium, or High, indicating a low, medium, or high likelihood that the spores detected originated from an indoor source. EMLab P&Kreserves the right to, and may at anytime, modify or change the MoldScore algorithm without notice.

Interpretation of the data contained in this report is left to the client or the persons who conducted the field work. This report is provided for informational and comparative purposes only and should not be relied upon for any other purpose. "Typical outdoor ranges" are based on the results of the analysis of samples delivered to and analyzed by EMLab P&K and assumptions regarding the origins of those samples. Sampling techniques, contaminants infecting samples, unrepresentative samples and other similar or dissimilar factors may affect these results. With the statistical analysis provided, as with all statistical comparisons and analyses, false-positive and false-negative results can and do occur. EMLab P&K hereby disclaims any liability for any and all direct, indirect, punitive, incidental, special or consequential damages arising out of the data contained in, or any actions taken or omitted in reliance upon, this report.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

MoldSTAT™: Supplementary Statistical Spore Trap Report

Outdoor Summary: 1956305: OD (Post)

Species detected	Outdoor sample spores/m3 (<100 / 1K / 10K / >100K)	Typical outdoor ranges (North America)	Freq. %
Alternaria	13	7 - 33 - 430	43
Ascospores	270	13 - 230 - 6,400	77
Basidiospores	800	13 - 480 - 23,000	91
Bipolaris/Drechslera group	110	7 - 13 - 240	16
Cladosporium	2,100	27 - 490 - 9,400	90
Nigrospora	53	7 - 20 - 270	17
Penicillium/Aspergillus types	160	13 - 190 - 2,600	67
Smuts, Periconia, Myxomycetes	53	7 - 53 - 1,100	65
Total	3,500		

The "Typical outdoor ranges" and "Freq. %" columns show the typical low, medium, and high spore counts per cubic meter and the frequency of occurrence for the given spore type. The low, medium, and high values represent the 2.5, 50, and 97.5 percentile values when the spore type is detected. For example, if the low value is 53 and the frequency of occurence is 63%, it would mean that we typically detect the given spore type on 63 percent of all outdoor samples and, when detected, 2.5% of the time it is present in levels below 53 spores/m3.

Indoor Samples

Location: 2142241: Headquarters Administration

% of outdoor total spores/m3	Friedman chi-square* (indoor variation)	Agreement ratio** (indoor/outdoor)	Spearman rank correlation*** (indoor/outdoor)	MoldSCORE**** (indoor/outdoor)
Result: 27%	dF: 2 Result: 5.2500 Critical value: 5.9915 Inside Similar: Yes	Result: 0.8000	dF: 9 Result: 0.8583 Critical value: 0.5833 Outside Similar: Yes	Score: 111 Result: Low

Species Detected	Spores/m3 (<100 / 1K / 10K / >100K)
Ascospores	53
Basidiospores	270
Bipolaris/Drechslera group	13
Cladosporium	480
Other brown	13
Penicillium/Aspergillus types	110
Smuts, Periconia, Myxomycetes	27
Total	960

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

MoldSTAT™: Supplementary Statistical Spore Trap Report

Location: 2142618: Classroom N.W. Side

% of outdoor total spores/m3	Friedman chi-square* (indoor variation)	Agreement ratio** (indoor/outdoor)	Spearman rank correlation*** (indoor/outdoor)	MoldSCORE**** (indoor/outdoor)
Result: 15%	dF: 2 Result: 5.2500 Critical value: 5.9915 Inside Similar: Yes	Result: 0.6154	dF: 9 Result: 0.7792 Critical value: 0.5833 Outside Similar: Yes	Score: 114 Result: Low

Species Detected	Spores/m3 (<100 / 1K / 10K / >100K)
Ascospores	110
Basidiospores	110
Cladosporium	210
Curvularia	13
Penicillium/Aspergillus types	110
Total	550

Location: 2142239: HHC Administration

% of outdoor total spores/m3	Friedman chi-square* (indoor variation)	Agreement ratio** (indoor/outdoor)	Spearman rank correlation*** (indoor/outdoor)	MoldSCORE**** (indoor/outdoor)
Result: 13%	dF: 2 Result: 5.2500 Critical value: 5.9915 Inside Similar: Yes	Result: 0.5455	dF: 8 Result: 0.8155 Critical value: 0.6190 Outside Similar: Yes	Score: 105 Result: Low

Species Detected	Spores/m3 (<100 / 1K / 10K / >100K)
Basidiospores	160
Cladosporium	270
Penicillium/Aspergillus types	53
Total	480

* The Friedman chi-square statistic is a non-parametric test that examines variation in a set of data (in this case, all indoor spore counts). The null hypothesis (H0) being tested is that there is no meaningful difference in the data for all indoor locations. The alternative hypothesis (used if the test disproves the null hypothesis) is that there is a difference between the indoor locations. The null hypothesis is rejected when the result of the test is greater than the critical value. The critical value that is displayed is based on the degrees of freedom (dF) of the test and a significance level of 0.05.

** An agreement ratio is a simple method for assessing the similarity of two samples (in this case the indoor sample and the outdoor summary) based on the spore types present. A score of one indicates that the types detected in one location are the same as that in the other. A score of zero indicates that none of the types detected indoors are present outdoors. Typically, an agreement of 0.8 or higher is considered high.

*** The Spearman rank correlation is a non-parametric test that examines correlation between two sets of data (in this case the indoor location and the outdoor summary). The null hypothesis (H0) being tested is that the indoor and outdoor samples are unrelated. The alternative hypothesis (used if the test disproves the null hypothesis) is that the samples are similar. The null hypothesis is rejected when the result of the test is greater than the critical value. The critical value that is displayed is based on the degrees of freedom (dF) of the test and a significance level of 0.05.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: IHST, Inc.
C/O: Mr. Tracy Bramlett
Re: 21816; Weslaco Readiness Center

Date of Sampling: 11-28-2017
Date of Receipt: 11-30-2017
Date of Report: 12-04-2017

MoldSTAT™: Supplementary Statistical Spore Trap Report

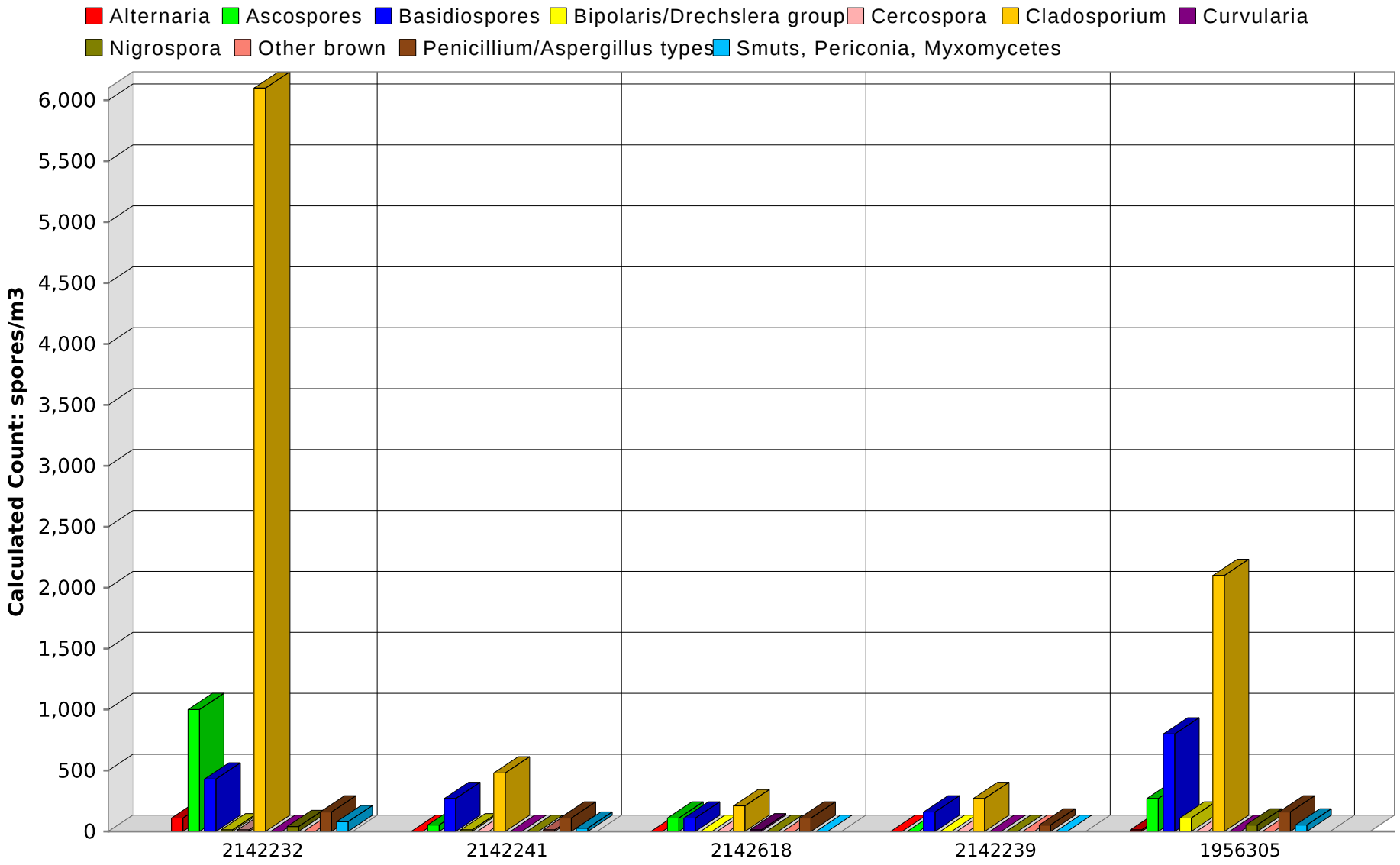
**** MoldSCORE™ is a specialized method for examining air sampling data. It is a score between 100 and 300, with 100 indicating a greater likelihood that the airborne indoor spores originated from the outside, and 300 indicating a greater likelihood that they originated from an inside source. The Result displayed is based on the numeric score given and will be either Low, Medium, or High, indicating a low, medium, or high likelihood that the spores detected originated from an indoor source. EMLab P&Kreserves the right to, and may at anytime, modify or change the MoldScore algorithm without notice.

Interpretation of the data contained in this report is left to the client or the persons who conducted the field work. This report is provided for informational and comparative purposes only and should not be relied upon for any other purpose. "Typical outdoor ranges" are based on the results of the analysis of samples delivered to and analyzed by EMLab P&K and assumptions regarding the origins of those samples. Sampling techniques, contaminants infecting samples, unrepresentative samples and other similar or dissimilar factors may affect these results. With the statistical analysis provided, as with all statistical comparisons and analyses, false-positive and false-negative results can and do occur. EMLab P&K hereby disclaims any liability for any and all direct, indirect, punitive, incidental, special or consequential damages arising out of the data contained in, or any actions taken or omitted in reliance upon, this report.

12-04-2017: 21816

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

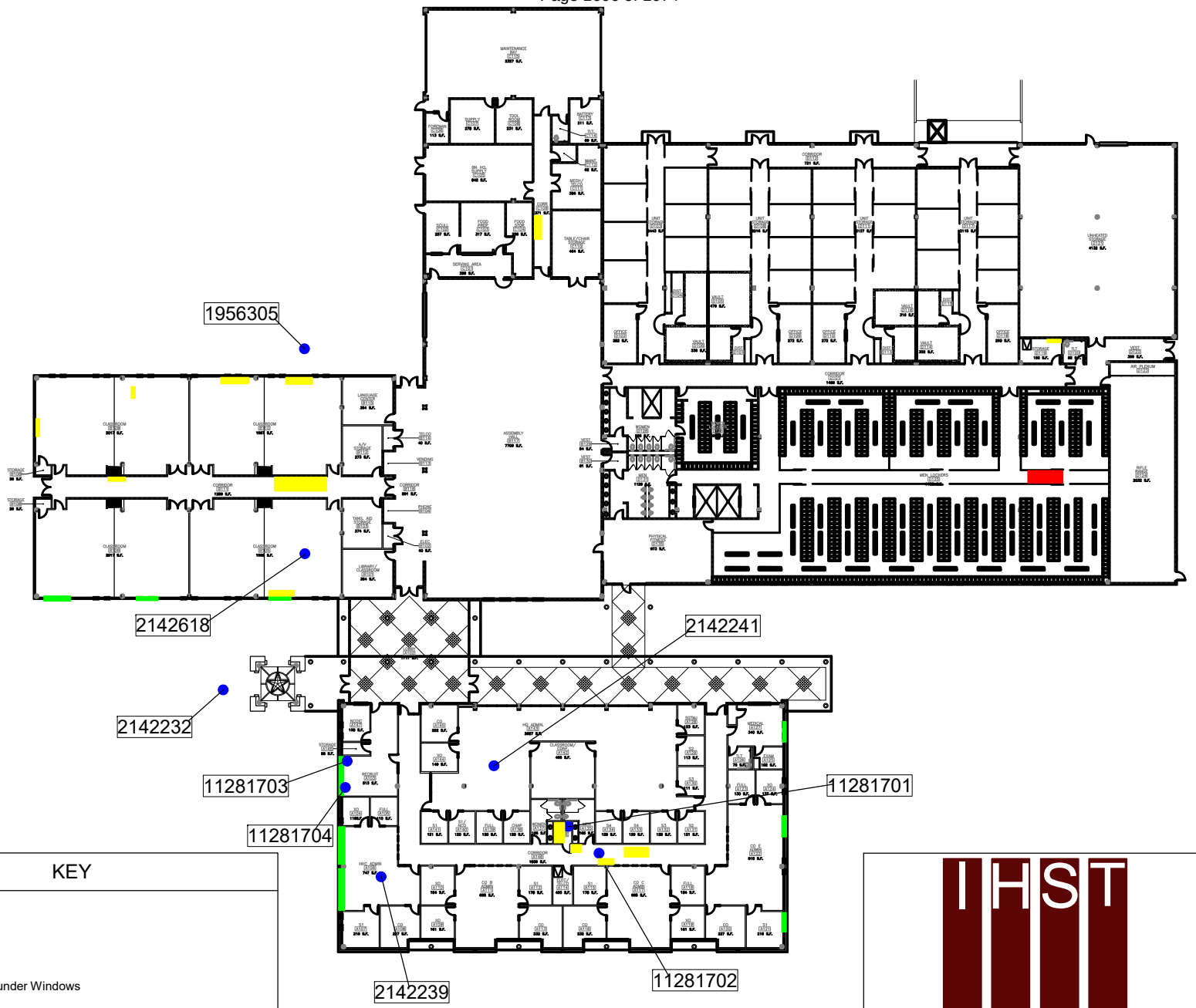
SPORE TRAP REPORT: NON-VIABLE METHODOLOGY



Comments:

Note: Graphical output may understate the importance of certain "marker" genera.

Appendix: Sample Locations and Site Diagram of Identified Mold and Water Damage



KEY

- Mold Sample Locations
- Stained Ceiling TIles
- Suspect Water Damage under Windows
- Pigeon Droppings

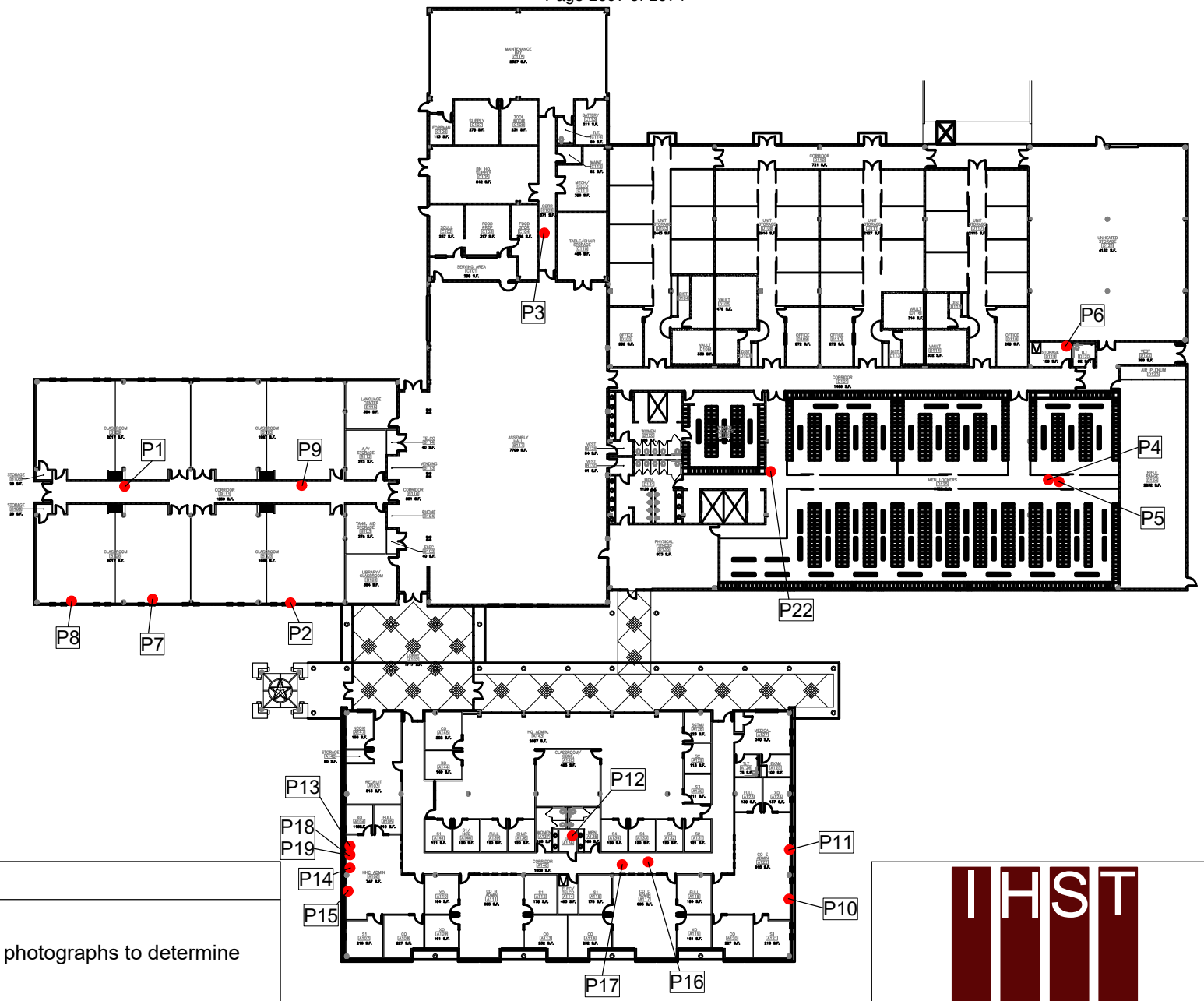
IHST

Industrial Hygiene
and
Safety Technology, Inc.

DRAWING TITLE:

Freese & Nichols
Weslaco Readiness Center
1100 Vo Tech
Weslaco, TX 78599

JOB NUMBER:	DRAWN BY:	DATE:	CAD File:	Scale:	Sheet:
21816	K. Girton	11/02/2017	Freese & Nichols Weslaco Readiness Center.TCW	None	1 of 2



Photograph Locations

Please refer to photographs to determine condition

IHST

Industrial Hygiene
and
Safety Technology, Inc.

DRAWING TITLE:

Freese & Nichols
Weslaco Readiness Center
1100 Vo Tech
Weslaco, TX 78599

JOB NUMBER:	DRAWN BY:	DATE:	CAD File:	Scale:	Sheet:
21816	K. Girton	11/02/2017	Freese & Nichols Weslaco Readiness Center.TCW	None	2 of 2

Appendix: Inspection Photographs

Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Weslaco Readiness Center



Weslaco Readiness Cente



Photo 1



Photo 2

Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Photo 3

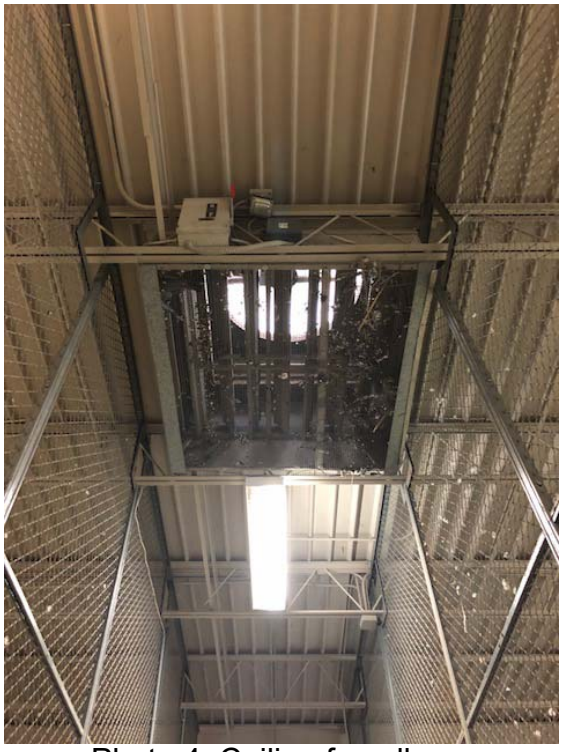


Photo 4, Ceiling fan allows bird droppings to get on floor



Photo 5, Bird droppings on floor



Photo 6

Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Photo 7



Photo 8



Photo 9

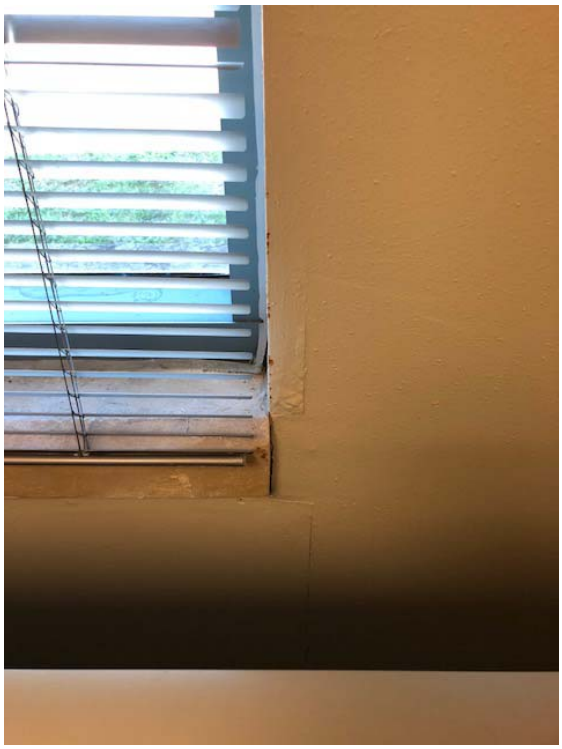


Photo 10, Evidence of moisture intrusion under window

Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Photo 11. Evidence of water intrustion



Photo 12



Photo 13, Evidence of water intrustion

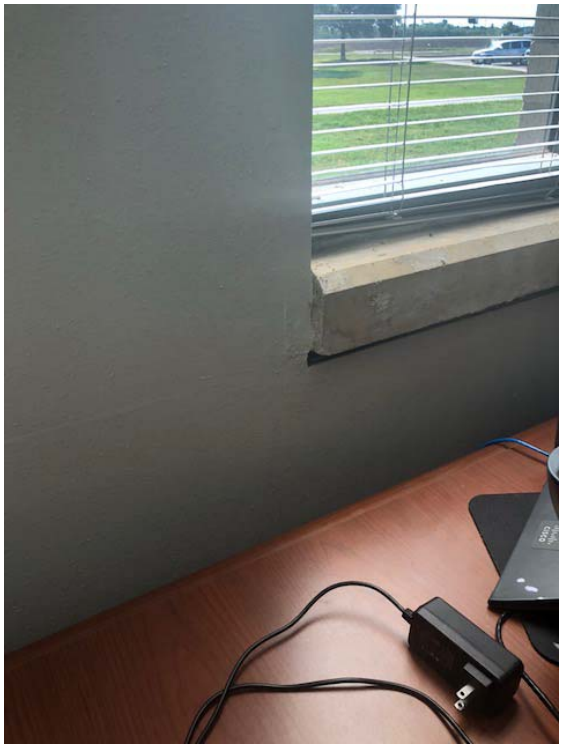


Photo 14, Evidence of water intrustion

Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Photo 15, Evidence of water intrustion



Photo 16



Photo 17



Photo 18, Mold on exterior of building

Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Photo 19, Mold on exterior of building



Photo 20, Damaged roof



Photo 21, Roof top Unit



Photo 22, Dirty return air in men's locker room

Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Photo 23, Dirty coils, RTU 7



Photo 24, Damaged roof

Industrial Hygiene and
Safety Technology, Inc.

2235 Keller Way
Carrollton, TX 75006
Phone: (972) 478-7415
Fax: (972) 478-7615

http://www.ihst.com

Leaders in
Quality, Service
and Innovation

Report of

Comprehensive Asbestos **and Lead** Survey

Prepared for:

Freese and Nichols, Inc.
4055 International Plaza, Suite 200
Fort Worth, TX 76109

Building Surveyed:

Weslaco Readiness Center

100 Vo Tech Drive
Weslaco, TX 78599
(Texas Army National Guard - Weslaco)

Report Date:

Thursday, November 09, 2017

Comprehensive
Asbestos **and Lead** Survey
Weslaco Readiness Center
100 Vo Tech Drive
Weslaco, TX 78599
(Texas Army National Guard - Weslaco)

Table of Contents

1.0	Introduction	3
2.0	Purpose and Scope	3
3.0	Report Organization	3
4.0	Field Investigation	3
5.0	Sampling	4
5.1	Laboratory Analysis	4
5.2	Analytical Methods	5
5.3	Bulk Sample Results	5
6.0	Hazard Assessment	6
6.1	Hazard Assessment Ratings	6
6.2	Asbestos-Containing Material Assessments	7
7.0	Hazard Assessment Summary	8
7.1	Response Actions	8
8.0	Qualifications	9

Appendices

Appendix A: Site Drawings

Appendix B: Lab Results

Appendix C: Bulk Summary Report

Appendix D: Photographs

Appendix E: Lead Report

1.0 Introduction

This document is a report of a Comprehensive Asbestos Survey performed by Industrial Hygiene and Safety Technology, Inc.(IHST). IHST is licensed by the Texas Department of State Health Services (DSHS), formerly the Texas Department of Health, as an Asbestos Consultant Agency (DSHS License #10-0145. Figure 1 provides a description of the assessment described by this report.

Figure 1. Comprehensive Asbestos Survey Profile

Client Name:	Freese and Nichols, Inc.
Facility/Campus	Texas Army National Guard - Weslaco
Building:	*Weslaco Readiness Center* 100 Vo Tech Drive Weslaco, TX 78599
Survey Date(s):	10/25/2017
Inspector(s):	Jose Reyes - DSHS Asbestos Inspector License #60-3316

2.0 Purpose and Scope

The purpose of this project was to locate, identify, and assess the condition of asbestos containing material (ACM) present at the subject building, and to develop recommendations based on existing and potential asbestos related hazards. The following scope of work was used during the asbestos assessment for the subject property:

A. Collecting and analyzing bulk samples of suspected asbestos-containing materials.

B. Quantification of the suspected asbestos-containing material.

C. Preparing a report discussing the findings and remedial recommendations.

3.0 Report Organization

This report is divided into sections which discuss the review of available documentation, field investigation, laboratory analysis, hazard assessments, and recommendations. Illustrations, such as tables and figures follow the text. Other supporting documentation, such as laboratory reports are also included.

4.0 Field Investigation

The survey was conducted to determine the amount of asbestos-containing materials present in the subject building. The survey included an observation of accessible areas and unusual conditions; and bulk sampling of suspected asbestos-containing materials. Bulk samples were collected of suspect materials and analyzed by Polarized Light Microscopy (PLM) with dispersion staining, in accordance with the Environmental Protection Agency's (EPA) Method for the Determination of Asbestos in Bulk Insulation Samples (Method 600/R-93/116). All of the samples that tested greater than 1% by the PLM method for counting asbestos were reanalyzed using the Transmission Electron Microscopy (TEM) method. This technique characterizes asbestos more precisely than PLM. Laboratory reports containing sample location and results are included with this report.

The survey was designed to identify the presence of both friable and non-friable asbestos- containing materials present in the surveyed area. Friable means that the material, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure. Building materials suspected of containing asbestos were grouped into "Homogeneous" sampling areas. The homogeneous areas were defined

based on uniform texture, color, and appearance. Additionally, homogeneous areas were further defined based on building construction date(s). Each of the items sampled were classified into one of three categories:

1.) Surfacing Material: A surfacing material is a building material which has been applied to a surface (i.e., walls or ceilings) or structural members. Examples of surfacing materials which may contain asbestos are: spray-applied fireproofing, spray-applied acoustical texture, and trowel-applied textured ceilings and walls.

2.) Thermal System Insulation: All types of insulation used on a building's mechanical system are classified into the category of thermal system insulation. Examples of thermal system materials which may contain asbestos are: boilers and related piping, or duct insulation.

3.) Miscellaneous: All remaining materials which do not fall into the two above categories are placed in the miscellaneous category. Examples of miscellaneous materials which may contain asbestos are: lay-in ceiling tile, floor tile, mastic adhesives and roofing felt.

An assessment was conducted for each building material sampled. The physical assessment consists of evaluating the condition of the suspect material and the potential for future disturbance. Recommendations made for a building material which contains asbestos are based on the assessments made by the inspector during the survey. The data developed during the asbestos survey is presented in the following sections of this report.

Table 1 contains the Summary of Bulk Sample Analysis and Assessment. This table presents specific locations, results of additional asbestos analysis, time schedules, and quantities of asbestos.

5.0 Sampling

Sampling during the field investigation included the collection of bulk samples of suspected asbestos containing materials, as listed in Table 1., Summary of Bulk Sample Analysis and Assessment. After sample recovery, samples were placed in secure containers, and the sampling vicinity was cleaned and sealed. Appropriate chain-of-custody protocols were initiated at that time to track handling of bulk samples.

5.1 Laboratory Analysis

The samples were transported to and analyzed by the analytical laboratory specified in Figure 2., a successful participant in the Department of Commerce, National Institute of Standards and Technology's (NIST) National Voluntary Laboratory Accreditation Program and licensed by the Texas Department of State Health Services (DSHS), formerly the Texas Department of Health. Ten percent (10%) of the bulk samples were reanalyzed independently as part of the quality assurance and quality control programs.

Figure 2. Bulk Sample Laboratory Profile

Laboratory Name: Moody Labs
DSHS License Number: #30-0084
NVLAP Lab ID: #102056-0 **Expires:** 5/31/2018

5.2 Analytical Methods

Bulk samples were analyzed by Polarized Light Microscopy (PLM). This technique characterizes the materials refractive indices, fiber morphology, birefringence, extinction angle, sign of elongation, and dispersion staining colors to detect asbestos. Percentage estimates are based on approximate area compositions under a stereo-microscope. All of the samples that tested greater than 1% by the PLM method for counting asbestos were reanalyzed using the Transmission Electron Microscopy (TEM) method. This technique characterizes asbestos more precisely than PLM.

5.3 Bulk Sample Results

The results of the sample analysis are presented in Table 1, and the laboratory analysis report is included as Appendix B.

Figure 3. Materials with Asbestos Detected at 1% or Greater

No materials were identified which contained 1% or more of asbestos.

Figure 4. Materials with NO Asbestos Detected (Pursuant to EPA and DSHS Definition)

Mat'l Type	*Description*	*Location*
Sheetrock	Drywall/Joint Compound/Sand Texture	Walls Throughout A & B Rooms
ACT	2'x4' SACT	Ceilings Throughout A Rooms
Adhesive	Clear Carpet Glue	Various Floors ikn A & B Rooms
Cove Base	4" Gray Cove Base/Yellow Mastic	Various Walls Throughout Building
Flooring Matls	12"x12" Beige Floor Tile/Yellow Mastic	Various Floors Throughout Building
Undercoating	White Sink Undercoating	Room A125
ACT	2'x4' Old SACT	Various Ceilings in B, C, & D Rooms
Cove Base	4" Black Cove Base/White Mastic	Room B105
PlasterSurf	Plaster	Exterior Awnings & Ceiling in Room D127
Sheetrock	2"x4" Smooth SACT	Various Ceilings in C & D Rooms
Caulking	Silver Caulk	Rooms C101 & C102
ACT	2'x4' New SACT	Room D135
Caulking	Exterior Gray Caulk	Around Exterior Windows & Doors
Mastic	Gray Duct Mastic	Duct Work Above Ceiling Tile Throughout the Building

6.0 Hazard Assessment

Asbestos is an airborne hazard. A hazard assessment refers to the process by which we evaluate a material's potential to release fibers into the air. Fibers may be released spontaneously as part of the aging process, or as a result of sudden impact, vibration, air movement, or localized deterioration. Assessing a material's potential for fiber release, and hence its associated hazard, is based upon evaluating the material's condition and potential for further disturbance, damage, or deterioration.

6.1 Hazard Assessment Rankings

Any material identified as asbestos containing that exhibits damage, should be considered a hazard to anyone who works in the area. Typically, damage is classified as minor or significant. Minor damage is characterized by small cuts, tears, scuffs, small openings, or other limited disturbance to asbestos containing materials. Areas with minor damage represent varying degrees of hazards from slight to high depending on:

* The nature of the damage;
* Proximity to disturbers, such as airstreams;
* Location with respect to building occupants;
* Activity in the immediate area; and
* Frequency of maintenance in the area.

Significant damage is characterized by large openings, visible flaking, loose particles, and debris on surfaces below the material. Asbestos containing materials which exhibit significant damage are either high or critical hazards, depending upon accessibility. High hazards exist where significantly damaged materials are generally inaccessible; however, where significant damage is accessible, or in the vicinity of building occupants, there is a critical hazard. The recommended action for addressing asbestos related hazards depends upon the degree of hazard. For example:

* An immediate hazard or critical assessment describes a situation in which the material is exposed and friable, accessible to personnel, and is disturbed releasing fibers in the air. In this situation, immediate action should be taken. At a minimum, the area should be isolated and access restricted.

* A high assessment describes a situation in which the material is in poor condition, exposed and friable, with a potential for disturbance. In this case, interim controls should be instituted, and the material should be removed when practical. Repairs should be made to the ACM if abatement is not scheduled.

* A medium or moderate assessment describes a situation in which a combination of the determining factors vary, such as a material that is in good condition but has a high asbestos content and is generally accessible. In situations like this, abatement can be scheduled with future building renovation or maintenance.

* A low or slight assessment describes a situation in which the material is in good condition and has a low potential for disturbance, damage, or deterioration. In this situation, an O&M program is usually all that is needed.

In general, those areas that are classified as critical or high damage should be abated. These are areas where a high probability of exposure could occur. Moderately damaged areas would require an Operations and Maintenance (O&M) Program to be instituted. In addition, these areas should be considered for abatement, or at the very least repaired.

6.2 Asbestos-Containing Material Assessments

Figure 5 provides a summary of the asbestos identified during the survey, along with a hazard assessment for each type and condition of asbestos-containing material.

Figure 5. Hazard Assessments for Asbestos-Containing Materials

No asbestos-containing materials were identified during the survey.

7.0 Hazard Assessment Summary

In the event other building materials are discovered in addition to the materials sampled in this survey, those building materials should be presumed to contain asbestos and treated as such until proven otherwise by PLM laboratory analysis.

7.1 Response Actions

No asbestos-containing materials were identified during the survey. No additional recommendations are necessary.

7.2 Explanation of Response Ratings

Table 1 includes a response rating based on factors such as friability, accessibility, potential for disturbance, etc. Definitions for the response ratings are listed below:

0 = Material does not contain detectable amounts of asbestos and requires no asbestos-related abatement action.

1 = Material contains asbestos, was non-friable, and requires no abatement action unless sanded, abraded, drilled or otherwise disturbed.

2 = Material contains asbestos and was friable. Damage was not observed; no immediate abatement action is required.

3 = Material contains asbestos, was friable, and shows signs of localized damage with a potential for disturbance.

4 = Material contains friable asbestos and was significantly damaged.

8.0 Qualifications

Industrial Hygiene and Safety Technology, Inc. has attempted to observe the existing conditions within the aforementioned building utilizing generally accepted procedures. Regardless of the thoroughness of a survey, the possibility exists that some areas containing asbestos were overlooked, inaccessible or different from those at specific locations. Furthermore, renovation and/or construction may reveal altered conditions.

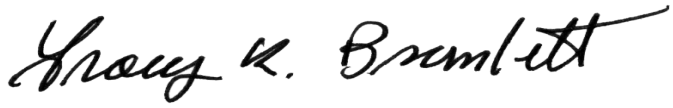
This report describes only the conditions present at the time of the survey, in the areas surveyed. The recommendations presented apply to the conditions that were observed during the survey. IHST policies are to not perform destructive sampling unless previously authorized by the client. Therefore, IHST does not perform core sampling of roofing materials unless previously authorized and accompanied by the owner and/or his representative. Other conditions may exist in unsurveyed or inaccessible areas such as behind walls and above permanent ceilings. In addition, the conditions of asbestos-containing materials may change gradually or suddenly depending upon use, maintenance or accident. As a result, the recommendations presented should be periodically reviewed and updated.

The quantity estimates presented in this report were based upon observations during the survey as well as information from building plans provided by the owner. While it is believed that the estimated quantities are reasonable, unanticipated conditions could be present in inaccessible or unsurveyed areas. Industrial Hygiene & Safety Technology, Inc. do not warrant or guarantee the quantity estimates. The use of such estimates shall be at the user's own risk and shall constitute a release and agreement to defend and indemnify Industrial Hygiene & Safety Technology, Inc. from and against any liability.

If you have any questions or comments regarding the content of this report, I would be glad to discuss them at your convenience.

Sincerely,

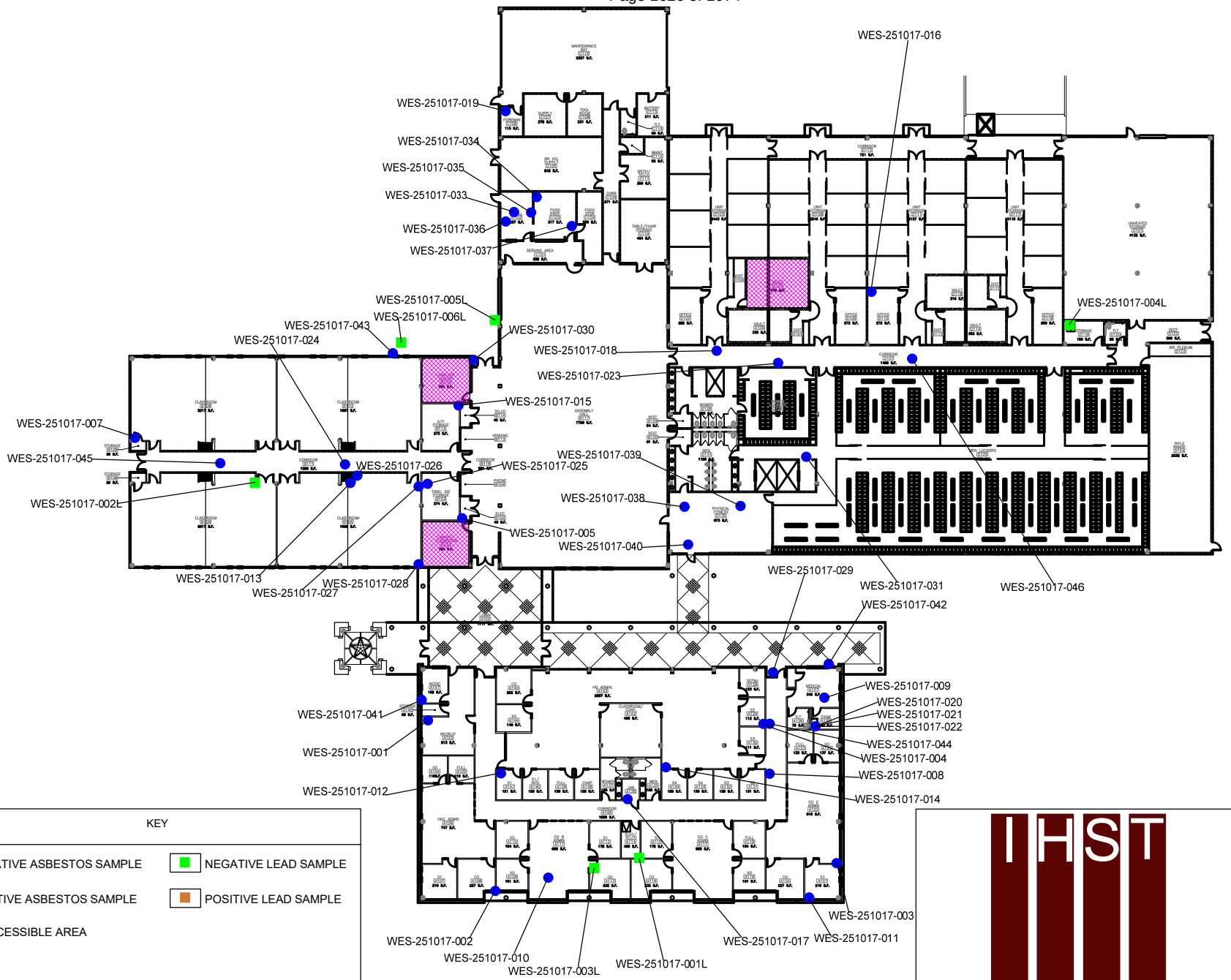
Jose Reyes - DSHS Asbestos Inspector License #60-3316



Tracy K. Bramlett
President
DSHS Individual Asbestos Consultant License #10-5040

Appendix:

Appendix A: Site Drawings



KEY

- NEGATIVE ASBESTOS SAMPLE
- NEGATIVE LEAD SAMPLE
- POSITIVE ASBESTOS SAMPLE
- POSITIVE LEAD SAMPLE
- INACCESSIBLE AREA

*POSITIVE ASBESTOS CONTAINING MATERIAL IS CLASSIFIED AS BEING GREATER THAN 1% ASBESTOS.

*POSITIVE LEAD CONTAINING MATERIAL IS CLASSIFIED AS BEING GREATER THAN OR EQUAL TO 0.5% LEAD BY WEIGHT.

IHST

Industrial Hygiene
and
Safety Technology, Inc.

DRAWING TITLE:

Freese & Nichols
Weslaco Readiness Center
1100 Vo Tech
Weslaco, TX 78599

JOB NUMBER:	DRAWN BY:	DATE:	CAD File:	Scale:	Sheet:
21816	K. Girton	11/02/2017	Freese & Nichols Weslaco Readiness Center.TCW	None	1 of 1

Appendix:

Appendix B: Lab Results

PLM Summary Report

Moody Labs
2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client :	Industrial Hygiene & Safety Technology	Lab Job No. :	17B-12807
Project :	Freese & Nichols, Weslaco Readiness Ctr., 1100 Vo Tech	Report Date :	10/30/2017
Project # :	21816	Sample Date :	10/25/2017
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

On 10/27/2017, forty six (46) bulk material samples were submitted by Jose Reyes of Industrial Hygiene & Safety Technology for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
WES-251017-001	Drywall / Joint Compound / Texture (Sand), Room A103	None Detected - Drywall Material None Detected - Joint Compound None Detected - Texture
WES-251017-002	Drywall / Joint Compound / Texture (Sand), Room A108	None Detected - Drywall Material None Detected - Joint Compound None Detected - Texture
WES-251017-003	Drywall / Joint Compound / Texture (Sand), Room A122	None Detected - Drywall Material None Detected - Texture / Joint Cmpd
WES-251017-004	Drywall / Joint Compound / Texture (Sand), Room A129	None Detected - Drywall Material None Detected - Joint Compound None Detected - Texture
WES-251017-005	Drywall / Joint Compound / Texture (Sand), Room B102	None Detected - Drywall Material None Detected - Joint Compound None Detected - Texture
WES-251017-006	Drywall / Joint Compound / Texture (Sand), Room B105B	None Detected - Drywall Material None Detected - Joint Compound None Detected - Texture
WES-251017-007	Drywall / Joint Compound / Texture (Sand), Room B109B	None Detected - Drywall Material None Detected - Joint Compound None Detected - Texture
WES-251017-008	2' x 4' Suspended Acoustic Ceiling Tile, Corridor A146	None Detected - Acoustic Tile
WES-251017-009	2' x 4' Suspended Acoustic Ceiling Tile, Room A127	None Detected - Acoustic Tile
WES-251017-010	2' x 4' Suspended Acoustic Ceiling Tile, Room A111	None Detected - Acoustic Tile
WES-251017-011	Carpet Glue (Clear), Room A121	None Detected - Clear Mastic
WES-251017-012	Carpet Glue (Clear), Room A141	None Detected - Clear Mastic
WES-251017-013	Carpet Glue (Clear), Room B105A	None Detected - Clear Mastic
WES-251017-014	4" Cove Base (Gray) / Mastic (Yellow), Room A143	None Detected - Cove Base None Detected - Yellow Mastic

PLM Summary Report

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Industrial Hygiene & Safety Technology
Project : Freese & Nichols, Weslaco Readiness Ctr., 1100 Vo Tech
Project # : 21816
Identification : Asbestos, Bulk Sample Analysis
Test Method : Polarized Light Microscopy / Dispersion Staining (PLM/DS)
EPA Method 600 / R-93 / 116

Lab Job No. : 17B-12807
Report Date : 10/30/2017
Sample Date : 10/25/2017

On 10/27/2017, forty six (46) bulk material samples were submitted by Jose Reyes of Industrial Hygiene & Safety Technology for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
WES-251017-015	4" Cove Base (Gray) / Mastic (Yellow), Room B112	None Detected - Cove Base None Detected - Yellow Mastic
WES-251017-016	4" Cove Base (Gray) / Mastic (Yellow), Room D110	None Detected - Cove Base None Detected - Yellow Mastic
WES-251017-017	12" x 12" Floor Tile (Beige) / Mastic (Yellow), Room A136	None Detected - Floor Tile None Detected - Yellow Mastic
WES-251017-018	12" x 12" Floor Tile (Beige) / Mastic (Yellow), Corridor D101	None Detected - Floor Tile None Detected - Yellow Mastic
WES-251017-019	12" x 12" Floor Tile (Beige) / Mastic (Yellow), Room C106	None Detected - Floor Tile None Detected - Yellow Mastic
WES-251017-020	Sink Undercoating (White), Room A125	None Detected - Sink Undercoating
WES-251017-021	Sink Undercoating (White), Room A125	None Detected - Sink Undercoating
WES-251017-022	Sink Undercoating (White), Room A125	None Detected - Sink Undercoating
WES-251017-023	2' x 4' Old Suspended Acoustic Ceiling Tile, Corridor D101	None Detected - Acoustic Tile
WES-251017-024	2' x 4' Old Suspended Acoustic Ceiling Tile, Corridor B111	None Detected - Acoustic Tile
WES-251017-025	2' x 4' Old Suspended Acoustic Ceiling Tile, Corridor B103	None Detected - Acoustic Tile
WES-251017-026	4" Cove Base (Black) / Mastic (White), Room B105A	None Detected - Cove Base None Detected - Cream Mastic
WES-251017-027	4" Cove Base (Black) / Mastic (White), Room B105A	None Detected - Cove Base None Detected - Cream Mastic
WES-251017-028	4" Cove Base (Black) / Mastic (White), Room B105A	None Detected - Cove Base None Detected - Cream Mastic
WES-251017-029	Plaster, Exterior Awnings	None Detected - Plaster
WES-251017-030	Plaster, Exterior Awnings	None Detected - Plaster

PLM Summary Report

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client :	Industrial Hygiene & Safety Technology	Lab Job No. :	17B-12807
Project :	Freese & Nichols, Weslaco Readiness Ctr., 1100 Vo Tech	Report Date :	10/30/2017
Project # :	21816	Sample Date :	10/25/2017
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

On 10/27/2017, forty six (46) bulk material samples were submitted by Jose Reyes of Industrial Hygiene & Safety Technology for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
WES-251017-031	Plaster, Room D127	None Detected - Plaster
WES-251017-032	2' x 4' Suspended Acoustic Ceiling Tile (Smooth), Room C101	None Detected - Drywall Tile None Detected - Vinyl Facing
WES-251017-033	2' x 4' Suspended Acoustic Ceiling Tile (Smooth), Room C102	None Detected - Drywall Tile None Detected - Vinyl Facing
WES-251017-034	2' x 4' Suspended Acoustic Ceiling Tile (Smooth), Room C103	None Detected - Drywall Tile None Detected - Vinyl Facing
WES-251017-035	Caulk (Silver), Room C102	None Detected - Caulking
WES-251017-036	Caulk (Silver), Room C102	None Detected - Caulking
WES-251017-037	Caulk (Silver), Room C103	None Detected - Caulking
WES-251017-038	2' x 4' New Suspended Acoustic Ceiling Tile, Room D135	None Detected - Acoustic Tile
WES-251017-039	2' x 4' New Suspended Acoustic Ceiling Tile, Room D135	None Detected - Acoustic Tile
WES-251017-040	2' x 4' New Suspended Acoustic Ceiling Tile, Room D135	None Detected - Acoustic Tile
WES-251017-041	Exterior Caulk (Gray), Exterior Windows and Doors	None Detected - Caulking
WES-251017-042	Exterior Caulk (Gray), Exterior Windows and Doors	None Detected - Caulking
WES-251017-043	Exterior Caulk (Gray), Exterior Windows and Doors	None Detected - Caulking
WES-251017-044	Duct Mastic (Gray), Ducts above Ceiling Tile	None Detected - Grey Mastic
WES-251017-045	Duct Mastic (Gray), Ducts above Ceiling Tile	None Detected - Grey Mastic
WES-251017-046	Duct Mastic (Gray), Ducts above Ceiling Tile	None Detected - Grey Mastic

PLM Summary Report

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client :	Industrial Hygiene & Safety Technology	Lab Job No. :	17B-12807
Project :	Freese & Nichols, Weslaco Readiness Ctr., 1100 Vo Tech	Report Date :	10/30/2017
Project # :	21816	Sample Date :	10/25/2017
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

On 10/27/2017, forty six (46) bulk material samples were submitted by Jose Reyes of Industrial Hygiene & Safety Technology for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content

These samples were analyzed by layers. Quantification, unless otherwise noted, is performed by calibrated visual estimate. The test report shall not be reproduced, except in full, without written approval of the laboratory. The results relate only to the items tested. These test results do not imply endorsement by NVLAP or any agency of the U.S. Government. Accredited by the National Voluntary Laboratory Accreditation Program for Bulk Asbestos Fiber Analysis under Lab Code 102056-0.

NVLAP® LAB #102056-0

Analyst(s): Willie Pruitt

Lab Manager : Heather Lopez — Approved Signatory : Heather Lopez

Lab Director : Bruce Crabb — Approved Signatory : Bruce Crabb

Thank you for choosing Moody Labs

Moody Labs
2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Industrial Hygiene & Safety Technology
Project : Freese & Nichols, Weslaco Readiness Ctr., 1100 Vo Tech
Project # : 21816

Lab Job No. : 17B-12807
Report Date : 10/30/2017

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
WES-251017-001	Drywall Material (Pale Pink)	40%	Glass Wool Fibers	2%	10/30	WP
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper / Tape (Tan / White)	35%	Cellulose Fibers	100%		
	Joint Compound (White)	23%	Calcite / Talc / Binders	100%		
	Texture (White)	2%	Calcite / Talc / Binders	100%		
WES-251017-002	Drywall Material (Pale Pink)	40%	Glass Wool Fibers	2%	10/30	WP
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper / Tape (Tan / White)	35%	Cellulose Fibers	100%		
	Joint Compound (White)	23%	Calcite / Talc / Binders	100%		
	Texture (White)	2%	Calcite / Talc / Binders	100%		
WES-251017-003	Drywall Material (White)	5%	Glass Wool Fibers	2%	10/30	WP
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	5%	Cellulose Fibers	100%		
	Texture / Joint Cmpd (White)	90%	Calcite / Talc / Binders	100%		
WES-251017-004	Drywall Material (White)	45%	Glass Wool Fibers	2%	10/30	WP
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper / Tape (Tan / White)	25%	Cellulose Fibers	100%		
	Joint Compound (White)	25%	Calcite / Talc / Binders	100%		
	Texture (White)	5%	Calcite / Talc / Binders	100%		
WES-251017-005	Drywall Material (White)	55%	Glass Wool Fibers	2%	10/30	WP
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper / Tape (Tan / White)	15%	Cellulose Fibers	100%		
	Joint Compound (White)	25%	Calcite / Talc / Binders	100%		
	Texture (White)	5%	Calcite / Talc / Binders	100%		

Moody Labs
2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Industrial Hygiene & Safety Technology
Project : Freese & Nichols, Weslaco Readiness Ctr., 1100 Vo Tech
Project # : 21816

Lab Job No. : 17B-12807
Report Date : 10/30/2017

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
WES-251017-006	Drywall Material (Pale Pink)	80%	Glass Wool Fibers	2%	10/30	WP
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper / Tape (Tan / White)	13%	Cellulose Fibers	100%		
	Joint Compound (White)	5%	Calcite / Talc / Binders	100%		
	Texture (White)	2%	Calcite / Talc / Binders	100%		
WES-251017-007	Drywall Material (Pale Pink)	70%	Glass Wool Fibers	2%	10/30	WP
			Cellulose Fibers	1%		
			Gypsum / Binders	97%		
	DW Paper / Tape (Tan / White)	15%	Cellulose Fibers	100%		
	Joint Compound (White)	10%	Calcite / Talc / Binders	100%		
	Texture (White)	5%	Calcite / Talc / Binders	100%		
WES-251017-008	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	10/30	WP
			Mineral Wool Fibers	30%		
			Perlite	20%		
WES-251017-009	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	10/30	WP
			Mineral Wool Fibers	30%		
			Perlite	20%		
WES-251017-010	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	10/30	WP
			Mineral Wool Fibers	30%		
			Perlite	20%		
WES-251017-011	Clear Mastic (Clear)	100%	Glue Binders	100%	10/30	WP
WES-251017-012	Clear Mastic (Clear)	100%	Glue Binders	100%	10/30	WP
WES-251017-013	Clear Mastic (Clear)	100%	Glue Binders	100%	10/30	WP
WES-251017-014	Cove Base (Grey)	50%	Calcite / Vinyl Binders	100%	10/30	WP
	Yellow Mastic (Yellow)	50%	Glue Binders	100%		
WES-251017-015	Cove Base (Grey)	50%	Calcite / Vinyl Binders	100%	10/30	WP
	Yellow Mastic (Yellow)	50%	Glue Binders	100%		

Moody Labs
2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Industrial Hygiene & Safety Technology
Project : Freese & Nichols, Weslaco Readiness Ctr., 1100 Vo Tech
Project # : 21816

Lab Job No. : 17B-12807
Report Date : 10/30/2017

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
WES-251017-016	Cove Base (Grey)	50%	Calcite / Vinyl Binders	100%	10/30	WP
	Yellow Mastic (Yellow)	50%	Glue Binders	100%		
WES-251017-017	Floor Tile (Beige / Black Spots)	99%	Calcite / Vinyl Binders	100%	10/30	WP
	Yellow Mastic (Yellow)	1%	Glue Binders	100%		
WES-251017-018	Floor Tile (Beige / Black Spots)	99%	Calcite / Vinyl Binders	100%	10/30	WP
	Yellow Mastic (Yellow)	1%	Glue Binders	100%		
WES-251017-019	Floor Tile (Beige / Black Spots)	99%	Calcite / Vinyl Binders	100%	10/30	WP
	Yellow Mastic (Yellow)	1%	Glue Binders	100%		
WES-251017-020	Sink Undercoating (Off-White)	100%	Cellulose Fibers	10%	10/30	WP
			Calcite / Talc	50%		
			Binders / Fillers	40%		
WES-251017-021	Sink Undercoating (Off-White)	100%	Cellulose Fibers	10%	10/30	WP
			Calcite / Talc	50%		
			Binders / Fillers	40%		
WES-251017-022	Sink Undercoating (Off-White)	100%	Cellulose Fibers	10%	10/30	WP
			Calcite / Talc	50%		
			Binders / Fillers	40%		
WES-251017-023	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	10/30	WP
			Mineral Wool Fibers	30%		
			Perlite	20%		
WES-251017-024	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	10/30	WP
			Mineral Wool Fibers	30%		
			Perlite	20%		
WES-251017-025	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	10/30	WP
			Mineral Wool Fibers	30%		
			Perlite	20%		
WES-251017-026	Cove Base (Black)	50%	Calcite / Vinyl Binders	100%	10/30	WP
	Cream Mastic (Cream)	50%	Calcite	50%		
			Glue Binders	50%		

Moody Labs
2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Industrial Hygiene & Safety Technology
Project : Freese & Nichols, Weslaco Readiness Ctr., 1100 Vo Tech
Project # : 21816

Lab Job No. : 17B-12807
Report Date : 10/30/2017

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
WES-251017-027	Cove Base (Black)	50%	Calcite / Vinyl Binders	100%	10/30	WP
	Cream Mastic (Cream)	50%	Calcite	50%		
			Glue Binders	50%		
WES-251017-028	Cove Base (Black)	50%	Calcite / Vinyl Binders	100%	10/30	WP
	Cream Mastic (Cream)	50%	Calcite	50%		
			Glue Binders	50%		
WES-251017-029	Plaster (White)	100%	Aggregate	65%	10/30	WP
			Calcite / Binders	35%		
WES-251017-030	Plaster (White)	100%	Aggregate	65%	10/30	WP
			Calcite / Binders	35%		
WES-251017-031	Plaster (White)	100%	Aggregate	65%	10/30	WP
			Calcite / Binders	35%		
WES-251017-032	Drywall Tile (Pale Pink)	94%	Cellulose Fibers	2%	10/30	WP
			Glass Wool Fibers	2%		
			Mica	<1%		
			Gypsum / Binders	96%		
	DW Paper Facing (Tan)	5%	Cellulose Fibers	100%		
	Vinyl Facing (White)	1%	Vinyl Binders	100%		
WES-251017-033	Drywall Tile (Pale Pink)	94%	Cellulose Fibers	2%	10/30	WP
			Glass Wool Fibers	2%		
			Mica	<1%		
			Gypsum / Binders	96%		
	DW Paper Facing (Tan)	5%	Cellulose Fibers	100%		
	Vinyl Facing (White)	1%	Vinyl Binders	100%		
WES-251017-034	Drywall Tile (Pale Pink)	94%	Cellulose Fibers	2%	10/30	WP
			Glass Wool Fibers	2%		
			Mica	<1%		
			Gypsum / Binders	96%		
	DW Paper Facing (Tan)	5%	Cellulose Fibers	100%		
	Vinyl Facing (White)	1%	Vinyl Binders	100%		

Moody Labs
2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Industrial Hygiene & Safety Technology
Project : Freese & Nichols, Weslaco Readiness Ctr., 1100 Vo Tech
Project # : 21816

Lab Job No. : 17B-12807
Report Date : 10/30/2017

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
WES-251017-035	Caulking (Silver)	100%	Silicone Binders	100%	10/30	WP
WES-251017-036	Caulking (Silver)	100%	Silicone Binders	100%	10/30	WP
WES-251017-037	Caulking (Silver)	100%	Silicone Binders	100%	10/30	WP
WES-251017-038	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	10/30	WP
			Mineral Wool Fibers	30%		
			Perlite	20%		
WES-251017-039	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	10/30	WP
			Mineral Wool Fibers	30%		
			Perlite	20%		
WES-251017-040	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	50%	10/30	WP
			Mineral Wool Fibers	30%		
			Perlite	20%		
WES-251017-041	Caulking (Grey)	100%	Binders / Fillers	100%	10/30	WP
WES-251017-042	Caulking (Grey)	100%	Binders / Fillers	100%	10/30	WP
WES-251017-043	Caulking (Grey)	100%	Binders / Fillers	100%	10/30	WP
WES-251017-044	Grey Mastic (Grey)	100%	Calcite	60%	10/30	WP
			Glue Binders	40%		
WES-251017-045	Grey Mastic (Grey)	100%	Calcite	60%	10/30	WP
			Glue Binders	40%		
WES-251017-046	Grey Mastic (Grey)	100%	Calcite	60%	10/30	WP
			Glue Binders	40%		

Analyze nll 17b-12807 PLM 46

IHST PROJECT #: 21816

PROJECT TITLE: Weslaco Readiness Center

PROJECT ADDRESS: 1100 Va Tech Dr
Weslaco, TX 78599

:DATE 10/25/2017

:INSPECTOR/TDH# Jose Reyes / 60-3316

:CLIENT/CONTACT Freese & Nichols

Turnaround Time ( ) Immediate ( )1 Day (x) 2 day ( ) 3 Day

HOMO AREA #	SAMPLE # WES-251017-	SAMPLE DESCRIPTION	LOCATION	ESTIMATED QUANTITY (SF/LF/ea.)	TYPE of ACM	F NF I NF II	CONDITION (G/D/SD)	POTENTIAL FOR DISTURBANCE	RESPONSE RATING
1	001	Drywall/Joint Compound/Sand Texture	Room A103	67,081 SF	S	NF II	G	L	
	002		Room A108						
	003		Room A122						
	004		Room A129						
	005		Room B102						
	006		Room B105B						
	007		Room B109B						
2	008	2'x4' SACT	Corridor A146	11,562 SF	M	F	G	L	
	009		Room A127						
	010		Room A111						
3	011	Clear Carpet Glue	Room A121	5,318 SF	M	NF I	G	L	
	012		Room A141						

Released by:	Date/Time:	Received by:	Date/Time:
[signature]	10/27/17 1050	Monica Tobar	10/27/17 1050 Am
Released by:	Date/Time:	Received by:	Date/Time:

Industrial Hygiene & Safety Technology, Inc. • 2235 Keller Way • Carrollton, Texas 75006 • 972-478-7415 • Fax 972-478-7615 TDH License #10-0145

E-mail address: labresults@ihst.com

IHST PROJECT #: 21816

PROJECT TITLE: Weslaco Readiness Center

PROJECT ADDRESS: 1100 Va Tech Dr
Weslaco TX 78599

17B-12807 :DATE

10/25/2017

Jose Reyes / 60-3316 :INSPECTOR/TDH#

Freese & Nichols :CLIENT/CONTACT

Turnaround Time ( ) Immediate ( )1 Day (x) 2 day ( ) 3 Day

HOMO AREA #	SAMPLE # WES-251017-	SAMPLE DESCRIPTION	LOCATION	ESTIMATED QUANTITY (SF/LF/ea.)	TYPE of ACM	F NF I NF II	CONDITION (G/D/SD)	POTENTIAL FOR DISTURBANCE	RESPONSE RATING
3	013	Clear Carpet Glue	Room B105A	5,318SF	M	NFI	G	L	
4	014	4" Gray Cove base/Yellow Mastic	Room A143	6,814LF	M	NFII	G	L	
↓	015	↓	Room B112	↓	↓	↓	↓	↓	
↓	016	↓	Room D110	↓	↓	↓	↓	↓	
5	017	12"X12" Beige FT/Yellow Mastic	Room A136	18,889SF	M	NFII	G	L	
↓	018	↓	Corridor D101	↓	↓	↓	↓	↓	
↓	019	↓	Room C106	↓	↓	↓	↓	↓	
6	020	White Sink Undercoating	Room A125	1SF	M	NFII	G	L	
↓	021	↓	↓	↓	↓	↓	↓	↓	
↓	022	↓	↓	↓	↓	↓	↓	↓	
7	023	2'X4' OLD SACT	Corridor D101	11,984SF	M	F	G	L	
↓	024	↓	Corridor B111	↓	↓	↓	↓	↓	

Released by:	Date/Time:	Received by:	Date/Time:
Released by:	Date/Time:	Received by:	Date/Time:

Industrial Hygiene & Safety Technology, Inc. • 2235 Keller Way • Carrollton, Texas 75006 • 972-478-7415 • Fax 972-478-7615 TDH License #10-0145

E-mail address: labresults@ihst.com

IHST PROJECT #: 21816

PROJECT TITLE: Weslaco Readiness Center

PROJECT ADDRESS: 1100 Va Tech Dr
Weslaco, TX 78599

17B-12807
:DATE 10/25/17

:INSPECTOR/TDH# Jose Reyes / 60-3316

:CLIENT/CONTACT Freese & Nichols

Turnaround Time ( ) Immediate ( )1 Day (x) 2 day ( ) 3 Day

HOMO AREA #	SAMPLE # WES-25/017-	SAMPLE DESCRIPTION	LOCATION	ESTIMATED QUANTITY (SF/LF/ea.)	TYPE of ACM	F NF I NF II	CONDITION (G/D/SD)	POTENTIAL FOR DISTURBANCE	RESPONSE RATING
7	025	2'X4' OLD SACT	Room B103	11,984SF	M	F	G	L	
8	026	4" Black Cove base / white Mastic	Room B105 A	134LF	M	NF II	G	L	
↓	027	↓	↓	↓	↓	↓	↓	↓	
↓	028	↓	↓	↓	↓	↓	↓	↓	
9	029	Plaster	Exterior Awnings	868SF	S	NF II	G	L	
↓	030	↓	↓	↓	↓	↓	↓	↓	
↓	031	↓	Room D127	↓	↓	↓	↓	↓	
10	032	2'X4' Smooth SACT	Room C101	1,618SF	M	NF II	G	L	
↓	033	↓	Room C102	↓	↓	↓	↓	↓	
↓	034	↓	Room C103	↓	↓	↓	↓	↓	
11	035	Silver Caulk	Room C102	52LF	M	NF II	G	L	
↓	036	↓	↓	↓	↓	↓	↓	↓	

Released by:	Date/Time:	Received by:	Date/Time:
Released by:	Date/Time:	Received by:	Date/Time:

Industrial Hygiene & Safety Technology, Inc. • 2235 Keller Way • Carrollton, Texas 75006 • 972-478-7415 • Fax 972-478-7615 TDH License #10-0145

E-mail address: labresults@ihst.com

IHST PROJECT #: 21816

PROJECT TITLE: Weslaco Readiness Center

PROJECT ADDRESS: 1100 Võ Tech Dr
Weslaco, TX 78599

10/25/2017 :DATE

Jose Reyes / 60-3316 :INSPECTOR/TDH#

:CLIENT/CONTACT

Turnaround Time ( ) Immediate ( )1 Day (x) 2 day ( ) 3 Day

HOMO AREA #	SAMPLE # (WES-251017-)	SAMPLE DESCRIPTION	LOCATION	ESTIMATED QUANTITY (SF/LF/ea.)	TYPE of ACM	F NF I NF II	CONDITION (G/D/SD)	POTENTIAL FOR DISTURBANCE	RESPONSE RATING
11	037	Silver Caulk	Room C103	52 LF	M	NFII	G	L	
12	038	2'X4' NEW SACT	Room D135	880SF	M	F	G	L	
	039								
	040								
13	041	Exterior Gray Caulk	Exterior Windows & Doors	802LF	M	NFII	G	L	
	042								
	043								
14	044	Gray Duct Mastic	Ducts Above Ceiling Tile	2306LF	M	NFII	G	L	
	045								
	046								

Released by:	Date/Time:	Received by:	Date/Time:
Released by:	Date/Time:	Received by:	Date/Time:

Industrial Hygiene & Safety Technology, Inc. • 2235 Keller Way • Carrollton, Texas 75006 • 972-478-7415 • Fax 972-478-7615 TDH License #10-0145

E-mail address: labresults@ihst.com

Appendix:

Appendix C: Bulk Summary Report

Table 1. Summary of Bulk Sample Analysis and Assessment

Freese and Nichols, Inc.

Weslaco Readiness Center
100 Vo Tech Drive
Weslaco, TX 78599

Survey Date(s): 10/25/2017 through 10/25/2017

Sample ID#	Sample Description	Material Location	Percent & Type of Asbestos Detected (a)	Estimated Quantity	Type of ACM (b)	Friability (c)	Physical Condition	Potential for Disturbance	Response Rating
WES-251017-001	Drywall/Joint Compound/Sand Texture (homogeneous area # 01)	Walls Throughout A & B Rooms	NAD - Drywall Material NAD - Joint Compound NAD - Texture	67081 s.f.	Surfacing	NF II	Good	Low	0
WES-251017-002	Drywall/Joint Compound/Sand Texture (homogeneous area # 01)	Walls Throughout A & B Rooms	NAD - Drywall Material NAD - Joint Compound NAD - Texture	67081 s.f.	Surfacing	NF II	Good	Low	0
WES-251017-003	Drywall/Joint Compound/Sand Texture (homogeneous area # 01)	Walls Throughout A & B Rooms	NAD - Drywall Material NAD - Texture/Joint Cmpd	67081 s.f.	Surfacing	NF II	Good	Low	0
WES-251017-004	Drywall/Joint Compound/Sand Texture (homogeneous area # 01)	Walls Throughout A & B Rooms	NAD - Drywall Material NAD - Joint Compound NAD - Texture	67081 s.f.	Surfacing	NF II	Good	Low	0
WES-251017-005	Drywall/Joint Compound/Sand Texture (homogeneous area # 01)	Walls Throughout A & B Rooms	NAD - Drywall Material NAD - Joint Compound NAD - Texture	67081 s.f.	Surfacing	NF II	Good	Low	0
WES-251017-006	Drywall/Joint Compound/Sand Texture (homogeneous area # 01)	Walls Throughout A & B Rooms	NAD - Drywall Material NAD - Joint Compound NAD - Texture	67081 s.f.	Surfacing	NF II	Good	Low	0

Sample ID#	Sample Description	Material Location	Percent & Type of Asbestos Detected (a)	Estimated Quantity	Type of ACM (b)	Friability (c)	Physical Condition	Potential for Disturbance	Response Rating
WES-251017-007	Drywall/Joint Compound/Sand Texture (homogeneous area # 01)	Walls Throughout A & B Rooms	NAD - Drywall Material NAD - Joint Compound NAD - Texture	67081 s.f.	Surfacing	NF II	Good	Low	0
WES-251017-008	2'x4' SACT (homogeneous area # 02)	Ceilings Throughout A Rooms	NAD - Acoustic Tile	11562 s.f.	Misc	F	Good	Low	0
WES-251017-009	2'x4' SACT (homogeneous area # 02)	Ceilings Throughout A Rooms	NAD - Acoustic Tile	11562 s.f.	Misc	F	Good	Low	0
WES-251017-010	2'x4' SACT (homogeneous area # 02)	Ceilings Throughout A Rooms	NAD - Acoustic Tile	11562 s.f.	Misc	F	Good	Low	0
WES-251017-011	Clear Carpet Glue (homogeneous area # 03)	Various Floors ikn A & B Rooms	NAD - Clear Mastic	5318 s.f.	Misc	NF I	Good	Low	0
WES-251017-012	Clear Carpet Glue (homogeneous area # 03)	Various Floors ikn A & B Rooms	NAD - Clear Mastic	5318 s.f.	Misc	NF I	Good	Low	0
WES-251017-013	Clear Carpet Glue (homogeneous area # 03)	Various Floors ikn A & B Rooms	NAD - Clear Mastic	5318 s.f.	Misc	NF I	Good	Low	0
WES-251017-014	4" Gray Cove Base/Yellow Mastic (homogeneous area # 04)	Various Walls Throughout Building	NAD - Cove Base NAD - Yellow Mastic	6814 l.f.	Misc	NF II	Good	Low	0

Sample ID#	Sample Description	Material Location	Percent & Type of Asbestos Detected (a)	Estimated Quantity	Type of ACM (b)	Friability (c)	Physical Condition	Potential for Disturbance	Response Rating
WES-251017-015	4" Gray Cove Base/Yellow Mastic (homogeneous area # 04)	Various Walls Throughout Building	NAD - Cove Base NAD - Yellow Mastic	6814 l.f.	Misc	NF II	Good	Low	0
WES-251017-016	4" Gray Cove Base/Yellow Mastic (homogeneous area # 04)	Various Walls Throughout Building	NAD - Cove Base NAD - Yellow Mastic	6814 l.f.	Misc	NF II	Good	Low	0
WES-251017-017	12"x12" Beige Floor Tile/Yellow Mastic (homogeneous area # 05)	Various Floors Throughout Building	NAD Floor Tile NAD - Yellow Mastic	18889 s.f.	Misc	NF I	Good	Low	0
WES-251017-018	12"x12" Beige Floor Tile/Yellow Mastic (homogeneous area # 05)	Various Floors Throughout Building	NAD Floor Tile NAD - Yellow Mastic	18889 s.f.	Misc	NF I	Good	Low	0
WES-251017-019	12"x12" Beige Floor Tile/Yellow Mastic (homogeneous area # 05)	Various Floors Throughout Building	NAD Floor Tile NAD - Yellow Mastic	18889 s.f.	Misc	NF I	Good	Low	0
WES-251017-020	White Sink Undercoating (homogeneous area # 06)	Room A125	NAD - Sink Undercoating	1 s.f.	Misc	NF I	Good	Low	0
WES-251017-021	White Sink Undercoating (homogeneous area # 06)	Room A125	NAD - Sink Undercoating	1 s.f.	Misc	NF I	Good	Low	0
WES-251017-022	White Sink Undercoating (homogeneous area # 06)	Room A125	NAD - Sink Undercoating	1 s.f.	Misc	NF I	Good	Low	0

Sample ID#	Sample Description	Material Location	Percent & Type of Asbestos Detected (a)	Estimated Quantity	Type of ACM (b)	Friability (c)	Physical Condition	Potential for Disturbance	Response Rating
WES-251017-023	2'x4' Old SACT (homogeneous area # 07)	Various Ceilings in B, C, & D Rooms	NAD - Acoustic Tile	11984 s.f.	Misc	F	Good	Low	0
WES-251017-024	2'x4' Old SACT (homogeneous area # 07)	Various Ceilings in B, C, & D Rooms	NAD - Acoustic Tile	11984 s.f.	Misc	F	Good	Low	0
WES-251017-025	2'x4' Old SACT (homogeneous area # 07)	Various Ceilings in B, C, & D Rooms	NAD - Acoustic Tile	11984 s.f.	Misc	F	Good	Low	0
WES-251017-026	4" Black Cove Base/White Mastic (homogeneous area # 08)	Room B105	NAD - Cove Base NAD - Cream Mastic	134 l.f.	Misc	NF II	Good	Low	0
WES-251017-027	4" Black Cove Base/White Mastic (homogeneous area # 08)	Room B105	NAD - Cove Base NAD - Cream Mastic	134 l.f.	Misc	NF II	Good	Low	0
WES-251017-028	4" Black Cove Base/White Mastic (homogeneous area # 08)	Room B105	NAD - Cove Base NAD - Cream Mastic	134 l.f.	Misc	NF II	Good	Low	0
WES-251017-029	Plaster (homogeneous area # 09)	Exterior Awnings & Ceiling in Room D127	NAD - Plaster	868 s.f.	Surfacing	NF II	Good	Low	0
WES-251017-030	Plaster (homogeneous area # 09)	Exterior Awnings & Ceiling in Room D127	NAD - Plaster	868 s.f.	Surfacing	NF II	Good	Low	0

Sample ID#	Sample Description	Material Location	Percent & Type of Asbestos Detected (a)	Estimated Quantity	Type of ACM (b)	Friability (c)	Physical Condition	Potential for Disturbance	Response Rating
WES-251017-031	Plaster (homogeneous area # 09)	Exterior Awnings & Ceiling in Room D127	NAD - Plaster	868 s.f.	Surfacing	NF II	Good	Low	0
WES-251017-032	2"x4" Smooth SACT (homogeneous area # 10)	Various Ceilings in C & D Rooms	NAD - Drywall Tile NAD - Vinyl Facing	1618 s.f.	Misc	NF II	Good	Low	0
WES-251017-033	2"x4" Smooth SACT (homogeneous area # 10)	Various Ceilings in C & D Rooms	NAD - Drywall Tile NAD - Vinyl Facing	1618 s.f.	Misc	NF II	Good	Low	0
WES-251017-034	2"x4" Smooth SACT (homogeneous area # 10)	Various Ceilings in C & D Rooms	NAD - Drywall Tile NAD - Vinyl Facing	1618 s.f.	Misc	NF II	Good	Low	0
WES-251017-035	Silver Caulk (homogeneous area # 11)	Rooms C101 & C102	NAD - Caulking	52 l.f.	Misc	NF II	Good	Low	0
WES-251017-036	Silver Caulk (homogeneous area # 11)	Rooms C101 & C102	NAD - Caulking	52 l.f.	Misc	NF II	Good	Low	0
WES-251017-037	Silver Caulk (homogeneous area # 11)	Rooms C101 & C102	NAD - Caulking	52 l.f.	Misc	NF II	Good	Low	0
WES-251017-038	2'x4' New SACT (homogeneous area # 12)	Room D135	NAD - Acoustic Tile	880 s.f.	Misc	F	Good	Low	0

Sample ID#	Sample Description	Material Location	Percent & Type of Asbestos Detected (a)	Estimated Quantity	Type of ACM (b)	Friability (c)	Physical Condition	Potential for Disturbance	Response Rating
WES-251017-039	2'x4' New SACT (homogeneous area # 12)	Room D135	NAD - Acoustic Tile	880 s.f.	Misc	F	Good	Low	0
WES-251017-040	2'x4' New SACT (homogeneous area # 12)	Room D135	NAD - Acoustic Tile	880 s.f.	Misc	F	Good	Low	0
WES-251017-041	Exterior Gray Caulk (homogeneous area # 13)	Around Exterior Windows & Doors	NAD - Caulking	802 l.f.	Misc	NF II	Good	Low	0
WES-251017-042	Exterior Gray Caulk (homogeneous area # 13)	Around Exterior Windows & Doors	NAD - Caulking	802 l.f.	Misc	NF II	Good	Low	0
WES-251017-043	Exterior Gray Caulk (homogeneous area # 13)	Around Exterior Windows & Doors	NAD - Caulking	802 l.f.	Misc	NF II	Good	Low	0
WES-251017-044	Gray Duct Mastic (homogeneous area # 14)	Duct Work Above Ceiling Tile Throughout the Building	NAD - Gray Mastic	2306 l.f.	Misc	NF II	Good	Low	0
WES-251017-045	Gray Duct Mastic (homogeneous area # 14)	Duct Work Above Ceiling Tile Throughout the Building	NAD - Gray Mastic	2306 l.f.	Misc	NF II	Good	Low	0
WES-251017-046	Gray Duct Mastic (homogeneous area # 14)	Duct Work Above Ceiling Tile Throughout the Building	NAD - Gray Mastic	2306 l.f.	Misc	NF II	Good	Low	0

Sample ID#	Sample Description	Material Location	Percent & Type of Asbestos Detected (a)	Estimated Quantity	Type of ACM (b)	Friability (c)	Physical Condition	Potential for Disturbance	Response Rating

Table Key:

(a) CH = Chrysotile; AM = Amosite; CR = Crocidolite; AN = Anthophyllite; AC = Actinolite; NAD = NAD = No Asbestos Detected
(b) Misc = Miscellaneous; TSI = Thermal Systems Insulation
(c) F = Friable; NF I = Non-Friable Category I; NF II = Non-Friable Category II

Appendix:

Appendix D: Photographs

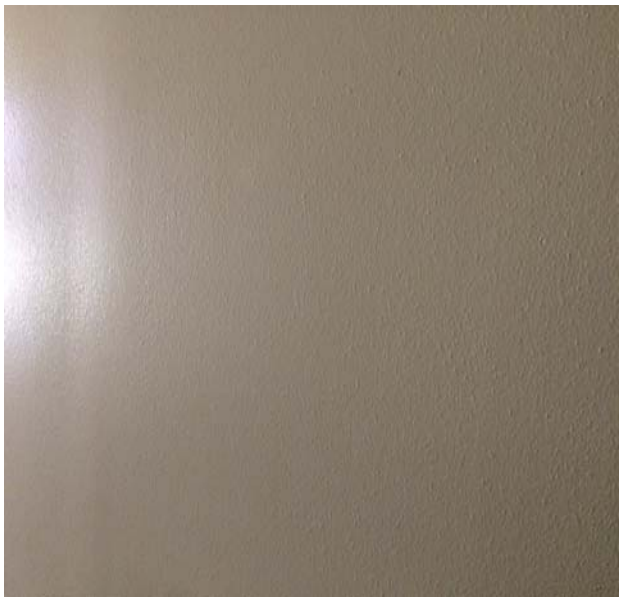
Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Weslaco Readiness Center - Weslaco



Weslaco Readiness Center - Weslaco



Samples 001-007



Samples 004-046

Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Samples 008-010



Samples 011-013



Samples 014-016



Samples 017-019

Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Samples 020-022



Samples 023-025



Samples 026-028



Samples 029-031

Weslaco Readiness Center
1100 Vo Tech
Weslaco, Texas



Samples 032-034



Samples 035-037



Samples 038-040



Samples 041-043

Appendix:

Appendix E: Lead Report

INDUSTRIAL HYGIENE AND
SAFETY TECHNOLOGY, INC.

November 6, 2017

Mr. Parris Jones
Freese and Nichols, Inc.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109

RE: Lead Base Paint Building Materials Survey
Location: Weslaco Readiness Center, 1100 Vo Tech Drive, Weslaco, TX 78599
Sample Date: October 25, 2017
IHST Job #: 21816

Dear Mr. Jones,

Mr. Jose Reyes representing Industrial Hygiene and Safety Technology, Inc. performed a visual inspection and collected bulk samples of suspect lead based paint at address listed above.

Six (6) suspect lead based painted materials were identified during the visual inspection of the structure. Table 1 list the materials sampled and the results of the lead based paint analysis. EMSL Analytical Inc. was contracted to perform the laboratory analysis. A copy of the original laboratory report is included as Appendix A to this report. The samples were analyzed utilizing SW 846 3050B/7000B method for lead analysis.

Table 1, Results of Lead Based Paint Testing

Sample ID	Material Tested	Location	Results
WES-251017-001L	Interior White Paint	Walls Throughout	<0.0080 % wt
WES-251017-002L	Interior Light Gray Paint	Rooms B106 & D135	<0.0090 % wt
WES-251017-003L	Interior Brown Paint	Room A113	<0.030 % wt
WES-251017-004L	Interior Beige Paint	Various Walls & Ceilings Throughout	<0.026 % wt
WES-251017-005L	Exterior Yellow Paint	Bollards & Curbs	<0.0080 % wt
WES-251017-006L	Exterior Red Paint	Curbs	<0.0080 % wt

In reviewing the results of the lead based paint sampling, all of the samples are less than the HUD/EPA standard of paint equal to or greater than 0.5% by weight. Lead base paint is not a hazard in the facility.

Should you or your staff have any questions regarding the content of this report, please do not hesitate to contact our office at your convenience.

Sincerely,



Tracy Bramlett, CIH, CSP
President

Appendix A – Laboratory Report

Appendix A – Laboratory Report

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order: 201711113
CustomerID: INDU60
CustomerPO:
ProjectID:

Attn: **Michael Gange**
Industrial Hygiene & Safety Technology
2235 Keller Way
Carrollton, TX 75006

Phone: (972) 478-7415
Fax: (972) 478-7615
Received: 10/30/17 9:40 AM
Collected: 10/25/2017

Project: **Weslaco Readiness Center / 21816**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
WES-251017-001L	*201711113-0001*	10/25/2017	11/3/2017	<0.0080 % wt
	Site: Interior White Paint			
WES-251017-002L	*201711113-0002*	10/25/2017	11/3/2017	<0.0090 % wt
	Site: Interior Light Grey Paint			
WES-251017-003L	*201711113-0003*	10/25/2017	11/3/2017	<0.030 % wt
	Site: Interior Brown Paint			
WES-251017-004L	*201711113-0004*	10/25/2017	11/3/2017	<0.026 % wt
	Site: Interior Beige Paint			
WES-251017-005L	*201711113-0005*	10/25/2017	11/3/2017	<0.0080 % wt
	Site: Exterior Yellow Paint			
WES-251017-006L	*201711113-0006*	10/25/2017	11/3/2017	<0.0080 % wt
	Site: Exterior Red Paint			

Phillip Worby, Lead Laboratory Manager
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 11/06/2017 10:23:58

LEAD

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Lead (Pb) Chain of Custody

EMSL Order ID *(Lab Use Only)*: 201711113

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE: 1-800-220-3675
FAX: (856) 786-5974

Company : IHST, Inc.	**EMSL-Bill to:** Same Different If Bill to is Different note instructions in Comments** *Third Party Billing requires written authorization from third party*
Street: 2235 Keller Way	
City: Carrollton **State/Province:** TX	**Zip/Postal Code:** 75006 **Country:** USA
Report To (Name): Michael Gange	**Telephone #:** 972-478-7415
Email Address: labresults@ihst.com	**Fax #:** 972-478-7615 **Purchase Order:**
Project Name/Number: Weslaco Readiness Center/21816	**Please Provide Results:** Fax (Email)
U.S. State Samples Taken: TX	**CT Samples:** Commercial/Taxable Residential/Tax Exempt

Turnaround Time (TAT) Options* - Please Check

3 Hour	6 Hour	24 Hour	48 Hour	72 Hour	96 Hour	(1 Week)	2 Week

*Analysis completed in accordance with EMSL's Terms and Conditions located in the Price Guide

Matrix	Method	Instrument	Reporting Limit	Check
Chips % by wt.	SW846-7000B	Flame Atomic Absorption	0.01%	

Name of Sampler: Jose Reyes **Signature of Sampler:** [signature]

Sample ID	Sample Description	Date Sampled
WES-251017-		10-25-17
001L	Interior White Paint	
002L	Interior Light Gray Paint	
003L	Interior Brown Paint	
004L	Interior Beige Paint	
005L	Exterior Yellow Paint	
006L	Exterior Red Paint	

Client Sample #'s **Total # of Samples:** 6

Relinquished (Client):	[signature]	**Date:**	10/27/17	**Time:**	
Received (Lab):	[signature]	**Date:**	10/30/17	**Time:**	940

Comments:

STAR Weslaco RC – Qualified Contractor's Questions

Questions to A/E:

Civil

- CLEARING OF DRAINAGE SWALE: A note on Sheet C-1 states: "Existing drainage swale to be cleaned of silt & debris". During the Pre-Bid Meeting it was noted the swale actually needs to be re-shaped to allow for positive drainage toward the existing culvert pipe. Will this area need to be seeded after the swale has been re-shaped and the surface grass is hauled away?
    - Response: Yes, refer to sheet C-3

- Sheet C2 Bid option 6, what are the parking improvements, please define type of improvements
    - Response: Refer to sheet C-2

- Sheet C2 note 6, are all curbs repainted and will all parking spaces be restriped?
    - Response: Refer to sheet C-2

- Please provide proposed grades for existing swale, need existing elevations for swale.
    - Response: Refer to sheet C-3

- Sheet C3, missing grades on 6-in drain line, how is storm water to flow into swale (missing inlets?) need more information on how to move storm water out of area also need elevations for this work such as flow line at outfall of 6-inch (what type of headwall for 6-inch line)
    - Response: Refer to sheets C-2 & C-3

Architecture

- TERMITE PRE-TREATMENT: Is termite pre-treatment required? If so, would it only be required at the new slab area, or, would it also be required beneath and around the portable restroom building and shower building?
    - Response: Termite pre-treatment is not required.

- MODULAR BUILDINGS: A) Section Q on 13 34 23-6 states to furnish stairs & landings at the Portable Restroom and Shower Buildings. Will temporary ramps meeting ADA requirements also be required? B) Will the Fire Alarm System need to be tied to the portable buildings? C) Will the Intrusion Detection System need to be tied to the Portable Buildings?
    - Response: A) Refer to updated Specification Section 13 34 23 "Modular Restroom and Shower Building" B) No C) No

- The lockers & benches in the portable shower make it a custom-built unit, very expensive. No vendor has had something like that to rent. Can the requirements be relaxed? Can the requirements be broken up into multiple trailers?

  - Response: Refer to updated Specification Section 13 34 23 "Modular Restroom and Shower Building"

- PORTABLE BUILDINGS: During the Pre-Bid Meeting, someone in the audience said they tried pricing the portable restroom building and portable shower building with several rental companies and none of them were able to provide a quotation because of the strict specifications. Do you know of a source where these units can be rented? Or, can the specifications be modified where standard rental units would be acceptable as long as they meet the basic criteria? If we also are unable to find a rental company capable of meeting the specifications, we'll need to custom make the 2 units. Please advise.
  - Response: Refer to updated Specification Section 13 34 23 "Modular Restroom and Shower Building".

- FENCING: Notes 6, 7 & 13 on Sheet A-3 call for new fencing and new gates to meet AFTP requirements. Is the existing fence to be removed and given to the Owner?
  - Response: Revised notes 6,7 & 13 on Sheet A-3

- Bid Option 9 is described as "Site security fencing to meet ATFP standoff regulations". After reviewing the fencing specifications, the following was noticed: Fencing spec does not make any reference to ATFP nor does it provide the standoff distance. Are we to assume the specified products meet the ATFP standoff regulations? Fencing specification appears to be for the San Marcos Readiness Center. Please clarify if this is a typo or if a new fencing spec will be issued. The steel post schedule on sheet A-5 does not appear to match the specified products in the spec. being the fabric width is 72" (6') per the spec. The sliding gate requirements per paragraph 2.06 of the spec does not match the drawings. For example, the drawings call for the total sliding gate height to be 8', however the spec calls for the fabric height to be 6', the gate opening specified is 24', and the drawings call for 30'.
  - Response: The new fencing does meet ATFP standard refer to Specification Section 32 31 13.53 ; in some instances it does not meet standoff distance
    Footer updated in specification. Revised Sheet A-5 Steel Post Schedule. Revised Detail 2/A-4

- The electrical site plan E-1 does not make reference of the fence grounding requirements. After reviewing the fencing spec, paragraph 2.1 calls out the material types and sizes to be used. This paragraph does not match the detail provided on sheet A-5, for example: the ground rod on the drawings is ¾" dia x 10' long in lieu of 5/8" x 8' long, there are also differences in wire sizes and other components.
  - Response: Specification Section 32 32 13.53 revised

- The fencing specifications call for bonding across openings, with and without gates in paragraph 3.06 which would require burying a wire 18" below finish grade. Since all openings for swing

gates and sliding gates appear to be in paved areas, would the engineer consider perhaps allowing an additional ground rod at each post in lieu of the buried #2 wire across the opening?
    - Response: Specification Section 32 32 13.53 revised

- WIRE MESH PARTITIONS: A) Is there a drawing showing dimensions of the wire mesh partitions in Room D121 on Sheet A-20? B) Do the wire mesh cubicles have wire mesh ceilings or do they go to the deck above?
    - Response: A) Added dimensions for layout B) Go to Deck. Need to frame each and every penetration going through WMP.

- LOCKERS: Are the lockers in Room D125 completely individual lockers or are they sharing common side panels?
    - Response: Individual lockers - BOD for the Standard locker. Yellow for both standard and TA-50 needs to be added to spec possibly custom color.

- PORTABLE BUILDING CUSTODIAL SERVICE: A) Will the owner be responsible for the daily cleaning of the portable restroom building and the portable shower building? B) Will the owner be responsible for consumables such as toilet paper, soap, paper towels, shower curtains etc.
    - Response: Yes, Owner responsible for daily cleaning and consumable items, soap etc.

- Keynote 5 on sheet A-6 states the existing metal lockers, benches and wire caging is to be demolished. Pe the site visit, it is our understanding the owner is seeking to salvage these items and will require the contractor to turn these over, and not necessarily demolish the items. Please confirm if this is correct, and if so, please advise us on the following: Will these items be required to be palletized of simply staged on site for the owner to pick up? Will the contractor be required to transport and deliver these items off site? If so, how far from the facility, and will the contractor be required to unload and stage these materials?
    - Response: Revised Sheet A-6 and A-10

- The plans call for replacing the inside and outside window sealants. Please clarify if the intent is the remove the interior drywall jamb and head in order to seal the window system or if we are only to replace the caulk on the inside.
    - Response: Only replace the caulk on the inside - Refer to revised sheet A-32, note #10

- Plans reference fire coating (intumescent coating), room finish schedule shows location of fire coating, but on partition types (G & H) shows additional areas. Provide clarification on areas for fire coating.
    - Response: Refer Sheet A-26 - Room Finish Schedule, Note #3 for rooms that will receive sprayed insulation and intumescent coating.

Structural

STAR Weslaco RC – Qualified Contractor's Questions

- Section 01 22 00 Unit Prices states the unit of measurement for the repair of concrete cracking and concrete spalling is cubic yard, however both the schedule of values and section 01 23 10 Bid Options and Allowances Paragraph 1.04 states Cubic Feet. Please confirm it is cubic feet.
    - Response: Spec section 01 22 00 has been modified to cubic feet. 01 22 00-2 - Unit of measure is cubic foot for spalled concrete.

Mechanical

- AIR FILTERING SYSTEM: Demolition will be producing dust particles. Of special concern is silica particles that are known to affect the lungs. Silica particles are released during demolition of concrete. Since the facility will be occupied by the Owner, will the contractor be required to use HEPA filters and have negative air flow to the outdoors?
    - Response: Technical Specification 01 31 00 Section 1.05C compels the contractor to "Comply with latest provisions of the Occupational Health and Safety Administration and other regulatory agencies in performing work." OSHA dictates allowable levels of respirable silica dust

- OPTION 5 (ALTERNATE 5): Option 5 is for a restroom and conference room renovation. A list of trades are listed however HVAC is not. A) Will HVAC need to relocate anything? B) Will the Testing & Balancing company need to rebalance the diffusers in this room?
    - Response: HVAC should be included. The Exhaust fan will be rebalanced and a return grill relocated as indicated in the addendum.

Plumbing

- FIRE SPRINKLER SYSTEM: There's no specification section for Fire Sprinkler Work. Is it anticipated at this point that there will be no work required to be performed on the existing system?
    - Response: There are no existing fire sprinklers and none are required.

Electrical

- EMERGENCY GENERATOR: Section 1.06.D.1 on 01 11 00-2 states the Owner will provide the emergency generator. Will the Owner also be arranging to have the generator delivered, unloaded and set in place?
    - Response: The scope of work was only to provide a connection for a portable generator. Temp Generator is not part of GC scope. Owner to furnish and install.

- The electrical site plan E-1 does not make reference of the fence grounding requirements.
    - Response: Grounding is not required.

- Mechanical notes call for roof receptacles within 25' of all equipment, however we could not find these on the electrical drawings. Please advise the locations, circuits and panels.

- Response: Locations of the receptacles can be found on sheets E-20 (note by symbol 14) and E-21 (note by symbol 2) of the package that was signed/sealed on 4/20/18.

Technology

- TELECOMM & IT SYSTEM: Section 1.06.A.1 on 01 11 00-2 states Telecomm & IT System components are by the Owner. However, on the Bid Cost Breakdown Sheet they are listed as a Base Bid Item and as Bid Option (Alternate) 3. Please clarify.
  - Response: IT Systems equipment will be by owner.

- INTRUSION DETECTION SYSTEM: Section 1.06.B.1 on 01 11 00-2 states the Owner will install the Intrusion Detection System only in the Weapons Vaults and the contractor is to employ the IDS contractor for the remainder of the project. Is this correct?
  - Response: There is no IDS work in this project, specification will be updated.

- IT SYSTEM: Option #3 is for furnishing a "Full" IT System including Upgrades. Paragraph 1.06.A on 01 11 00-2 states the Telecomm and IT Systems will be contracted separately by the Owner. Is there a possibility of a double-up in scope of work?
  - Response: Base Bid refers to only room C111 and a new cable to A134 and is not duplicated in Option 3.

<u>Questions to Owner:</u>

- ATTACHMENT A- COST BREAKDOWN FORM: A) Can you re-issue Attachment A in an Excel format? We receive bids from subcontractors nearly right up to bid time and they sometimes are the low bids. Having Attachment A in Excel would help expedite being able to review the last minute bids and enter the dollar amounts on the form. Also, having the figures typed in lieu of hand written would make for a more legible form. B) Several columns on the form are blacked out. Are we to only fill in the column labeled "Total"?
  A) Response: No, the form will not be re-issued in Excel. B) Yes, if blacked out then only total is to be filled

- 3rd PARTY INSPECTORS: The 2nd last line above Project Total on the Cost Breakdown Sheet is for retaining a 3rd Party Inspector. Section 1.01.A "Special Inspector" and 1.01.C "Testing Agent" on 01 40 00-1 are both referred to as 3rd Party Inspectors. Is the cost for both of them to be entered on the line reading "3rd Party Inspector Cost Total"?
  - Response: The 3rd party inspector is not Section 1.01.A "Special Inspector" and 1.01.C "Testing Agent" on 01 40 00-1, these costs are separate from the 3rd party inspector. The cost of the 3rd party inspector is referenced in the 3rd party Guidelines and the Uniform General Conditions.

- HUB DOCUMENTS, SUB LIST & CONSTRUCTION SCHEDULE: Can we submit the HUB Documents, List of Subcontractors and Construction Schedule via e-mail within 24 hours after bid time? This

would allow us to focus more on properly completing the Bid Cost Breakdown Worksheet with last minute bids we receive.
    - Response: No. All documents required must be submitted by the due date and time listed in the solicitation document.

- BUILDING OCCUPANCY DURING CONSTRUCTION: Paragraph 1.05.B on 01 11 00-2 states the facility (meaning entire building) will be unoccupied during construction. During the Pre-Bid Meeting today (7/11/18) it was noted activities will be taking place inside the facility throughout construction. Please clarify as to whether or not the facility will be occupied.
    - Response: The facility will be occupied during the duration of construction.

- COST OF TEMPORARY UTILITIES FOR BUILDING: Paragraph 1.01.B states the contractor is to pay for all utilities during construction. The contractor will be working in various areas throughout the facility while at the same time the Owner will be actively occupying various areas adjacent to construction areas throughout the facility. Please advise if it would be more beneficial for the contractor to use the Owner's utilities during construction.
    - Response: Contractor will be using owner's utilities during construction.

- COST FOR TEMPORARY UTILITIES FOR PORTABLES: If cost of Temporary Utilities is by the Owner, will the Owner also pay for Temporary Utilities for the Portable Restroom Building and the Portable Shower Building?
    - Response: Utility costs for portable (showers/restrooms) will be covered by the owner.

- SUBMISSION OF RFIs: Paragraph 3.A on Page 2 of the Invitation to Bid states all RFIs are to go to Jennifer Escamilla and Paragraph 3.D states contact with personnel other than contact listed above will be grounds for bid response disqualification. During the Pre-Bid Meeting today, it was noted all RFIs are to go to the attention of Van Cashen with the firm Freese and Nichols. Please clarify.
    - Response: Clarification: all questions are to be submitted to OED Contracting POC during bidding. All instances of Jennifer Escamilla should be replaced with Lanette Thaler.

- WORKING HOURS: Due to the noise level of demolishing concrete, will the contractor be restricted from demolishing concrete during any certain hours of the day?
    - Response: No.

- WASTE MANAGEMENT: During the Pre-Bid Meeting it was noted a Waste Management Plan might not be required. Paragraph 1.06 on page 01 74 19-2 calls for a Waste Management Plan, and personnel to oversee the plan. Please clarify if this specification section pertains to this project.
    - Response: Yes, a Waste Management Plan is required for this project

STAR Weslaco RC – Qualified Contractor's Questions

- CONSTRUCTION TIME: During the Pre-Bid Meeting, someone in the audience said the contract time is 330 calendar days. Paragraph 15.C on Page 8 of 1386 has a blank line to be filled in with the number of days we think it will take. Is the later correct?
    - Response: In Section 15.C of the IFB, the Bidder is to write in the number of days they estimate it will take for the project to be substantially completed unless delayed by inclement weather.

- BUILDING PERMIT: During the Pre-Bid Meeting, someone in the audience said this project will not require a building permit because it's a Federal Project. Is this correct?
    - Response: Yes, it does not require a building permit because it is a State facility.

- SAW CUTTING vs. DEMO HAMMER DURING DEMOLITION: The facility will be actively occupied by the Owner throughout construction while a large area of concrete foundation will be removed. In an effort to lessen the noise level, will there be any requirement to sawcut the concrete slab into 18" x 18" slabs that can be removed by hand and only use the demo hammer at the grade beams?
    - Response: Means and methods are the responsibility of the contractor.

- BID EVALUATION: Paragraph 1 on Page 2 of 1386 refers to Bid Evaluations. What will be the grading criteria be to determine the best value to the State of Texas and TMD?
    - Response: Section 12 (Award) of the IFB states: "Award will be based on the most qualified, responsive, responsible Bidder and lowest price based on base bid and all alternates. TMD will consider best value for the state as directed by Texas Government Code 2155.074 when awarding a Contract."

- PRE-BID ATTENDANCE SHEETS: We would appreciate if you would be able to issue copies of the attendance sheets from the two days of Pre-Bid Meetings.
    - Response: The sign in sheets are provided in the addendum.
- JOBSITE SECURITY: Are we to furnish security personnel for the duration of the project or will the security the National Guard has in place suffice?
    - Response: The General Contractor (GC) is responsible for the security of materials, work-in-progress, and finished product.

- PORTABLE BUILDING SEWER CONNECTION: A) Paragraph 1.05.A on 13 34 23-3 states the Owner will extend utilities to the portable buildings. Does this include sanitary sewer or just water and electric.
    - Response: The contractor will be responsible for connecting all utilities to portable buildings

- Can we please receive a digital copy of the schedule of values sent to us via email?
    - Response: Answer: It is issued in email format, but not in Excel.

STAR Weslaco RC – Qualified Contractor's Questions

- If work is taking place within an occupied space, who will be responsible for removing the user's furniture and equipment?
    - Response: It will be the Unit's responsibility to move furniture/equipment.

- How many original and copies do we need to turn in of our bid proposal?
    - Response: For the purposes of this IFB, please submit one original and one copy of the bid response.

- How is the proposal package need to be turned in? In person, mail, email?
    - Response: Per the IFB Cover Page: RETURN SEALED BIDS TO:

      Texas Military Department
      P. O. Box 5218
      Austin, TX 78763-5218
      OR HAND DELIVER TO:
      2200 W. 35th St..
      Building 11, 2nd Floor (8:00AM - 5:00PM)
      OR OVERNIGHT/EXPRESS MAIL TO:
      2200W. 35th St.
      Camp Mabry Mail Room (7:30AM - 4:00PM)
      ATTN: Lanette Thaler
      Austin, TX 78703

Please Print (or initial next to name to indicate attendance)

Pre-Bid Meeting **Date:** 11 JUL 2018	**Weslaco TXARNG Readiness Center** **at SM Readiness Center**		**Weslaco, TX**	TIME(S) 2:00 pm	
Name & E-mail Address	**Role**	**Mailing Address**	**Physical Address if different from mailing**	**Phone Fax Mobile**	
Rj Vargas Rj Vargas rogelio.vargas6.mil@cfmo.mil.texas.gov rogelio.vargas6.mil@mail.mil	Project Manager (PM)	Camp Mabry; Bldg. #37 P.O. Box 5218 Austin, TX 78763-5218	Camp Mabry; Bldg. #37 2200 W. 35th St. Austin, TX 78703	(512) 782-6071	Office Mobile
	Business Manager	Camp Mabry; Bldg. #37 P.O. Box 5218 Austin, TX 78763-5218	Camp Mabry; Bldg. #37 2200 W. 35th St. Austin, TX 78703	(512) 782-5715	Office Mobile
		Camp Mabry; Bldg. #11 P.O. Box 5218 Austin, TX 78763-5218	Camp Mabry; Bldg. #11 2200 W. 35th St. Austin, TX 78703		Office Mobile
	Unit Point of Contact (POC)				Office Mobile
Brian Hoot bryan.r.hoot.nfg@mail.mil	Maintenance Manager	Camp Mabry; Bldg. #35	Camp Mabry; Bldg. #35	(512) 496-8049 (512) 496-8049	Office Mobile
Michael Torres Mtorres@Interlexfleury.com	Estimater	1301 Business Park Dr Mission TX 78547		956-483-0356	Office Mobile
Frank Meza frankm@tabezaholdings.com	Tabeza Holdings	4121 N. 10th St McAllen TX 78504		956 739 8601	Office Mobile
Ray Sustaita rays@tabezaholdings.com	TH	" "		956 569 2384	Office Mobile

Please Print (or initial next to name to indicate attendance)

Pre-Bid Meeting	**Weslaco TXARNG Readiness Center**		
Date: 11 Jul 2018	**at SM Readiness Center**	**Weslaco, TX**	2:00 pm

Please Print (or initial next to name to indicate attendance) **Name & E-mail Address**	**Role**	**Mailing Address**	**Physical Address if different from mailing**	**Phone** **Fax** **Mobile**	
MICHAEL MONTALVO che@holchemont.com	PM.	900 N. MAIN St. MCALLEN TX 78501	W: 956.686-2901	C: 956.212.4915.	Phone
				956.686 2925	Fax
RAMIRO PECINA R.pecina@supervisorslaw.com	Estimator	600 Ash Ave McAllen Texas 78501		682-6005	Mobile
Jarrod Neck				793-9971	Phone
econgroup3025@gmail.com	Intern	3025 S. Sugar Edinburg TX 78539			Fax
				956-289-8005	Mobile
JAIME ENRIQUEZ, PE		3025 S. SUGAR RD		956.259.8005	Phone
jenriquez@econgroup.us	PROJECT ENGINEER	EDINBURG TX 78539		259.8009	Fax
					Mobile
Eddie Johnson		4412 W 83rd Suite B		232-2863	Phone
ejohnson@agd.-us.com		McAllen TX 78504			Fax
				331-9152	Mobile
Claudio Marroquin					Phone
Claudi@vintagetileing.net	Estimator	2020 W Nolana McAllen, TX	956	6318528	Fax
					Mobile
Cesar Ortez	Proj. Mng.	2020 W Nolana McAllen, TX			Phone
Vintage Tile + Stone					Fax
					Mobile
Van Cashen				817-734-7816	Phone
Vance Freese.com	A/E	405 International Plaza, ste 200 Ft Worth, TX 76109			Fax
					Mobile

Please Print (or initial next to name to indicate attendance)

Pre-Bid Meeting | **Weslaco TXARNG Readiness Center** | | |
Date: 11 Jul 2018 | **at SM Readiness Center** | **Weslaco, TX** | 2:00 pm

Please Print (or initial next to name to indicate attendance) **Name & E-mail Address**	**Role**	**Mailing Address**	**Physical Address** **if different from mailing**	**Phone** **Fax** **Mobile**	
Henry Herrera henry@smrconstructioninc.com SMR Construction	Project Manager	411 Industrial dr. suite109 Richardson, texas 75081		972-231-7272	Phone Fax Mobile
Samar Bashir samar@smrconstructioninc.com SMR Construction	President	"		972-231-7272	Phone Fax Mobile
ARTURO TREVIZO atrevizo@falkenbergconstruction.com FALKENBERG	PROJECT MANAGER	4850 SAMUELL BLVD. MESQUITE, TX. 75149	SAME	214-324-4779 214-324-9667 817-602-0264	Phone Fax Mobile
Jaime Tijerina jtijerina@ccc-inc.com	Proj mgr	320 N. mccoll McAllen TX 78501		956-905-5180 956-254-3009	Phone Fax Mobile
Romeo Rojas TELE PRO Communications romeo@Teleprocom...		12005 N Bryan Rd Mission TX 78573		956-618-2360	Phone Fax Mobile
Sara A. Orta trigensara@gmail.com Tri-Gen Construction	P. M	2900 N Texas Blvd Suite 201 Weslaco TX 78599		956 447 1048 956 447 2003 956 292 1765	Phone Fax Mobile
Jorge Gonzalez trigen24@gmail.com		2900 N Texas Blvd Suite 201 Weslaco TX 78599		956447 1048 956 533 1919	Phone Fax Mobile

Please Print (or initial next to name to indicate attendance)

Pre-Bid Meeting **Date:** 11 JUL 2018	**Weslaco TXARNG Readiness Center at SM Readiness Center**		**Weslaco, TX**	TIME(S) 2:00 pm	
Name & E-mail Address	**Role**	**Mailing Address**	**Physical Address if different from mailing**	**Phone Fax Mobile**	
Rj Vargas rogelio.vargas6.mil@cfmo.mil.texas.gov rogelio.vargas6.mil@mail.mil	Project Manager (PM)	Camp Mabry; Bldg. #37 P.O. Box 5218 Austin, TX 78763-5218	Camp Mabry; Bldg. #37 2200 W. 35th St. Austin, TX 78703	(512) 782-6071	Office Mobile
	Business Manager	Camp Mabry; Bldg. #37 P.O. Box 5218 Austin, TX 78763-5218	Camp Mabry; Bldg. #37 2200 W. 35th St. Austin, TX 78703	(512) 782-5715	Office Mobile
		Camp Mabry; Bldg. #11 P.O. Box 5218 Austin, TX 78763-5218	Camp Mabry; Bldg. #11 2200 W. 35th St. Austin, TX 78703		Office Mobile
	Unit Point of Contact (POC)				Office Mobile
Brian Hoot BHoot bryan.r.hoot.nfg@mail.mil	Maintenance Manager	Camp Mabry; Bldg. #35	Camp Mabry; Bldg. #35	(512) 496-8049 (512) 496-8049	Office Mobile
Bill Scoggins Scoggins Const. Co, Inc bill@scogginsconstruction.com	OWNER/ PRESIDENT	17862 GRAHAM RD HARLINGEN, TX 78552		956-421-3550 956-421 3154 956-778-6426	Office Mobile
Edward Delagarza edelagarza@cydesign.com Cont. Rep. DeLaGarza	COO/ QC	4112 N. McAllen TX 78504		956-232-2983 210-296-4572	Office Mobile
Rolando Rodriguez MALLITES mng. TXARNG					Office Mobile

Please Print (or initial next to name to indicate attendance)

Pre-Bid Meeting **Weslaco TXARNG Readiness Center**
Date: 11 JUL 2018 **at SM Readiness Center** **Weslaco, TX** 2:00 PM

Please Print (or initial next to name to indicate attendance) **Name & E-mail Address**	**Role**	**Mailing Address**	**Physical Address** **if different from mailing**	**Phone** **Fax** **Mobile**	
Charlie Flores cflores@alamoconcrete.com	Sales Manager	2020 Industrial Blvd Harlingen, TX 78550		956-739-4732	Phone Fax Mobile
					Phone Fax Mobile
					Phone Fax Mobile
					Phone Fax Mobile
					Phone Fax Mobile
					Phone Fax Mobile
					Phone Fax Mobile

Please Print (or initial next to name to indicate attendance)

Pre-Bid Conference — **WESLACO TXARNG Readiness Center**

2:00PM 11 July, 2018

Name & E-mail Address	Role	Mailing Address	Physical Address if different from mailing	Phone / Fax / Mobile	
Al Kupkowski	Estimator	Spaw Glass		956-412-9880	Office
Al Kupkowski		4909 E. Grimes #116			
al.kupkowski@spawglass.com		Harlingen, Tx. 78550		956-238-0733	Mobile
Dan Cameron	Project Manager	Spawglass		956 412 9880	Office
Dan.cameron@spawglass.com		4909 E GRIMES #116			
		Harlingen TX 78550		956 245 4573	Mobile
					Office
					Mobile
					Office
					Mobile
					Office
					Mobile
					Office
					Mobile
					Office
					Mobile

Please Print (or initial next to name to indicate attendance)

Pre-Bid Meeting	**Weslaco TXARNG Readiness Center**		
Date: 12 JUL 2018	**at SM Readiness Center**	**Weslaco, TX**	10:00 AM

Please Print (or initial next to name to indicate attendance) **Name & E-mail Address**	**Role**	**Mailing Address**	**Physical Address** **if different from mailing**	**Phone** **Fax** **Mobile**	
R. VARGAS rogelio.vargas6.mil@cfmo.mil.texas.gov	PM- TMD	2200 W. 35th St Austin TX		512 782 5149	Phone Fax Mobile
Van Cashen vmc@freese.com	A/E PM	4055 International plaza, Suite 200 Ft. Worth, TX 76109		817-734-7816	Phone Fax Mobile
BRYAN HOOT BRYAN.R.HOOT.NFG@Mail.mil	CFMO Maintenance			512.496.8049	Phone Fax Mobile
					Phone Fax Mobile
					Phone Fax Mobile
					Phone Fax Mobile
					Phone Fax Mobile

Please Print (or initial next to name to indicate attendance)

Pre-Bid Meeting	**Weslaco TXARNG Readiness Center**		
Date: 12 - JUL - 2018	**at SM Readiness Center**	**Weslaco, TX**	10:00 AM

Please Print (or initial next to name to indicate attendance) **Name & E-mail Address**	**Role**	**Mailing Address**	**Physical Address** **if different from mailing**	**Phone** **Fax** **Mobile**	
Michael Dodson Mikedodson@marshallcompanyinc.com	General Contr. Bidder	P.O. Box 4995 Corpus Christi, Texas 78469	1001 Second St. Corpus Christi, Texas 78403	(361)883-4369 (361)883-6265 (361)438-1975	Phone Fax Mobile
Jaime Tijerina jtijerina@ccc-inc.com	Proj. Mgr	301 N. McColl Suite 301 McAllen TX 78501		956-905-5180 956-254-3009	Phone Fax Mobile
Emmanuel Arias earias@teleprocommunications.com	Manager	12605 N Bryan Rd Mission TX, 78573	← same	956-618-2360	Phone Fax Mobile
Joe Garcia JGARCIA@trevinogroup.com	Division Manager + Partner	302 W Rhapsody Dr. San Antonio TX 78216	same	210-568-1547	Phone Fax Mobile
Atanacio Carrisal atanacio@amstarinegc.com	Project Manager	1211 Pleasanton Rd San Antonio, TX 78214		210-927-5705 210-557-7228	Phone Fax Mobile
Eli Javier Lopez eli@amstarinegc.com	Superintendent	522 S. Texas Blvd weslaco Tx.	same	210-748-0825	Phone Fax Mobile
Jessica Garcia jagarcia@trevinogroup.com	Office Manager/ PA	302 W. Rhapsody, San Antonio, TX 78216	"	210-568-1547 210-568-1576	Phone Fax Mobile