



# SPECIFICATIONS

Tropical Texas Behavioral Health  
HOP Villa Renovations  
Harlingen, TX.

More Attentive Service

Milnet Architectural Services, PLLC

608 S. 12th Street  
McAllen, Texas 78501

Phone: 956-688-5656  
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Project No. 217027
Set No:

**Tropical Texas Behavioral Health  
HOP Villa Renovations**

# PROJECT MANUAL

**Plans and Specifications – Project No. 217027**

**Tropical Texas Behavioral Health  
HOP Villa Renovations  
Harlingen, Texas 78550**



**TEXAS BOARD OF ARCHITECTURAL EXAMINERS**  
333 Guadalupe, Suite 2-350, AUSTIN, TX 78701-3942  
(Tel: 512/305-9000)  
HAS JURISDICTION OVER INDIVIDUALS LICENSED UNDER  
THE ARCHITECT'S REGISTRATION LAW  
ARTICLE 249a, VERNON'S CIVIL STATUTES".

**MILNET ARCHITECTURAL SERVICES, PLLC**  
**608 S. 12<sup>th</sup> St.**  
**McALLEN, TEXAS 78501**  
**(956) 688-5656 - FAX (956) 687-9289**

**Tropical Texas Behavioral Health**  
**HOP Villa Renovations**  
 Harlingen, Texas 78550  
 MAS Project No. 217027

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8/17/2018



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# TRINITY

MEP ENGINEERING

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### 1.1 PROJECT INFORMATION

- A. Notice to Proposers: Qualified Proposers are invited to submit proposals to Tropical Texas Behavioral Health, at 1901 S. 24<sup>th</sup> Avenue, Edinburg, Texas for Project as described in this Document according to the instructions to Proposers.
- B. Project Identification: **TROPICAL TEXAS BEHAVIORAL HEALTH HOP VILLA RENOVATIONS**
1. Project Location: 105 N. Loop 499, Harlingen, Texas 78550/Villa Community Center Revised Block 1 Lot 1, Acres 1.928, Cameron County, Texas.
- C. Owner: Tropical Texas Behavioral Health  
1901 S. 24<sup>th</sup> Ave.  
Edinburg, Texas 78539  
(956) 289-7000
1. Owner's Representative: W. Terry Crocker, CEO.
- D. Architect: Milnet Architectural Services  
608 South 12th Street  
McAllen, Texas 78501
- E. Construction Contract: Proposals will be received for the following work:
1. General Contract (all trades).

### 1.2 PROPOSAL SUBMITTAL AND OPENING

- A. SUBMITTAL:
- Owner will receive sealed proposals (1-Original and 4 Copies) until the proposal time and date at the location indicated below. Owner will consider proposals prepared in compliance with the instructions to Proposers issued by Owner, and delivered as follows:
1. Proposal Date: Wednesday, September 12, 2018
  2. Proposal Time: 4:00p.m., local time
  3. Location: Tropical Texas Behavioral Health, Front Desk  
1901 S. 24<sup>th</sup> Avenue, Edinburg, Texas 78539.
- B. OPENING:
- Proposals will be thereafter publicly opened and read aloud.
1. Date: Wednesday, September 12, 2018
  2. Proposal Time: 4:15pm, local time.
  3. Location: Tropical Texas Behavioral Health, Board Room,  
1901 S. 24<sup>th</sup> Avenue, Edinburg, Texas 78539.
- C. Any proposal received after the proposal date and time will not be accepted, it will be declined or returned via mail, no facsimiles, electronic mail or late arrivals will be accepted.

### 1.3 PROPOSAL SECURITY



- A. Proposers will be required to provide Proposal Security in the form of a Proposal Bond in the amount of 5 percent of the largest possible total proposal, including consideration of alternates, with each proposal. A Proposal Bond shall be issued by a Surety acceptable to the Owner and meeting the requirements of General Conditions of the Contract for Construction. Proposal Bonds shall be prepared on forms meeting all the requirements of applicable States of Texas statutes. Proposal Bonds shall be issued on forms acceptable to the Owner and shall include, as a minimum standard, the information, requirements and standard illustrated by AIA Document A310, latest revised edition available. Failure to provide the Proposal Bond with the proposal will constitute a non-responsive proposal and the proposal will not be considered.

#### 1.4 PRE-PROPOSAL CONFERENCE

- A. A pre-proposal conference for all proposers will be held at Tropical Texas Behavioral Health – 105 N. Loop 499, Harlingen, Texas on September 05, 2018, Wednesday at 3:00 p.m., local time. Prospective proposers are requested, and encouraged to attend; however, it is not mandatory.

#### 1.5 INSPECTION OF SITE

- A. The site is accessible for inspection upon notification to Belford Melvin, Safety Officer/Facilities Manager at (956) 227-4183 (cell). Proposers are encouraged to visit the site and assess existing conditions.

#### 1.6 DOCUMENTS

- A. Copies of the Proposal Documents, including Drawings and Project Manual (Proposal Requirements & Contract Forms, General Conditions of the Contract for Construction, Specifications) may be obtained, from the Architect's office at RGV Reprographics, Inc. at 519 S. Broadway, McAllen, by depositing \$250.00 in cash, check or money order payable to Milnet Architectural Services PLLC. Deposits will be refunded in full if the complete, undamaged Contract Documents are returned within **10 days** of the proposal Deadline date. Copies of the proposal Documents are on file at the Architect's office, Builders Exchange of Texas, and at the local Associated General Contractors (AGC) and Dodge Plan Rooms.

#### 1.7 PERFORMANCE, LABOR AND MATERIAL PAYMENT BONDS

- A. The successful offeror will be required to provide 100% Performance and Labor and Materials Payment Bonds in strict conformance with all the requirements of the Contract Documents. Failure to do so will result in cancellation of the contract award and forfeiture of the Proposal Bond security as liquidated damages.

#### 1.8 PROPOSAL WITHDRAWAL

- A. Proposals will be required to be submitted under a condition of irrevocability for a period of 60 days after submission.

#### 1.9 OWNER'S RIGHT OF REJECTION

- A. The Owner reserves the right to accept or reject any or all offers (competitive sealed proposals).

#### 2.0 INTERPRETATION OR CORRECTION OF PROCUREMENT DOCUMENTS

- A. The proposer shall carefully study and compare the Procurement and Contracting Documents with each other, and with other work being proposed concurrently or presently under construction to the extent that it relates to the Work for which the Proposal is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.
- B. Proposers and Sub-proposers requiring clarification or interpretation of the Procurement and Contracting Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Proposals. Submit all questions in writing to Milnet Architectural Services PLLC via email or fax to the following:
  - 1. Email: [juanmart@milnet-archservices.com](mailto:juanmart@milnet-archservices.com)

2. Fax: (956) 687-9289
3. Phone: No phone calls, verbal questions or inquiries, will be taken.

C. Interpretations, corrections and changes of the Procurement and Contracting Documents will be made by Addendum. Interpretations, corrections and changes of the Procurement and Contracting Documents made in any other manner will not be binding, and Proposers shall not rely upon them.

D. Last day for questions, requests for information, interpretations, clarifications or corrections shall be **September 10, 2018**, at 5:00 p.m., local time.

## 2.1 TIME OF COMPLETION AND LIQUIDATED DAMAGES

- A. Proposers shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time.
- B. Work is subject to liquidated damages, at a rate of \$500.00 per day beyond substantial completion date.

## 2.2 PROPOSER'S QUALIFICATIONS

- A. Reference Document **Section 08 71 00 INSTRUCTIONS TO PROPOSERS**.
- B. Proposers must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Proposer.

## 2.3 EVALUATION, SELECTION CRITERIA AND WEIGHTING

## 2.4 EVALUATION COMMITTEE

- A. An evaluation committee for Tropical Texas Behavioral Health will be evaluating and ranking the Request for Proposals for Construction Services.
- B. The ranking will be published once the evaluation and ranking is completed.
- C. The committee shall be comprised of the following:
  1. Chief Executive Officer
  2. Chief Operating Officer
  3. Chief Administrative Officer
  4. Chief Financial Officer
  5. Project Architect or Engineer
  6. Project Manager

## 2.5 SELECTION CRITERIA AND WEIGHTING

## 2.6 CONSTRUCTION EXPERIENCES: (0 to 4 points each item)

- A. Please list the health care/office building renovation projects constructed of similar size, type, and complexity to this project. Please provide in chronological sequence beginning with the recent. The list should include the name and location, project cost, a description of services the contractor provided for the project description, and project manager.
  1. Has your firm had direct experience with Tropical Texas Behavioral Health (-2 to 2 points)
  2. Has your firm had direct experience with the architect on this project? (-2 to 2 points)
  3. How long has your firm been in the construction business? Is your firm incorporated? Please list all of the assumed names the firm has operated under. (-2 to 2 points)

2.7 PAST PERFORMANCES: (0 to 4 points each item)

A. Provide three (3) letters of reference from OWNERS listed on item 1, which specifically address the following points. Ensure letters specifically address ALL points listed and are dated within three years. The letters will not count if not dated. (More than three letters may be provided less than three will result in one-point deduction for each letter missing).

1. The quality of the work provided by proposer.
2. The proposer's history of providing warranty documents.
3. The proposer's history of timeliness in completing warranty work.
4. The proposer's history of staying on schedule.
5. The proposer's cooperative attitude when working with the owner and its architect in
  - a. resolving construction issues.
  - b. The proposer's history of providing detailed documentation and a fair assessment of change (order pricing).

B. Provide six (6) letters of reference from three (3) major suppliers and three (3) subcontractors which specifically address the following point. Ensure letters are dated within three years. The letters will not count if not dated (More than three letters may be provided, less than six will result in one-point deduction for each letter missing)

1. The proposer's history of paying sub-contractors and material providers on time.

2.8 CHANGE ORDER PROCEDURES: (0 to 4 points each item)

A. Please provide a letter of reference from an Architectural firm addressing the following points. Ensure letter specifically address ALL points listed and are dated within three years. The letter will not count if not dated.

1. The proposer's history of providing detailed documentation and a fair assessment of change order pricing.
2. Please provide a recent example of an executed change order.

2.9 PERSONNEL: (0 to 4 points each item)

A. Please provide the names and complete resume of key supervisory personnel to be assigned to the project. Key personnel should have demonstrated experience on projects of similar size and complexity.

2.10 REPUTATION: (0 to 4 points each item)

A. Please provide relevant information addressing the following:

1. Has the proposer demonstrated a presence in the South Texas market?
2. Have past clients expressed a willingness to work with proposer again?
3. Has the proposer maintained a positive and professional reputation with past clients and architects?

2.11 FINANCIAL STRENGTH: (0 to 4 points each item)

A. Please provide the documents addressing each of the following:

1. Provide a copy of the most recent audited financial statements.
2. Provide a bank letter of reference with regard to the company's financial strength.
3. Please provide information from your performance and Payment Bonding Company with regards to your bonding capacity.
4. Provide a statement attesting if the company and/or company's principal(s) have ever filed for bankruptcy.

2.12 PRICE: (50 points)

A. Based on proposals submitted.

**INVITATION FOR BID AND AWARD**

Issued By: Janie Tovar  
Purchasing Supervisor  
Edinburg, TX 78539  
956-289-7007

Date Issued: August 27, 2018

Page No. 1

**INVITATION FOR BID FOR HOP Villa Renovations**– 105 N. Loop 499, Harlingen, Texas 78550/Villa Community Center Revised Block 1 Lot 1, Acres 1.928, Cameron County, Texas.

Sealed bids in duplicate, subject to the Terms and Conditions of this Invitation for Bids and the accompanying Specifications, such other contract provisions, drawings or other data as are attached or incorporated by reference in the Specifications, will be received at Tropical Texas Behavioral Health- Front Desk, Attn: Beatriz Trejo, CFO, 1901 South 24<sup>th</sup> Avenue, Edinburg, TX 78539 until **4:00 P.M. Central Time Wednesday, September 12, 2018**, and at that time publicly opened and read out loud at 4:15 P.M., for furnishing the supplies or services described in the accompanying specifications. Mark bid as **“HOP Villa Renovations Competitive Sealed Proposal - 2018”** For questions please call Belford Melvin, Safety Officer/Facilities Manager at 956-227-4183 (cell). Appointments may be made for site inspection.

GENERAL INFORMATION AND INSTRUCTION TO BIDDERS ARE CONTAINED IN THE TERMS AND CONDITIONS ON THE REVERSE SIDE

**SPECIFICATIONS**

**Bids may be submitted for the job as follows:**

**HOP Villa Renovations:**

Copies of the Proposal Documents, including Drawings and Project Manual (Proposal Requirements & Contract Forms, General Conditions of the Contract for Construction, Specifications) may be obtained, from the Architect’s office at RGV Reprographics, Inc. at 519 S. Broadway, McAllen

*Tropical Texas Behavioral Health is a Community Based Mental Health and Intellectual and Developmental Disabilities Center, and as such qualifies as a political subdivision of the State of Texas. The Center is exempt from sales tax and excise tax.*

**BASE PROPOSAL:**

Total Cost (in Word): HOP Villa Renovations - \$\_\_\_\_\_

Total Cost (Dollars): HOP Villa Renovations - \$\_\_\_\_\_

Date When Work Can Begin: \_\_\_\_\_

# of Days for Work to be Completed: \_\_\_\_\_

Name and Address of Bidder: \_\_\_\_\_ Signature of Person Authorized to Sign Bid: \_\_\_\_\_ Date of Bid: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signer’s Typed or Printed Name

Title

Phone Number

\_\_\_\_\_  
Fax Number

## **VIII. GENERAL CONDITIONS**

The following conditions and information applies to all proposals:

- a. Bidders shall thoroughly examine the drawings, specifications, schedules, instruction and all other contract documents.
  - b. Bidders shall make all investigations necessary to thoroughly inform themselves regarding the facilities for delivery of materials and equipment as required by the bid conditions. No plea of ignorance by the bidder of conditions that exist or that may hereafter exist as a result of failure or omission on the part of the bidder to make the necessary examinations and investigations, or failure to fulfill in every detail the requirements of the contract documents, will be accepted as a basis for varying the requirements of Tropical Texas Behavioral Health or the compensation to the vendor.
  - c. Bidders are advised that all Tropical Texas Behavioral Health contracts are subject to all legal requirements provided by state and federal statutes, rules and regulations.
1. **Preparation of Bids.** Bids will be prepared in accordance with the following:
    - a. All information required by the bid form shall be furnished. The bidder shall print or type his/her name and manually sign the specifications and each continuation sheet on which an entry is made.
    - b. Unit prices shall be shown, and where there is an error in extension of price, the unit price shall govern.
    - c. Alternate bids will not be considered unless authorized by the invitation for bids.
    - d. Propose delivery tie must be shown and shall include Sundays and Holidays.
    - e. Tropical Texas Behavioral Health is exempt from payment of federal taxes; State of Texas limited sales excise and use taxes. Bidders will not include such taxes in bid prices. An exemption certificate will be signed where applicable upon request.
  2. **Description of Supplies.** Any catalog or manufacturer's reference used in describing an item is merely descriptive and not restrictive, unless otherwise noted, and is used only to indicate type and quality of material. Bidders are required to state exactly what they intend to furnish, otherwise they shall be required to furnish the items specified.
  3. **Submission of Bids.**
    - a. Bids and changes thereto shall be enclosed in sealed envelopes addressed to the Chief Financial Officer, 1901 South 24<sup>th</sup> Avenue, Edinburg, TX. The name and address of bidder, the date and hour of the bid opening and the material or services bid on shall be placed on the outside of the envelope. Tropical Texas Behavioral Health is not responsible for the lateness of mail, courier, etc.
    - b. Bids must be submitted on the forms furnished.
    - c. Samples, when required, must be submitted within the time specified, at no expense to Tropical Texas Behavioral Health. If not destroyed or completely used during testing, samples will be returned upon request at the bidder's expense.
  4. **Right to Accept or Reject Any/Or All Proposals.** TTBH reserves the right to accept or reject any or all proposals submitted and to waive any informality in proposals received. TTBH also reserves the right to request additional information from proposers. TTBH may reject if the bidder misstates or conceals any material fact in the bid or the Bid does not strictly conform

to the law or requirements of the bid. No bid submitted herein shall be considered unless the bidder warrants that upon execution of a contract with TTBH, he will not engage in employment practices which have the effect of discrimination against employees or prospective employees because of race, color sex, creed, or national origin and will submit such reports as TTBH may thereafter require to assure compliance. TTBH may also waive any minor informalities or irregularities in any bid. The award will be made to the firm which, in the opinion of TTBH, is the best qualified and is in the best interest of TTBH.

5. Withdrawal of Bids. Bids may not be withdrawn after time set for the bid opening, unless approved by the Board of Trustees.
6. Late Proposals. Proposals received after the submission deadline shall be unopened and will be considered VOID AND UNACCEPTABLE. TTBH is not responsible for the lateness of mail, courier, etc.
7. Altering Proposal. Proposals cannot be altered after the submission deadline. Any interlineations, alteration, or erasure made before the opening must be initialed by the signer of the proposal.
8. Clarification or Objection to Bid Specifications. If any person contemplating submitting a bid for this contract is in doubt as to the true meaning of the specifications or other bid documents, or any part thereof, he may submit to the Chief Financial Officer on or before five (5) days prior to scheduled opening a request for clarification. All such requests for information shall be made in writing and the person submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed bid, if made, will be made only by Addendum duly issued. A copy of such Addendum will be mailed or delivered to each person receiving a set of bids. TTBH will not be responsible for any other explanation or interpretation of the proposed bid made or given prior to the award of the contract. Any objections to the specifications and requirements as set forth in this bid must be filed in writing with the Chief Financial Officer on or before five (5) days prior to scheduled opening.
9. Discounts. Prompt payment discounts will be considered in making the award provided the period of the discount offered is sufficient to permit payment within such period in the regular course of business. In connection with any discount offered, time will be computed from the date of receipt of supplies or services or from the date a correct invoice is received, whichever is the later date. Payment is deemed to be made on the date of mailing of the check.
10. Addenda. Any interpretations, corrections, or changes to this competitive sealed proposal will be made by addenda. Sole issuing authority of addenda will be vested in TTBH. Addenda will be mailed, faxed, or emailed to all parties that are known to have received a copy of the competitive sealed proposal.
11. Oral Interviews. Oral interviews may be required.
12. Proposals Retained. All proposals submitted become the exclusive property of TTBH.
13. Changes. No oral statement of any person shall modify or otherwise change or affect the terms, conditions, plans and/or specifications stated in the various proposal packages and/or proposal instructions/requirements.

14. Ethics. The proposer shall not accept or offer gifts or anything of value, nor enter into any business arrangement with any employee, official or agent of TTBH.
15. Minimum Standards for Responsible Proposer. A prospective proposer must affirmatively demonstrate proposer's responsibility. A prospective proposer must meet the following requirements:
  - A. Have adequate financial resources, or the ability to obtain such resources as required;
  - B. Be able to comply with the required or proposed delivery schedule;
  - C. Have a satisfactory record of performance; and
  - D. Be otherwise qualified and eligible to receive an award.
16. Rights to Request Additional Information. TTBH may request representation and other information sufficient to determine proposer's ability to meet these minimum standards listed above.
17. References. TTBH requires proposer to furnish, with this proposal, a list of at least three (3) references where like services have been supplied by the firm. Include the name of the business, address, and contact name and telephone number.
18. Documentation. Proposer shall provide, with this proposal response, all documentation required by this proposal. Failure to provide this information may result in rejection of the proposal.
19. Silence of Specifications. The apparent silence of these specifications as to any detail or to the apparent omission from it of a detailed description concerning any point shall be regarded as meaning that only the best practices are to prevail. All interpretations of these specifications shall be made on the basis of this statement.
20. Legibility. Proposals *must be* legible and of a quality that can be reproduced.
21. Vendor Proposal and Demonstration Costs. All costs incurred by the vendor associated with preparing proposal responses and demonstrating products or services shall not be charged to TTBH.
22. Sales Tax. TTBH is, by statute, exempt from State sales tax and Federal tax.
23. Time of Award. Award may be made during the October 2018 Board of Trustees meeting. TTBH reserves the right to schedule a Special Called Meeting on another date for the purpose of making the award.
24. Contract Award. Awarding of the contract will be made by TTBH's Board of Trustees. The term of this agreement will begin upon final execution of the contract by both parties and will extend until final acceptance of the completed project by TTBH.

The following provisions may apply to the contract with the contracting firm:

- a. Contract. TTBH reserves the right to negotiate a contract with the selected proposer. This proposal, when properly accepted by TTBH, shall constitute a contract equally binding



between the successful proposer and TTBH. No different or additional terms will become part of this contract.

- b. Payment Method. Payment will be a lump sum fee agreement with payments distributed throughout the life of the project based upon percentages or work completed. Any additional services contracted for will likewise be lump sum.
- c. Indemnification. The proposer will indemnify TTBH against any claims, demands, and judgments of sums of money to any party accruing against TTBH for the loss of life or injury or damage to persons or property growing out of or resulting from this agreement.
- d. Termination for Default. TTBH reserves the right to enforce the performance of this contract in any manner prescribed by law or deemed to be in the best interest of TTBH in the event of breach of default of this contract. Non-performance of the proposer in terms of specifications shall be a basis for the termination of the contract by TTBH. TTBH shall not pay for services which are unsatisfactory. Vendors will be given a reasonable opportunity before termination to correct the deficiencies. This, however, shall in no way be construed as negating the basis for termination for non-performance.
- e. Independent Contractor. The Contractor will be considered an independent contractor and not an employee of TTBH for any purpose. TTBH will not withhold or pay on behalf of Contractor any sums for income tax, unemployment insurance, social security, or any other withholding, or make available to bidder any of the benefits, including workers' compensation insurance coverage, afforded to employees of TTBH. All such benefits, if any, are the sole responsibility of the bidder.
- f. Insurance. Contractor agrees to maintain at its sole cost and expense policies of general and liability insurance coverage in order to insure bidder and TTBH against any claim for damages arising in connection with bidder's responsibilities under the contract. The Contractor shall furnish copies of the general and liability insurance policies and a certificate of insurance to TTBH prior to execution of the contract.
- g. Payment and Performance Bonds. The successful bidder(s), if the contract exceeds \$25,000, will be required to furnish a Payment Bond in the amount of One Hundred Percent (100%) of the contract price. A Performance bond in the amount of the one hundred percent (100%) of the contract price will be required if the contract amount exceeds \$100,000. In either case, the bond(s) must be issued by one or more corporate sureties qualified to do business in Texas and acceptable to TTBH.
- h. Certification of Child Support Payment Obligor. Under Section 231.006 (Texas Family Code related to child support), a Contractor is considered ineligible to receive payments from TTBH in the event the Contractor is past due on child support payments.
- i. Confidentiality of Information and Prohibition Against Disclosure. In accordance with Texas Health and Safety Code, Chapter 611, and the Texas Administrative Code, Chapter 414, Subchapter A, "*Protected Health Information*", the bidder may not disclose confidential communications or records except as provided by Section 611.004 or 611.0045.
- j. Contractual Abeyance or Bar. Prior to the execution of the agreement, the Contractor

must notify Center if the Contractor is or becomes held in abeyance or barred from the award of a federal or state contract during the term of the contract.

- I. Personal Protective Equipment: Contractors performing services on TTBH's properties shall adhere to but not be limited by the 2013 Uniform General Conditions, Article 7. The contractor shall furnish, at its own cost, Personnel Protective Equipment for its employees and site managers as required by OSHA regulations (29 CFR 1910 and 29 CFR 1926).

## **IX. PROCEDURES FOR SUBMITTING COMPETITIVE SEALED PROPOSAL**

Submit one (1) original and four (4) copies of the Proposal and any attachments in a sealed envelope, marked "**HOP Villa Renovations Competitive Sealed Proposal - 2018**" Proposals must be received **no later than 4:00p.m. CTS, Thursday, September 12, 2018**. Proposals should be addressed to:

Attn: Beatriz Trejo  
Chief Financial Officer  
Tropical Texas Behavioral Health  
1901 South 24<sup>th</sup> Avenue (78539)/P.O. Drawer 1108  
Edinburg, Texas 78540-1108 Phone: (956) 289-7015

If hand delivered must be delivered to the front desk no exceptions. Tropical has the right to reject any or all proposals to waive formalities and reasonable irregularities in submitted documents as it deems to be in its best interest, and is not obligated to accept the lowest proposal. TTBH will not be responsible for any proposals lost in the mail or not delivered by the stated deadline for any reason.

## **X. BOARD OF TRUSTEES APPROVAL**

TTBH's Board of Trustees will make the final selection of the award, if any, on the October 2018 meeting.

TTBH reserves the right to reject, for any reason and at its sole discretion, in total or in part, any and/or all proposals, regardless of comparability for price, terms or any other matter, to waive any formalities, and to negotiate on the basis of the proposals received for the most favorable terms and best service for TTBH. If an architectural firm is selected, TTBH will execute a contract. If TTBH's funding is materially decreased during the contract term, the contract may be amended and/or terminated.

No contract shall be deemed to exist between TTBH and any contractor until a mutually acceptable, comprehensive and binding agreement has been executed by TTBH and that firm. A countersigned copy of the qualifications proposal or any other preliminary written agreements shall not suffice to bind TTBH to any legal obligation of any kind whatsoever with regard to the work considered hereby.

## **XI. REQUEST FOR PROPOSAL INQUIRIES**

Direct proposal inquiries to Beatriz Trejo, Chief Financial Officer, at (956) 289-7015 (v), or by e-mail at [beatrejo@ttbh.org](mailto:beatrejo@ttbh.org).

**CONFLICT OF INTEREST (CIQ) QUESTIONNAIRE** **FORM CIQ**  
**For vendor or other person doing business with local governmental entity**

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This questionnaire is being filed in accordance with Chapter 176 of the Local Government Code by a person doing business with the governmental entity.

By law this questionnaire must be filed with the records administrator of the local government not later than the 7<sup>th</sup> business day after the date the person becomes aware of facts that require the statement to be filed. See Section 176.006, Local Government Code.

A person commits an offence if the person violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor.

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1. Name of person doing business with local governmental entity.

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2.  Check if you are filing an update to a previously filed questionnaire.

(The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than September 1 of the year for which an activity described in Section 176.006(a), Local Government Code, is pending and not later than the 7<sup>th</sup> business day after the date the originally filed questionnaire becomes incomplete or inaccurate.)

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3. Describe each affiliation or business relationship with an employee or contractor of the local governmental entity who makes recommendations to a local government officer of the local governmental entity with respect to expenditure of money.

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4. Describe each affiliation or business relationship with a person who is a local government officer and who appoints or employs a local government officer of the local governmental entity that is the subject of this questionnaire.

**CONFLICT OF INTEREST (CIQ) QUESTIONNAIRE**  
**For vendor or other person doing business with local governmental entity**

**FORM CIQ**  
**Page 2**

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5. Name of the local government officer with who filer has affiliation or business relationship. (Complete this section only if the answers to A, B, or C is YES.)

This section, item 5 including subparts A, B, C & D, must be completed for each officer with whom the filer has affiliation or business relationship. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income from the filer of the questionnaire?  Yes  No

B. Is the filer of the questionnaire receiving or likely to receive taxable income from or at the direction of the local government officer named in this section AND the taxable income is not from the local governmental entity?  Yes  No

C. Is the filer of this questionnaire affiliated with a corporation or other business entity that the local government officer serves as an officer or director, or holds an ownership of 10 percent or more?  Yes  No

D. Describe each affiliation or business relationship.

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6. Describe any other affiliation or business relationship that might cause a conflict of interest.

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7.

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Signature of person doing business with the governmental entity

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Date



**TROPICAL TEXAS BEHAVIORAL HEALTH**

**Notice of Felony Conviction**

Any person or business entity, other than a publicly-held corporation, must submit a completed version of this notice form with the bid indicating whether the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony, if any.

If the Owner determines that the person or business entity gave false or misleading information in this notice, or misrepresented the conduct resulting in the conviction, the Owner may terminate the contract after compensating the person or business entity for services performed before the termination of the contract.

I, \_\_\_\_\_, the undersigned owner of the business entity named herein, certify that the information I have provided herein is true and correct and within my personal knowledge.

Type of Business Entity (e.g., sole proprietorship, partnership, limited partnership, limited liability company, close corporation, publicly-held corporation, etc.): \_\_\_\_\_

Name of Business Entity: \_\_\_\_\_

Address of Principal Place of Business: \_\_\_\_\_

Mailing Address: \_\_\_\_\_ Phone: \_\_\_\_\_

*(all business entities other than publicly-held corporations must complete the following)*

\_\_\_ No owner or operator of the business entity named herein has ever been convicted of a felony.

\_\_\_ The business entity named herein is owned or operated by the following person(s) who has (have) been convicted of a felony:

Name: \_\_\_\_\_; Reason for conviction: \_\_\_\_\_; Date of conviction: \_\_\_\_\_; Dates and Place of Incarceration: \_\_\_\_\_; Probation/Parole Status: \_\_\_\_\_

Name: \_\_\_\_\_; Reason for conviction: \_\_\_\_\_; Date of conviction: \_\_\_\_\_; Dates and Place of Incarceration: \_\_\_\_\_; Probation/Parole Status: \_\_\_\_\_

Name: \_\_\_\_\_; Reason for conviction: \_\_\_\_\_; Date of conviction: \_\_\_\_\_; Dates and Place of Incarceration: \_\_\_\_\_; Probation/Parole Status: \_\_\_\_\_

Name: \_\_\_\_\_; Reason for conviction: \_\_\_\_\_; Date of conviction: \_\_\_\_\_; Dates and Place of Incarceration: \_\_\_\_\_; Probation/Parole Status: \_\_\_\_\_

Date: \_\_\_\_\_ Owner: \_\_\_\_\_

SECTION 00 52 13 — AGREEMENT FORM - STIPULATED SUM

PART 1 - GENERAL

1.1 AGREEMENT FORM:

- A. The modified “Standard Form of Agreement Between Owner and Contractor where the Basis of Payment is a Stipulated Sum”, AIA Document A101, 2007 Electronic Format Edition, will be the form used as a Contract for this Project.
- B. General Condition AIA – A201 will be used in this project. See attached
- C. A copy of the Standard AIA Document may be examined at the office of the Architect. Copies may be purchased from the American Institute of Architects, 1735 New York Avenue, N.W., Washington, D.C., 20006.
- D. Modification may be made to the above Agreement & General Conditions A201 form or an Owner provided agreement and general conditions may be utilized. Either of which will be provided to contractor for review upon award of project, for final execution of the contract. See attached.
- E. Section 00 73 00 Supplementary Conditions forms part of this Agreement.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

## SECTION 01 11 00 - SUMMARY

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 SUMMARY OF WORK

- A. Project Identification: As follows:
  - 1. Project: HOP Villa Renovations
  - 2. Owner: Tropical Texas Behavioral Health
  - 3. Location: 105 N. Loop 499, Harlingen, TX 78550
- B. Contract Documents, dated August 20, 2018 were prepared by Milnet Architectural Services, 608 S. 12<sup>th</sup> St. McAllen, TX. 78501.
- C. The Work consists of the interior renovation of a 22,000SF existing building, renovation consists of replacing flooring, painting, new plumbing fixtures, new doors, replacing HVAC, replacing windows. Also as part of renovation a 750SF covered walkway will be provided at the main entrance along with a building marquee, project site is located at 105 N. Loop 499 Harlingen, Texas 78550.

#### 1.3 WORK RESTRICTIONS

- A. Contractor's Use of Premises: During construction, Contractor shall have **limited** use of **site** indicated. Contractor's use of premises is limited only by Owner's right to perform work or employ other contractors on portions of Project.
- B. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.
- C. Move any stored Products, under Contractor's control, which interfere with operations of the Owner and separate contractor.



PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

## SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 UNIT PRICES

- A. Changes to the Work incorporating Unit Prices will be made by Change Order.

#### 1.3 CONTRACT MODIFICATION PROCEDURES

- A. On Owner's approval of a proposal from Contractor, Architect will issue a Change Order on AIA Document G701, for all changes to Contract Sum or Contract Time.
- B. When Owner and Contractor disagree on the terms of a proposal, Architect may issue a Construction Change Directive on AIA Document G714, instructing Contractor to proceed with the change. Construction Change Directive will contain a description of the change and designate the method to be followed to determine changes to Contract Sum or Contract Time.

#### 1.4 PAYMENT PROCEDURES

- A. Submit a Schedule of Values **at least 10 days before** the first Application for Payment. In Schedule of Values, break down Contract Sum into at least one line item for each Specification Section. Correlate the Schedule of Values with Contractor's Construction Schedule.
- B. Submit 3 copies of each application for payment on AIA Document G702/703, according to the schedule established in Owner/Contractor Agreement.
  - 1. For the second Application for Payment through the Application for Payment submitted at Substantial Completion, submit partial releases of liens from each subcontractor or supplier for whom amounts were requisitioned in the previous Application for Payment.
  - 2. Submit final Application for Payment after completion of Project closeout procedures with release of liens and supporting documentation. Include consent of surety to final payment and insurance certificates.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 21 00 — ALLOWANCES

PART 1 - GENERAL

1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 RELATED DOCUMENTS

- A. Section 01 20 00 – Price and Payment Procedures.

1.3 CONTINGENCY ALLOWANCE

- A. Include in the Contract, a stipulated sum of One Hundred and Fifty Thousand Dollars (\$150,000.00) for use upon Architect's instruction.
- B. Include in the Contract, a stipulated sum of Fifteen Thousand Dollars (\$15,000.00) for use upon Architect's instruction for Fire Protection Repairs.
- C. Include in the Contract, a stipulated sum of Fifty Five Thousand Dollars (\$55,000.00) for use upon Architect's instruction for Landscaping.

1.4 PROCEDURES FOR MANAGING ALLOWANCES

- A. Contractor's costs for Products, delivery, installation, labor, payroll, taxes, bonding, and equipment rental will be included in Construction Change Directives authorizing expenditure of funds from Allowances.
- B. Funds will be drawn from Allowances only by Construction Change Directives.
- C. At closeout of Contract, funds remaining in Allowances will be credited to Owner by Change Order.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

## SECTION 01 25 00 – SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 SUBSTITUTION REQUIREMENTS

- A. When material, article, or method is specified using name of proprietary product manufacturer, vendor, or method followed by phrase "or equal," specific item mentioned establishes basis upon which projects are to be built.
  - 1. Other manufacturers' materials, articles, and methods not named will be considered as substitutions provided required information is submitted on "SUBSTITUTION REQUEST FORM" and will not require substantial revisions of Contract Documents.
  - 2. This applies to specific construction methods when required by Contract Documents.
  - 3. Substitution Requests must be filled out on enclosed "Substitution Request Form".
- B. Whenever material, article, or method is specified or described without phrase "or equal," no substitutions will be allowed.
- C. Costs for redesigns due to substituted items are responsibility of Applicant.
- D. In making request for substitution, Applicant/Contractor represents that he:
  - 1. Has personally investigated proposed product or method and determined that it is equal in all respects to that specified.
  - 2. Will provide same guarantee for substitution as for product or method specified.
  - 3. Will coordinate installation of accepted substitution into work, making design and construction changes to complete work in all respects following the Contract Documents.

#### 1.3 SUBMITTAL OF DATA FOR PROPOSED SUBSTITUTIONS

- A. In order for substitutions that do not change design intent to be considered, submit no later than 10 days prior to bid date deadline, 3 copies of complete data set forth herein to permit complete analysis of proposed substitutions listed on submitted "SUBSTITUTION REQUEST FORM".

1. For Products:
  - a. Identification including manufacturer's name and address.
  - b. Manufacturer's literature, including but not necessarily limited to:
    - 1) Product description, performance, and test data.
    - 2) Reference standards.
  - c. Samples where appropriate.
  - d. Name and address of similar projects on which product was used and dates of installation with contact name and telephone number.
2. For Construction Methods:
  - a. Detailed description of proposed method.
  - b. Drawings illustrating methods.
  - c. Name and address of similar projects on which method was used and dates of use with contact name and telephone number.
3. Comparison of proposed substitution with product or method specified
4. Data relating to impact on construction schedule by proposed substitution.
5. Impact on other contracts.

#### 1.4 APPROVAL OF SUBSTITUTION

- A. Architect's decision regarding evaluation of substitutions will be final and binding.
- B. All approved substitutions will be incorporated into the Contract Documents by Addendum.

PART 2 - PRODUCTS  
NOT USED

PART 3 - EXECUTION  
NOT USED

### SUBSTITUTION REQUEST FORM

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Project: \_\_\_\_\_ Substitution Request Number: \_\_\_\_\_  
\_\_\_\_\_  
From: \_\_\_\_\_  
To: \_\_\_\_\_ Date: \_\_\_\_\_  
\_\_\_\_\_  
A/E Project Number: \_\_\_\_\_  
Re: \_\_\_\_\_ Contract For: \_\_\_\_\_

---

Specification Title: \_\_\_\_\_ Description: \_\_\_\_\_  
Section: \_\_\_\_\_ Page: \_\_\_\_\_ Article/Paragraph: \_\_\_\_\_

---

Proposed Substitution: \_\_\_\_\_  
Manufacturer: \_\_\_\_\_ Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
Trade Name: \_\_\_\_\_ Model No.: \_\_\_\_\_

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

---

Submitted by: \_\_\_\_\_

Signed by: \_\_\_\_\_

Firm: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Telephone: \_\_\_\_\_

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#### A/E's REVIEW AND ACTION

- Substitution approved - Make submittals in accordance with Specification Section 01340 Submittals
- Substitution approved as noted - Make submittals in accordance with Specification Section 01340 Submittals
- Substitution rejected - Use specified materials.
- Substitution Request received too late - Use specified materials.

Signed by: \_\_\_\_\_

Date: \_\_\_\_\_

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Supporting Data Attached:  Drawings  Product Data  Samples  Tests  Reports  \_\_\_\_\_

END OF SECTION



## SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 PROJECT MANAGEMENT AND COORDINATION

- A. Verify layout information shown on Drawings, in relation to property survey and existing benchmarks, before laying out the Work.
- B. Coordinate construction to ensure efficient and orderly execution of each part of the Work.
- C. Progress meetings will be held at Project site every two weeks. Notify Owner and Architect of meeting dates. Each subcontractor or other entity concerned with current progress or involved with planning or coordination of future activities, shall attend. The Contractor shall:
  - 1. Prepare a progress meeting agenda.**
  - 2. Prepare a sign in sheet for each progress meeting.**
  - 3. Prepare minutes of each meeting and distribute to parties present.**

#### 1.3 CONSTRUCTION SCHEDULE

- A. Prepare a horizontal bar-chart construction schedule. Provide a separate time bar for each activity and a vertical line to identify the first workday of each week. Use same breakdown of Work indicated in the Schedule of Values. As Work progresses, mark each bar to indicate actual completion.
  - 1. Submit within twenty (20) days after date established for Commencement of the Work.
  - 2. Coordinate each element with other activities. Show each activity in proper sequence. Indicate sequences necessary for completion of related Work.
  - 3. Indicate Substantial Completion and allow time for Architect's procedures necessary for certifying Substantial Completion.
  - 4. Schedule Distribution: Distribute copies to Owner, Architect, subcontractors, and parties required to comply with dates.

5. Updating: Revise the schedule after each meeting or activity where revisions have been made. Distribute revised copies to Owner, Architect, subcontractors, and parties required to comply with dates.

#### 1.4 SUBMITTAL PROCEDURES

- A. Coordinate submittal preparation with construction schedule, fabrication lead-times, other submittals, and activities that require sequential operations.
  1. No extension of Contract Time will be authorized due to failure to transmit submittals in time to permit processing sufficiently in advance of when materials are required in the Work.
  2. Architect will not accept submittals from sources other than Contractor.
- B. Prepare submittals by placing a permanent label on each for identification. Provide a 4 by 5 inch space on the label or beside title block to record review and approval markings and action taken. Include the following information on the label:
  1. Project name.
  2. Date.
  3. Name and address of Contractor.
  4. Name and address of subcontractor or supplier.
  5. Number and title of appropriate Specification Section.
  6. Contractor's certification that materials comply with specified requirements.
- C. Coordinate each submittal with other submittals and with work that does not require submittals.
- D. Product Data: Mark each copy to show applicable choices and options. Include the following:
  1. Data indicating compliance with specified standards and requirements.
  2. Notation of coordination requirements.
  3. For equipment data, include rated capacities, dimensions, weights, required clearances, and furnished specialties and accessories.
- E. Shop Drawings: Submit newly prepared information drawn to scale. Do not reproduce Contract Documents or copy standard information. Submit 1 reproducible print and 1 blue- or black-line print on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches. Architect will return the reproducible print. Include the following:
  1. Dimensions, profiles, methods of attachment, coordination with adjoining work, large scale details, and other information, as appropriate for the Work.
  2. Identification of products and materials.
  3. Notation of coordination requirements.
  4. Notation of dimensions established by field measurement.
  5. Identification of deviations from Contract Documents.
- F. Samples: Submit Samples finished as specified and identical with the material proposed. Where variations are inherent in the material, submit sufficient units to show limits of the variations. Include product name or name of the manufacturer.
- G. Architect will review each submittal, mark as appropriate to indicate action taken, and return copies less those retained. Compliance with specified requirements remains Contractor's responsibility.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

## SECTION 01 33 00 - SUBMITTALS

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Provide shop drawings, product data, physical samples and color samples as indicated herein and in each technical section of these specifications.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Additional submittal requirements specific to the particular section of the specifications.

### PART 2 - PRODUCTS

#### 2.1 SHOP DRAWINGS

- A. Prepare shop drawings using competent draftsmen, clearly and precisely showing the following:
  - 1. The size and gage of members.
  - 2. The method of anchoring and securing members of parts together.
  - 3. The quantity and location of each item.
  - 4. Other pertinent data necessary to show the Work to be done and where and how it is to be done.
- B. Prepare Drawings to scale, including full size details as required to fix and illustrate the Work required. Do not use Contract Documents or reproductions thereof as shop drawing submittals.
- C. Each sheet of Drawings shall be 30 x 40 inches maximum size with borders. Provide a title block in the lower right hand corner with the following information:
  - 1. Title of the sheet.
  - 2. Name and location of Project.
  - 3. Names of:
    - a. Architect/Engineer.
    - b. General Contractor.
    - c. Manufacturer of the specified materials and equipment.

4. The date of the Submittal.
  5. The date of each correction or revision.
  6. **Submittal number including Division No.** (such as submittal no. 3 under Division 11 is numbered "11-03").
- D. Fold drawings to 8-1/2x11 inch dimensions with title block exposed to top.
- E. Check the Drawings and add any corrections of field measurements needed. Stamp and sign the Contractor's approval, checker's signature, and date of approval before submitting to the Architect. Shop Drawings which do not bear the Contractor's stamp or have not been reviewed by the Contractor, will be returned by the Architect without review or approval.
- F. Number Shop Drawings consecutively. Indicate working and erection dimensions, arrangements, sectional views, necessary details including complete information for making connections with other Work, kinds of materials, and finishes.
- G. Provide a transmittal letter in duplicate, pointing out any deviations from items, methods or named manufacturers included in the Specifications or on the Drawings. Note submittal file number including Division.
- H. Submit ~~six~~ **(6)** blue line prints of each Shop Drawing sheet.
- I. Make such corrections, changes, resubmit bound sets of Shop Drawings prints, as required herein, until approved is obtained. Any corrections or changes indicated on Shop Drawings shall not be considered as an extra work order.

## 2.2 PHYSICAL SAMPLES

- A. Provide duplicate samples of items as specified. Samples shall be 12 inches square or 12 inches long unless noted otherwise. Minimum liquid samples shall be 1 pint. Installed materials shall match approved samples.
- B. For Architect's permanent files provide one (1) 6" x 6" sample of all interior finishes, colors and materials (aluminum finish, glazing, plastic laminate, paint finish flooring materials, ceiling finish, etc.)
- C. Provide a transmittal letter with each sample, listing the following:
1. Specification section title and paragraph specifying the material.
  2. Name and location of Project.
  3. Names of:
    - a. Architect/Engineer.
    - b. General Contractor.
    - c. Manufacturer of the specified materials and equipment.
  4. The date of the Submittal.
  5. Submittal file number including Division.
- D. If samples are not acceptable they will be returned directly to the Contractor for modification and resubmission.
- E. If samples are acceptable, notification will be sent directly to the Contractor, and the sample retained for comparison with the complete Work.

## 2.3 MANUFACTURER'S PRODUCT DATA

- A. Provide **six (6)** copies of pre-printed Product Data of items as specified. Carefully mark out all items not applicable to the specified item.
- B. Standard catalogs, brochures, etc. including information not applicable to the project and not marked through, will be returned without review or approval.
- C. Provide a transmittal letter with the Product Data from each manufacturer, listing the following information:
  - 1. Name and location of Project.
  - 2. Names of:
    - a. Architect/Engineer.
    - b. General Contractor.
    - c. Manufacturer of the specified materials and equipment.
  - 3. The date of the Submittal.
  - 4. Submittal file number including Division.
- D. If Product Data is not approved, one copy will be marked and returned directly to the Contractor for modification and resubmission.
- E. If Product Data is approved, notification and one copy of the acceptable Product Data will be sent directly to the Contractor.
- F. When requested by the Architect, provide six (6) copies of each ASTM Federal Specification, or other applicable documents referenced in the material Section.

## PART 3 - EXECUTION

### 3.1 REVIEW PROCEDURE

- A. Submittals will be reviewed with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. Architect shall be allowed a maximum review period of **fourteen (14)** calendar days. The review of a separate item shall not indicate a review of an assembly in which the item functions. Submittals that contain excessive errors or that are incomplete will be returned without review and approval and any delay caused thereby shall be the responsibility of the Contractor.
- B. If any submittals are not approved as submitted, all copies will be returned directly to the Contractor for revision. The reviewed submittals will be returned to the Contractor as soon as practicable.
- C. The Contractor shall make all revisions as noted and shall resubmit the required number of corrected copies of submittals, until no exceptions are taken. The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than those requested on previous submissions.
- D. The review of submittals shall not relieve the Contractor of responsibility for deviations from the requirements of the Contract Documents unless the Contractor has submitted, in writing, such deviations and written approval has been given to each specific deviation. The review shall not relieve the Contractor from responsibility for errors and omissions in the Shop Drawings and samples.

- E. No portion of the Work requiring a submittal shall commence until the submittal has been approved as designated in the Conditions of the Contract. All such portions of the Work shall be in accordance with the submittal that has been stamped with final “Reviewed Without Exceptions” note, or “Approved” note.
- F. Materials and equipment specified or approved prior to beginning the Work are required to be used on the Project. Any proposed substitution resulting from no availability of specified items must be proven “better than” by the Contractor and approved in writing by the Architect. Substitutions included in submittals shall be so noted and brought to the Architect’s attention in the submittal and on the transmittal. Failure to follow this procedure will render the substitution as not acceptable whether or not reviewed by the Architect.
- G. The Contractor shall have the approved shop drawings at the site at all times for use in the construction of the Work. Failure of the Contractor to supply such drawings will be deemed sufficient cause to delay the Work until such drawings are available for field use and reference.
- H. For submittals that will be reviewed by one of the Architect’s consultants, these submittals shall be delivered directly to the Architect. The Architect will then be responsible to provide the Consultant with a copy of the submittal.
- I. For submittals that will be reviewed by one of the Architect’s consultants, do not send to the Consultant as part of the package any items which will be reviewed by the Architect. As an example, do not provide a single submittal package combining Structural Steel and Miscellaneous Metal Fabrications.

END OF SECTION

## SECTION 01 35 16 — ALTERATION PROJECT PROCEDURES

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 SECTION INCLUDES

- A. Products and installation for patching and extending Work.
- B. Transition and adjustments.
- C. Repair of damaged surfaces, finishes, and cleaning.

#### 1.3 RELATED SECTIONS

- A. Section 01 11 00 – Summary: Work sequence and Phasing.
- B. Section 01 73 29 – Cutting and Patching: Requirements and limitations for cutting and patching of work.
- C. Section 01 50 00 – Temporary Facilities and Controls: Temporary enclosures, protection of installed work, and cleaning during construction.

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS FOR PATCHING AND EXTENDING WORK

- A. New Materials: As specified in product sections; match existing Products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing Products where necessary, referring to existing Work as a standard.



### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that demolition is complete and areas are ready for installation of new Work.
- B. Beginning of restoration Work means acceptance of existing conditions.

#### 3.2 PREPARATION

- A. Cut, move, or remove items as necessary for access to alterations and renovation Work. Store items scheduled for reinstallation. Replace and restore at completion.
- B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.
- C. Remove debris and abandoned items from area and from concealed spaces.
- D. Prepare surface and remove surface finishes to provide for proper installation of new work and finishes.
- E. Close openings in exterior surfaces to protect existing work, salvaged, and stored items from weather and extremes of temperature and humidity. Temporarily seal wall cavities and substrates exposed by cutting, patching, and demolition work to prevent accumulation and trapping of moisture which will allow the development of mildew.

#### 3.3 INSTALLATION

- A. Coordinate work of alterations and renovations to expedite completion sequentially. Do not remove existing items which weatherproof buildings (windows, roofing, doors, exterior finishes etc.) until new materials and items are ready for installation.
- B. Remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring products and finishes to specified condition. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes, in accordance with Section 01 73 29 – Cutting and Patching.
- C. Install Products as specified in individual sections.

#### 3.4 TRANSITIONS

- A. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.
- B. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division. Consult Architect for direction on making transitions.

#### 3.5 ADJUSTMENTS

- A. Where removal of partitions or walls result in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- B. Fit work at penetrations of surfaces as specified in Section 01 73 29 – Cutting and Patching.

3.6 REPAIR OF DAMAGED SURFACES

- A. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.
- B. Repair substrate prior to patching finish.

3.7 FINISHES

- A. Finish surfaces as specified in individual Product sections.
- B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

END OF SECTION

## SECTION 01 40 00 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 SECTION REQUIREMENTS

- A. Quality-control services include inspections, tests, and related actions including reports. Quality-control services are further specified in other Sections of these Specifications and shall be performed by independent testing agencies provided by Contractor or Owner, as specified.
  - 1. Unless otherwise indicated, quality-control services required by authorities having jurisdiction will be provided by Owner.
- B. Contractor is responsible for scheduling inspections and tests.
- C. **Retesting: Contractor shall pay for retesting where results of inspections and tests prove unsatisfactory and indicate noncompliance with requirements.**
- D. Auxiliary Services: Cooperate with agencies performing inspections and tests. Provide auxiliary services as requested. Notify agency in advance of operations requiring tests or inspections, to permit assignment of personnel. Auxiliary services include the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities to assist inspections and tests.
  - 3. Adequate quantities of materials that require testing, and assisting in taking samples.
  - 4. Facilities for storage and curing of test samples.
  - 5. Security and protection of samples and test equipment.
- E. Duties of Testing Agency: Testing agency shall cooperate with Architect and Contractor in performing its duties. Agency shall provide qualified personnel to perform inspections and tests.
  - 1. Agency shall promptly notify Architect and Contractor of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Agency shall not release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
  - 3. Agency shall not perform duties of Contractor.

- F. Submittals: Testing agency shall submit a certified written report of each inspection and test to the following:
1. Owner.
  2. Architect.
  3. Contractor.
  4. Structural engineer.
  5. Authorities having jurisdiction, when authorities so direct.
- G. Report Data: Reports of each inspection, test, or similar service shall include at least the following:
1. Name, address, and telephone number of testing agency.
  2. Project title and testing agency's project number.
  3. Designation (number) and date of report.
  4. Dates and locations where samples were taken or inspections and field tests made.
  5. Names of individuals taking the sample or making the inspection or test.
  6. Designation of the product and test method.
  7. Complete inspection or test data including an interpretation of test results.
  8. Ambient conditions at the time of sample taking and testing.
  9. Comments or professional opinion on whether inspected or tested Work complies with requirements.
  10. Recommendations on retesting or reinspection.
  11. Name and signature of laboratory inspector.
- H. Testing Agency Qualifications: Engage inspection and testing agencies that are prequalified as complying with the American Council of Independent Laboratories' "Quality Assurance Manual" and that specialize in the types of inspections and tests to be performed.
1. Each testing agency shall be authorized by authorities having jurisdiction to operate in the state where Project is located.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

## SECTION 01 50 00 — TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 SECTION INCLUDES

- A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone and fax service, water, and sanitary facilities.
- B. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, and water control.
- C. Construction Facilities: Access roads, parking, progress cleaning, project signage and temporary buildings.

#### 1.3 TEMPORARY ELECTRICITY

- A. Cost: By General Contractor. Utilize existing power service if approved by Owner. Extend temporary outlets in NEC and OSHA approved manner to facilitate construction.
- B. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.
- C. Provide main service disconnect and over correct protection at convenient location.
- D. Provide sufficient and adequate distribution equipment, wiring, and outlets to ensure unimpeded progress of the Work.
- E. Permanent convenience receptacles may be utilized during construction.

#### 1.4 TEMPORARY LIGHTING

- A. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.

- B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.
- C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- D. Permanent building lighting may be utilized during construction.
- E. Maintain lighting and provide routine repairs.

1.5 TEMPORARY HEAT

- A. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.
- B. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in product sections.

1.6 TEMPORARY COOLING

- A. If required for the proper installation of particular materials, systems, or equipment, provide and pay for cooling devices and cooling as needed to maintain specified conditions.

1.7 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Utilize existing ventilation equipment if approved by Owner. Extend and supplement equipment with temporary fan units as required to maintain clear air for construction operations.

1.8 TELEPHONE SERVICE

- A. Provide, maintain and pay for telephone service to field office.

1.9 FACSIMILE SERVICE

- A. Provide, maintain and pay for separate telephone line to be used solely for fax service to field office.

1.10 TEMPORARY WATER SERVICE

- A. Utilize existing water service if approved by Owner for construction operations.
- B. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing as required.

1.11 TEMPORARY SANITARY

- A. Provide and maintain required facilities and enclosures. Existing facility use is **not** permitted. Provide at time of project mobilization.

#### 1.12 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas to protect existing facilities and adjacent properties from damage from construction operations and demolition. Barriers must isolate occupied use from construction activities. If and when needed, barriers must be capable of attenuating sound.
- B. Provide protection for existing plant life and landscaped. Maintain plant life and landscaped areas as necessary during construction operations. Replace damaged plant life.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
- D. Barrier plan and method subject to approval by the Architect and the Owner.

#### 1.13 FENCING

- A. Construction: Commercial grade chain link fence.
- B. Provide 6 foot high fence around construction site, equip with vehicular and pedestrian gates with locks. Fence must be capable of restricting entry by on-site facility users.

#### 1.14 WATER CONTROL

- A. Grade site to drain where additions are undertaken. Maintain excavations free of water. Provide, operate, and maintain pumping equipment and/or any other means, methods or techniques necessary to maintain excavation and site free of water.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

#### 1.15 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protect for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
- B. Provide temporary protection of existing wall cavities, substrates, and surfaces exposed to weather during cutting and minor demolition operations to prevent entrapment of moisture and development of mildew.

#### 1.16 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection to prohibit damage and where specified in individual specification sections.
- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.

- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic in all landscaped areas.

#### 1.17 SECURITY

- A. Provide security and facilities to protect Work and existing facilities from unauthorized entry, vandalism, or theft.
- B. Coordinate project security program with Owner's existing security operations at project mobilization.
- C. Maintain program throughout construction period until Owner acceptance precludes the need for Contractor security.
- D. Restrict entrance of persons and vehicles into Project site and existing facilities, allowing entrance only to authorized persons and persons identified by the Contract Document and/or the Architect or Owner as authorized to visit Project site.

#### 1.18 ACCESS

- A. Provide and maintain temporary roads accessing public thoroughfares to serve construction area.
- B. Extend and relocate as work progress requires. Provide detours necessary for unimpeded traffic flow.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Existing on-site roads may be used for construction traffic.

#### 1.19 PARKING

- A. Provide temporary surface parking areas to accommodate construction personnel. Existing site areas may be used if approved in advance by the Owner.
- B. Contractor to propose plan for Owner concurrence and approval.

#### 1.20 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.



- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and rubbish from site weekly and dispose off-site.

1.21 PROJECT IDENTIFICATION

- A. Provide project sign. Refer to drawings for size and content.
- B. Erect on site at location established by Architect.
- C. No other signs are allowed without Owner permission except those required by law.

1.22 FIELD OFFICES AND SHEDS

- A. Office: Weather tight with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture drawing rack, and drawing display table, phone and fax.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Provide storage sheds and facilities to accommodate Work. Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01 25 00.
- D. Designated existing covered and uncovered hard paved areas and facilities may be used for field storage areas. Protect and secure existing areas used for storage. Upon completion of Work, clean, repair, and restore all existing areas used for storage and restore to acceptable condition.

1.23 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials prior to Substantial Completion.
- B. Remove underground installation to a minimum depth of 2 feet. Grade site to drain.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

## SECTION 01 73 29 — CUTTING AND PATCHING

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 SECTION INCLUDES

- A. Requirements and limitations for cutting and patching of Work.

#### 1.3 RELATED SECTIONS

- A. Section 01 10 00 – Summary: Work by Owner or by separate Contractors.
- B. Section 01 35 16 – Alteration Project Procedures.
- C. Section 01 25 00 – Substitution Procedures.
- D. Individual Product Specification Sections:
  - 1. Cutting and patching incidental to work of the section.
  - 2. Advance notification to other sections of openings required in work of those sections.
  - 3. Limitations on cutting structural members.

#### 1.4 SUBMITTALS

- A. Submit written request in advance of cutting or alteration which affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. 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. Written permission of affected separate Contractor.
8. Date and time work will be executed.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Primary Products: Those required for original installation.
- B. Product Substitution: For any proposed change in materials, submit request for substitution in accordance with Section 01 25 00 – Substitution Procedures.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
- B. After uncovering existing Work, assess conditions affecting performance of work.
- C. Beginning of cutting or patching means acceptance of existing conditions.

### 3.2 PREPARATION

- A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- B. Provide protection from elements for areas which may be exposed by uncovering work. Avoid unnecessary or extended exposure to weather of work exposed by cutting. Avoid entrapment of moisture or other deleterious mater between existing substrates and new work.
- C. Maintain excavations free of water.

### 3.3 CUTTING

- A. Execute cutting and fitting including excavation and fill to complete the Work.
- B. Uncover work to install improperly sequenced work.
- C. Remove and replace defective or non-conforming work.
- D. Remove samples of installed work for testing when requested.

- E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight-exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

#### 3.4 PATCHING

- A. Execute patching to complement adjacent Work.
- B. Fit Products together to integrate with other Work.
- C. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
- D. Employ skilled installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.
- E. Restore work with new Products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. 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

## SECTION 01 77 00 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.

#### 1.2 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

#### 1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction

- photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
  5. Submit test/adjust/balance records.
  6. Submit sustainable design submittals required in Division 01 sustainable design requirements Section and in individual Division 02 through 33 Sections.
  7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
  6. Advise Owner of changeover in heat and other utilities.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements, including touchup painting.
  10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.

## 1.6 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
  - 1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
  - 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  - 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  - 4. Submit pest-control final inspection report.
  
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
  - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  - 1. Organize list of spaces in sequential order.
  - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  - 3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.
  - 4. Submit list of incomplete items in the following format:
    - a. MS Excel electronic file. Architect will return annotated file.

#### 1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
  
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during

construction period by separate agreement with Contractor.

- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
  
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other



- foreign deposits.
  - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - g. Sweep concrete floors broom clean in unoccupied spaces.
  - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
  - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - j. Remove labels that are not permanent.
  - k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
  - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls."

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.

- a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01700

## SECTION 02 41 19 - SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 SECTION REQUIREMENTS

- A. Unless otherwise indicated, demolished materials become Contractor's property. Remove from Project site.
- B. Items indicated to be removed and salvaged remain Owner's property. Remove, clean, and deliver to Owner's designated storage area.
- C. Comply with EPA regulations and disposal regulations of authorities having jurisdiction.
- D. Conduct demolition without disrupting Owner's use of the building.

### PART 2 - PRODUCTS (Not Applicable)

### PART 3 - EXECUTION

#### 3.1 DEMOLITION

- A. Maintain and protect existing utilities to remain in service before proceeding with demolition, providing bypass connections to other parts of the building.
- B. Locate, identify, shut off, disconnect, and cap off utility services to be demolished.
- C. Employ a certified, licensed exterminator to treat building and to control rodents and vermin.
- D. Conduct demolition operations and remove debris to prevent injury to people and damage to adjacent buildings and site improvements.

- E. Provide and maintain shoring, bracing, or structural support to preserve building stability and prevent movement, settlement, or collapse.
- F. Protect building structure or interior from weather and water leakage and damage.
- G. Protect remaining walls, ceilings, floors, and exposed finishes. Erect and maintain dustproof partitions. Cover and protect remaining furniture, furnishings, and equipment.
- H. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
- I. Promptly patch and repair holes and damaged surfaces of building caused by demolition. Restore exposed finishes of patched areas and extend finish restoration into remaining adjoining construction.
- J. Promptly remove demolished materials from Owner's property and legally dispose of them. Do not burn demolished materials.

END OF SECTION

## SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. All concrete work, including sidewalks, exterior ramps, steps, miscellaneous concrete.
- B. All form work.
- C. Reinforcing steel.
- D. Installation of sleeves which are furnished by plumbing, heating and electrical contractors.
- E. Equipment bases are shown on architectural, mechanical, plumbing and electrical drawings.
- F. Provide and install waterstop material at below grade joints.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Testing Laboratory services.
- B. Excavation and fill.
- C. Concrete paving, curbs, sidewalks and site concrete.

#### 1.4 DRAWING REFERENCES: See drawings for reinforcing sizes and placement.

#### 1.5 Submittals:

- A. DESIGN MIX: Submit six (6) copies directly to the project Architect the proposed concrete mix(es). Include cement brand and type, aggregate identification, admixtures, proportions and anticipated strengths.

- B. **PLASTIC CHAIR SUPPORTS:** Submit manufacturer's literature indicating dimensions, configurations and performance data. Submit sample for approval by the Architect. Space at a maximum of 45" centers each way. Provide closer spacing where required to prevent excessive sag, where indicated on the drawings, or to support the weight of concrete pump hose.
- C. **ADMIXTURES:** Submit manufacturer's product data describing material and mix proportions.
- D. **WATERSTOPS:** Submit manufacturer's product data describing material and installation procedures.
- E. **CURING COMPOUND:** Submit Manufacturer's literature indicating composition and recommended application procedures.
- F. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

#### 1.6 SAMPLES

- A. Plastic chair support.

#### 1.7 WARRANTY

- A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

#### 1.8 QUALITY ASSURANCE

- A. Cast-in-place concrete shall be installed by technicians specially trained in the proper handling, placing and protection of concrete and reinforcing steel. If required by the Architect, installer shall submit for approval a list of similar installations successfully completed.
- B. Comply with ASTM C 94; ACI 301, "Specification for Structural Concrete"; ACI 117, "Specifications for Tolerances for Concrete Construction and Materials"; and CRSI's "Manual of Standard Practice."
- C. Engage a qualified independent testing agency to design concrete mixes.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. **GENERAL:** All materials used in the Work shall be stored or handled in a manner that will prevent deterioration; any materials that have been damaged shall be immediately and completely removed from the Work. All manufactured materials, such as cement, shall be delivered and stored in their original packages that show marks or other evidence of damage shall be wholly rejected.
- B. **Deformed Reinforcing Bars:** ASTM A 615/A 615M, Grade 60.
- C. **Plain Steel Wire:** ASTM A 82, as drawn.
- D. **Steel Welded-Wire Fabric:** ASTM A 185, flat sheets not rolls. Use mesh for sidewalks and equipment pads, as indicated on the drawings.

- E. Portland Cement: ASTM C 150, Type I, latest edition.
- F. The use of Fly Ash in the concrete mix is not acceptable.
- G. Aggregates: ASTM C 33, uniformly graded.
- H. Fiber Reinforcement: ASTM C 1116, Type III, synthetic fibers, 1/2 to 1 inch.
- I. Air-Entraining Admixture: ASTM C 260.
- J. Chemical Admixtures:
  - 1. General: All admixtures shall be added only at the plant during mixing and must be prior approved by the Testing Laboratory. Admixtures shall comply with the requirements of ASTM C260 and C-494. Admixtures containing calcium chloride are not acceptable. Do not use admixtures in footings or seal slabs.
- K. Water Stops: Flat dumbbell or center-bulb type, of either rubber (CRD C 513) or PVC (CRD C 572).
- L. **Vapor Barrier: Reference Spec Section 07 26 16 Under Slab Vapor Barrier.**
- M. Liquid Membrane-Forming Curing Compound: ASTM C 309, clear, Type I, Class A or B, solvent borne, wax free.
- N. Liquid Membrane-Forming Curing and Sealing Compound: ASTM C 1315, clear, Type I, Class A, solvent borne.
- O. Slip-Resistive Aggregate: Factory-produced, rustproof, nonglazing, fused aluminum-oxide granules or crushed emery, unaffected by freezing, moisture, and cleaning materials.
- P. Joint-Filler Strips: ASTM D 1751, cellulosic fiber, or ASTM D 1752, cork.
- Q. Repair Underlayment: Factory-packaged, portland or blended hydraulic cement-based, polymer-modified, self-leveling underlayment with minimum 28-day compressive strength of 4100 psi (29 MPa).
- R. Repair Topping: Factory-packaged, portland or blended hydraulic cement-based, polymer-modified, self-leveling traffic-bearing topping with minimum 28-day compressive strength of 5700 psi (39 MPa).

## 2.2 MIXES

- A. Proportion normal-weight concrete mixes to provide the following properties:
  - 1. Compressive Strength:
    - a. Ramps and sidewalks: 3000 psi at 28 days.
  - 2. Slump Limit: 5 inches at point of placement.
  - 3. Air Content: 5.5 to 7.0 percent for concrete exposed to freezing and thawing, 2 to 4 percent elsewhere.

## 2.3 FORMWORK

- A. GENERAL: Forms shall conform to the shapes, lines, grade and dimensions of the concrete as indicated in the drawings. Lumber used in forms for exposed surfaces shall be dressed to a uniform thickness and shall be free of loose knots or other defects. Lumber once used in forms shall be thoroughly cleaned be-

fore another usage. Form **full depth** of outside face of perimeter grade beams without horizontal joints or cracks. Forms shall be substantial and sufficiently tight to prevent leakage. They shall be properly shored, braced or otherwise tied or supported to maintain the desired position and shape during and after placement of concrete. Use no formwork which may stain exposed concrete surfaces.

- B. FORM LINING: For exposed concrete the final finish shall be smooth, even and free of defects.
- C. FORM REMOVAL: Forms shall remain in place sufficient time for the concrete to obtain necessary strength to support its own weight and construction load.

### PART 3 - EXECUTION

#### 3.1 CONCRETING

- A. Construct formwork and maintain tolerances and surface irregularities within ACI 117 limits of Class A for concrete exposed to view and Class C for other concrete surfaces.
- B. Set water stops where indicated to ensure joint water tightness.
- C. Place vapor retarder on prepared subgrade, with joints lapped 6 inches (150 mm) and sealed.
- D. Accurately position, support, and secure reinforcement.
- E. Install construction, isolation, and contraction joints where indicated. Install full-depth joint-filler strips at isolation joints.
- F. Place concrete in a continuous operation and consolidate using mechanical vibrating equipment.
- G. Protect concrete from physical damage, premature drying, and reduced strength due to hot or cold weather during mixing, placing, and curing.
- H. Formed Surface Finish: Smooth-formed finish for concrete exposed to view, coated, or covered by waterproofing or other direct-applied material; rough-formed finish elsewhere.
- I. Slab Finishes: Float finish for ramps and surfaces to receive waterproofing or other direct-applied material. Trowel and fine-broom finish for surfaces to receive thin-set tile. Non-slip-broom finish to exterior concrete platforms, steps, and ramps.
- J. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over initially floated surfaces; tamp and float. Expose non-slip aggregate after curing.
- K. Uniformly spread 100 lb/100 sq. ft. (49 kg/10 sq. m) of mineral dry-shake floor hardener over initially floated surfaces, repeat float finishing to embed each application, and then apply a trowel finish.
- L. Cure formed surfaces by moist curing for at least seven days.
- M. Begin curing concrete slabs after finishing.
- N. Owner will engage a testing agency to perform field tests and to submit test reports.
- O. Protect concrete from damage. Repair surface defects in formed concrete and slabs.



- P. Repair slabs not meeting surface tolerances by grinding high areas and by applying a repair underlayment to low areas receiving floor coverings and a repair topping to low areas to remain exposed.

### 3.2 CLEANING AND PROTECTION

- A. **CLEANING:** Slabs are to be kept free of any foreign substances (wax, oil, paint, etc.) or surface irregularities that may affect the final appearance of the completed installation.
- B. Unless otherwise approved by the Architect, no vehicular traffic will be allowed on any concrete until after the 7 day concrete tests have been made by the laboratory indicating that the concrete has attained 3,000 psi compressive strength.
- C. Contractor shall coordinate with Architect and Owner to determine a suitable on-site “wash-out” area for concrete trucks. Contractor shall be responsible for clean-up of the area.
- D. Contractor shall keep clean all adjacent public streets and rights of way. Wash down daily or more often as needed to remove mud and maintain a safe condition at entrances/exits to job site.

END OF SECTION

## SECTION 03 50 00 - CONCRETE FLOOR FINISHING

### PART 1 – GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Finishing slabs-on-grade, monolithic floor slabs, and separate floor toppings.
- B. Related Sections include the following:
  - 1. Division 3 Section "Cast-in-Place Concrete" for concrete slab construction and finish and concrete topping slabs.
  - 2. Division 7 Section "Joint Sealers"

#### 1.2 REFERENCES

- A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
  - 1. ACI 301 - Specifications for Structural Concrete for Buildings
  - 2. ACI 302 - Guide for Concrete Floor and Slab Construction
  - 3. ASTM E1155 - Determining Floor Flatness and Levelness Using the F-Number System (Inch-Pound Units).

#### 1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- B. Submittals
  - 1. Product Data: Submit manufacturer's data showing compliance with the specifications for the following products:

a. Sealer

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.
- B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2.2 RELATED MATERIALS

- A. Semi rigid Joint Filler: Two-component, semi rigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of 80 per ASTM D 2240.
- B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- C. Saw cut joint filler: Euco 700 epoxy by The Euclid Chemical Company, or approved equal.

PART 3 - EXECUTION

3.1 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Concrete slabs shall be finished as specified below, within the tolerances specified elsewhere in this Section.
  - 1. Highway straightedges are recommended for use in lieu of bull floats for all slab placement and finishing operations.
  - 2. Screeding: Immediately after placing, slab shall be vibrated and struck off true by double screeding to the required level, at or below the elevation or grade of the finished slabs as indicated on the Drawings. Vibrators shall not be used to spread the concrete. When camber is indicated for slabs supported on formwork, screed to the required camber. Fixed screed guides are recommended where specified surface tolerance exceeds FF25/FL20.
  - 3. Floating: Immediately after screeding, before any excess bleed water is present on the surface, float the surface using long-handled bull floats or darbies.

4. Straightedging: Immediately after screeding and before excess bleed water is present on the surface, straighten the surface using a highway straightedge.
  5. Edging and jointing, where required, shall be done after bleed water has evaporated and before further finishing.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish.
  2. Locations: All concrete surfaces under waterproofing membrane, setting beds for brick, mud-set tile, pavers, or terrazzo, and noncomposite topping slabs.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten 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 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. Locations: Exposed concrete floors not otherwise specified, concrete surfaces under carpets, vinyl tile, thin set tile, wood flooring, elastomeric coatings, and painted concrete floors, and roof slabs that are future floors.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- 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.

### 3.2 FINISHING CONCRETE TOPPING SLABS

- A. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.
1. Screed surface with a straightedge and strike off to correct elevations.
  2. Slope surfaces uniformly where indicated.
  3. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.

- B. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.
  - 1. Provide floor finish as described above.
    - a. Finish surfaces to specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15, and notify independent testing agency to permit measurement within 24 hours according to ASTM E 1155 for a randomly trafficked floor surface.
    - b. Finish and measure surface so gap at any point between surface and an unlevleed freestanding 10-foot-long straightedge, resting on 2 high spots and placed anywhere on the surface, does not exceed 1/4 inch.

### 3.3 CONTROL JOINTS IN TOPPING SLABS

- A. Saw-cut Control Joints with Soff-Cut saw: After completion of finishing operation, cut control joints using a "Soff-Cut" brand electric saw along straight lines where called for on the Drawings. Follow manufacturer's instructions in using "Soff-Cut" saw. Sawcutting shall be done within 2 hours after the completion of finishing, but not so soon as to cause raveling of the joint. Cut to depth indicated on the Drawings.
  - 1. After completion of finishing operations, cut control joints along straight lines where called for on the Drawings. Saw cutting shall be done within 4 hours after the completion of finishing, but not so soon to cause raveling of the joint. Cut to the depth indicated on the Drawings.
- B. Form joints in concrete topping slabs at 8'-4" o.c. max.
- C. Construct control joints for a combined depth equal to 1/4 the topping thickness.

### 3.4 JOINT FILLING

- A. Prepare, clean, and install joint filler per manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least one month(s). 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 semi rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.
  - 1. Install joint-filler strips in lengths if practicable. Where more than one length is required, lace or clip sections together.

3.5 CONCRETE FINISH MEASUREMENT AND TOLERANCES

- A. All floors are subject to measurement for flatness and levelness and shall comply with the following:
1. Measurement Standard: All floors are subject to measurement for flatness and levelness, according to ASTM E1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System."
- B. Two-Tiered Measurement Standard: Each floor test section and the overall floor area shall conform to the two-tiered measurement standard as specified herein.
1. Minimum Local Value: The minimum local FF/FL values represent the absolute minimum surface profile that will be acceptable for any one test sample (line of measurements) anywhere within the test area.
  2. Specified Overall Value: The specified overall FF/FL values represent the minimum values acceptable for individual floor sections as well as the floor as a whole.
- C. Floor Test Sections
1. A floor test section is defined as the smaller of the following areas:
    - a. The area bounded by column and/or wall lines.
    - b. The area bounded by construction and/or control joint lines.
    - c. Any combination of column lines and/or control joint lines.
  2. Test sample measurement lines within each test section shall be multidirectional along two orthogonal lines, as defined by ASTM E1155, at a spacing to be determined by the Owner's testing agency.
  3. The precise layout of each test section shall be determined by the Owner's testing agency.
- D. Concrete Floor Finish Tolerance
1. The following values apply before removal of shores. Levelness values (FL) do not apply to intentionally sloped or cambered areas, nor to slabs poured on metal deck or precast concrete.
    - a. Typical:

Overall Value	FF25/FL20
Minimum Local Value	FF17/FL15
- E. Floor Elevation Tolerance Envelope:
1. The acceptable tolerance envelope for absolute elevation of any point on the slab surface, with respect to the elevation shown on the Drawings, is as follows:
    - a. Slab-on-Grade Construction: +/- 3/4"
    - b. Top surfaces of formed slabs measured prior to removal of supporting shores: +/- 3/4"
    - c. Top surfaces of all other slabs: +/- 3/4"

- d. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10'-0" at any point, up to 3/4" from theoretical elevation at any point.

### 3.6 FIELD QUALITY CONTROL

#### A. Concrete Floor Flatness and Levelness:

1. Measurement Standard: Floors shall be measured for flatness and levelness according to ASTM E1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System." Tolerances are specified in Section 03 30 00.
2. Time Period for Measuring and Reporting: All measurements shall be made by the testing laboratory or designated agency before the end of the next workday after the completion of finishing operations. For structural elevated floors, measurement shall also be made prior to removal of forms and shores. The Contractor shall be notified immediately after the measurements of any section are complete, and a written report of the floor measurement results shall be submitted within 72 hours after finishing operations are complete. The Contractor shall take immediate action to correct any work that is outside the specified tolerances.
3. Measuring Equipment: The concrete surface profile shall be measured using equipment manufactured for the purpose, such as the Dipstick Floor Profiler, as manufactured by the Edward W. Face Company, Norfolk, Virginia, or by other methods specified in ASTM E1155.
4. Floor Test Sections:
  - a. A floor test section is defined as the smaller of the following areas:
    - 1) The area bounded by column and/or wall lines.
    - 2) The area bounded by construction and/or control joint lines.
    - 3) Any combination of column lines and/or control joint lines.
  - b. Test sample measurement lines within each test section shall be multidirectional along two orthogonal lines.
  - c. The precise layout of each test section shall be determined by the testing agency and shall be submitted for the Architect's review and approval.

### 3.7 REPAIRS

- A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.
- B. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:
  1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:
    - a. The composite overall values of flatness or levelness of any test section or the entire floor installation measure less than specified values.

- b. Any individual test sample (line of measurements) measures less than the specified absolute minimum flatness or levelness value.
2. Modification of Existing Surface:
- a. If, in the opinion of the Architect or Owner's representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, the Contractor shall immediately undertake the approved repair method.
  - b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair, and time required to make the repair.
  - c. Repair method(s), at the sole discretion of the Architect or Owner's Representative, may include grinding (floor stoning), planing, retopping with specified floor leveling compound, or any combination of the above.
  - d. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.
3. Removal and Replacement:
- a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, the Contractor shall remove and replace the defective work as directed.
  - b. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or Owner's Representative.
  - c. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

END OF SECTION



SECTION 04 05 13 — MORTAR

PART 1 - GENERAL

1.01 COORDINATION

- A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.02 SCOPE:

- A. Perform all work required to furnish the Masonry Mortar indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.
- B. The requirements of Division 0 – “Bidding and Contract Requirements” and Division 1 – “General Requirements” of this Project Manual shall apply to all Work required for this Section.
- C. Application of Mortar used in the installation of masonry units is specified in each respective Unit Masonry Section and is not included in the work required for this Section.

1.03 SUBMITTALS:

- A. Submit product data on all mortar and admixtures.
- B. Submit certification that mortar and grout material meet ASTM standards.

1.04 PRODUCT DELIVERY AND STORAGE:

- A. Delivery: Delivery materials to Project site dry and in unbroken containers.
- B. Storage: Store materials above ground in waterproof shelters.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Material manufactured by any of the following manufacturers is acceptable, provided it complies with the Contract Documents.
  - 1. PORTLAND CEMENT:
    - a. Capitol Lone Star
    - b. Trinity Texas Industries

- c. Universal Atlas Cement
  - 2. LIME:
    - a. Gibsonburg Lime Products Co., Tiger Limes
    - b. Texas Lime Company
    - c. United States Gypsum Company
    - d. National Gypsum Company
  - 3. WATER PROOFING ADMIXTURE:
    - a. Master Builders-Omicron Mortarproofing
    - b. Sonneborn Building Products-Hydracide
    - c. W.R. Grace-Hydratite Plus
  - 4. MORTAR COLOR:
    - a. Gray-
  - 5. ***DRY BLOCK-One pound per cubic foot of cementitious material, 1/2 sack per sack of 2 sacks of cement fluted, split –face CMU for warranty purposes***
- B. Refer to Section 01 25 00 - Substitutions Procedures for manufacturers not listed above.

2.02 MATERIALS:

- A. Portland Cement: ASTM C150, TYPE I.
- B. Hydrated Lime: ASTM C207, TYPE S.
- C. Fine Aggregate: ASTM C144,
- D. Coarse Aggregate: ASTM C404, Size No. 8
- E. Water: Clean and free of deleterious acids, alkalies, or organic matter.
- F. Waterproofing Admixture: Omicron Mortarproofing, manufactured by Master Builders.
- G. Grout Admixture: “Fluidifier” by Master Builders.
- H. Sealer: “DEFY” Block Water Repellant

2.03 PROPORTIONS AND MIXING:

- A. Meet requirements of ASTM C270 and proportion mortar types as specified.
- B. Meet requirements of ASTM C476 for masonry grout and proportion grout type as specified.
- C. Proportion material accurately and mix thoroughly by machine to a uniform consistency and color. Mix mortars with the maximum amount of water consistent with workability.
- D. Do not use mortar that has begun to set. Retemper mortar by adding water if mortar begins to stiffen from evaporation or absorption of a part of the mixing water. Use and place mortar in final position within 2-1/2 hours after mixing.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. See specific section of Masonry Materials for installation instructions.

3.02 MORTAR SCHEDULE:

- A. Exterior Masonry Walls:
  - 1. Mortar-Type S, ASTM C270.
  - 2. Waterproofing Admixture-*dry block required to provide warranty.*
- B. Interior Masonry Partitions:
  - 1. Mortar-Type N, ASTM C270.
- C. Interior Paving Tile:
  - 1. Mortar-Type S, ASTM C270.
- D. Exterior Paving Tile:
  - 1. Mortar-Type M, ASTM C270.

3.03 GROUT SCHEDULE:

- A. Paving Tile:
  - 1. Portland Cement-one part.
  - 2. Fine Aggregate-three parts.
  - 3. No lime.
  - 4. Sealer

END OF SECTION

SECTION 04 22 00 — CONCRETE MASONRY UNIT

PART 1 - GENERAL

1.0 COORDINATION

- A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.02 SCOPE:

- A. Perform all Work required to complete the Concrete Unit Masonry indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.
- B. The requirements of Division 0 – “Bidding and Contract Requirements” and Division 1 – “General Requirements” of this Project Manual shall apply to all Work required for this Section.

1.03 PRODUCTS INSTALLED UNDER THIS SECTION BUT SPECIFIED ELSEWHERE:

- A. Section 04 05 13 – Mortar.
- B. Section 07 92 00 – Sealants and Caulking.

1.04 SUBMITTALS:

- A. Submit technical data for each type wall reinforcement, anchors and ties.
- B. Submit 12” long sample of control joint filler. Submit various samples for split face cmu.
- C. Submit certificate that masonry units conform to ASTM and NBFU standards specified.

1.05 STORAGE AND HANDLING:

- A. Handle materials in a manner to prevent breakage and chipping. Store materials on platforms raised free of ground and protect materials with stainproof tarpaulin covers.

1.06 ENVIRONMENTAL CONDITIONS:

- A. Lay no masonry when the temperature of the air is 40°F. twenty-four (24) hours after laying. Do not build on frozen work.

- B. Store masonry units on the job so that they are kept off the ground and protected from rain.

## PART 2 - PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS:

- A. Material manufactured by any of the following manufacturers is acceptable, provided it complies with the Contract Documents.
1. REINFORCEMENT, ANCHORS AND TIES:

Duro-O-Wal	AA Wire Products Company
Heckman Build Products, Inc.	Hohmann and Barnard, Inc.
Masonry Reinforcing Corp. of America	National Wire Products Corp.
  2. SPLIT FACE BLOCK SEALER:  
"DEFY" Split Face Block Water Repellant

### 2.02 MATERIALS:

- A. UNITS:
1. Hollow Concrete Masonry: ASTM C90, medium weight, Grade N-1
  2. **Split Face CMU: Integrated color (exterior).**
- B. REINFORCEMENT:
1. Block Wall Joint Reinforcement:  
ASTM A82, AA Wire Products Co., "BLOK-TRUS", AA600 two wire, width 2" less than wall thickness, standard weight galvanized ASTM A116, Class 1.
  2. Lintel and Bond Beam Reinforcement: Domestic, ASTM A615, or ASTM A616, deformations ASTM A305. Unless otherwise shown on drawings provide 2-#4 Ø cont. lap 30 dias.
- C. WATER: Clean and free of deleterious acids, alkalies or organic material.
- D. **Bullnose edge at all masonry corners for interior walls. Provide sealer for all exterior split face c.m.u.**

## PART 3 - EXECUTION

### 3.01 CONDITION OF SURFACES:

- A. Do not commence with masonry work until foundation has properly cured a minimum of seven (7) days and reinforcing steel that is dowelled for masonry units has been approved.
- B. Consult other trades and make provisions to permit installation of their work to avoid cutting and patching. Before closing up any pipe chase, or similar inaccessible spaces, remove all rubbish and sweep out areas to be enclosed.

### 3.02 PREPARATION:

- A. Provide, install and maintain all scaffolding, staging and forms of protection necessary for execution of the work; substantially constructed, maintained, moved and dismantled as required to properly follow the sequence of operation.

- B. Provide and install all shores and centering for the work, constructed true to require shape, size and form; well-braced and made rigid in all parts, and capable of supporting and sustaining the loads to which subjected.
- C. Leave all shores and centering in place until the masonry has sufficiently set to safely carry its own weight and the added loads of construction. Shore free-standing walls to prevent windstorm damage until walls are protected.
- D. Examine surfaces to receive masonry and report any discrepancies before commencing work. Accept no former measurements, but lay work according to the plans and dimensions thereon.

### 3.03 LAYING CONCRETE MASONRY UNITS:

- A. Do not dampen units before laying, and do not lay units which have surface water or contain frost. Lay units plumb, level, and true to a line in running bond, or as indicated. Align on exposed face or as indicated.
- B. Lay first course of masonry in full bed of mortar. Lay all other hollow units in a full mortar bed on shell surface and at ends.
- C. Lay hollow units with the thicker edge of the face shell up and make all joints 3/8" thick. Lay corners prior to laying mid-portion of wall. Rock closures into place with the head joints shoved against the two adjacent units in place.
- D. Cut units with power saw through the unit to insure straight, evenly cut edges. Do not use fractional parts of masonry units in the work where whole units can be used.
- E. Avoid over-plumbing and pounding of the corners and jambs to fit stretcher units after setting in place. Remove mortar and replace with fresh mortar where adjustment must be made after initial settings.
- F. Do not use masonry units having cracks, chipped edges, broken corners or other defects in exposed faces. Build walls full thickness as shown. Blocks with open cells exposed will not be permitted.
- G. Provide all special precast lintels, fillers, closers, control joint units, trough tile, etc., required to form all corners, returns, openings, jambs, offsets, etc., to maintain a proper bond throughout all masonry work.
- H. Protect all sills, ledges, off-sets, etc., from droppings of mortar and protect door jambs and corners from damage during construction.
- I. Stop off longitudinal run of masonry only where absolutely necessary by racking one-half block length in each course. Remove loose mortar before new work is started.
- J. Cover tops of walls at end of day's work and when rain is imminent, with waterproof membrane. Overhang two feet on each side of wall and anchor securely. Protect masonry from weather or construction damage.

### 3.04 JOINTS:

- A. Mortar joints shall be straight, clean and uniform in thickness. Tool joints of all walls to produce a dense surface well bonded to the edges. Joints which are not tight at the time of tooling shall be raked out, pointed, and then tooled.
- B. Tool when the mortar is partially set but still sufficiently plastic to bond. Use a tool which compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out.

- C. Finish joints that will remain exposed with a tool slightly larger than the width of the joint to form a concave surface. Tool vertical joint first. Finish flush, joint that will not remain exposed.
- D. Unless otherwise specified the horizontal and vertical mortar joints shall be 3/8" thick with full mortar coverage on the face shells and on the webs surrounding cells to be filled with grout.
- E. Vertical head joints shall be buttered well for a thickness equal to the face shell of the unit and these joints shall be shoved tightly so that the mortar bonds with both units. Joints shall be solidly filled from the face of the block to at least the depth of the face shell.

3.05 REINFORCING:

- A. Install continuous joint reinforcing 16" on centers for running bond. Install joint reinforcing in the first and second bed joint above and below openings extending 24" beyond each side of opening.
- B. Lap splices a minimum of 6" and install prefabricated corners and tees at such locations. Do not extend reinforcing through expansion joints. Center reinforcing in joint with 5/8" minimum mortar coverage on the exterior face and 1/2" minimum mortar coverage on the interior face.
- C. Do not extend reinforcing through control joints when anchorage is provided on each side of joint. If no anchorage is provided at joint, extend reinforcing through control joint at 48" on center.
- D. Reinforce bond beams and lintels as indicated with continuous bars placed as the work progresses. Maintain 1/2" minimum clear distance between masonry units and reinforcement.

3.06 ANCHORING:

- A. Anchor interior partitions to abutting or intersecting walls by common bond or with prefabricated reinforcing tees.
- B. Anchor interior load bearing partitions laterally a maximum of 12'-0" o.c. by either an intersecting partition or anchorage to foundation with 4-#4Ø dowels and continuous 4 #4Ø bars to top of wall. Grout fill cells to top of wall.
- C. Do not attach construction supports to wall except where specifically permitted by the Architect.
- D. Intersecting load bearing masonry walls and partitions shall be bonded by the use of rigid steel anchors at twenty-four (24) inches o.c. maximum. Corners shall have a standard masonry bond by overlapping units and shall be solid grouted.

3.07 CONTROL JOINTS:

- A. Locate 3/8" wide control joints as indicated but do not exceed 30 feet on centers. Keep vertical joints straight, true and continuous from top to bottom of masonry.
- B. Use sash units to form control joints and install continuous control joint filler with sash units tightly butted to compress neoprene flanges and completely seal joint. Where masonry abuts structural concrete or steel and control joint filler cannot be used, keep joint clean of mortar as work progresses or use expansion joint spacer.
- C. Locate building expansion joints as indicated and install expansion joint spacer properly recessed back from face to allow for sealant.

3.08 EMBEDDED ITEMS:

- A. Build in flashing, sleeves, anchors, clips, mechanical and electrical items, and accessories as work progresses. Accurately cut units to fit all plumbing, ducts, openings and electrical work with all holes neatly patched.
- B. Install loose lintels, as indicated in full beds of mortar. Fill voids at metal frames with mortar and build in frame anchors.

3.09 GROUTING:

- A. Fill with grout, vertical cells, bond beams, lintels and other structural members having reinforcement. Secure in place and inspect reinforcing before grouting. Keep mortar droppings out of grout space and puddle or vibrate all grout in place.
- B. Provide solid bearing under structural members at least 8" vertically and at least 16" horizontally. Bearing shall be hollow units reinforced with 2#4Ø bars U.N.O. and filled with concrete grout.
- C. Build masonry in filled cell construction to preserve the unobstructed vertical continuity of the cells to be filled. Fully bed all walls and cross webs forming such cells to prevent leakage of grout and strike cell joints smooth. Maintain a continuous vertical alignment of cells so the unobstructed cell area is not less than 2"x3".
- D. Grout vertical cells in lifts not to exceed 4'-0". Stop grout where necessary at mid-point but not over openings, when filling trough unit and provide suitable dam to retain grout. Stop grout one and one half inches below the top of the last course when filling vertical cells to form key for next pour.
- E. Grout from inside face of masonry and prevent grout from staining masonry face. Protect projecting surfaces from droppings and clean immediately any grout which comes in contact with face of masonry.

3.010 CLEANING:

- A. Keep face of blockwork free from excess mortar while laying blocks. Clean blockwork that will remain exposed, promptly, with fiber brushes and clear water. Use of wire brushes or acid permitted only with specific approval.
- B. Repair and repoint defective work and pin line holes to match adjacent similar work. Replace broken or damaged blocks.

END OF SECTION



## SECTION 05 12 00 — STRUCTURAL STEEL

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Furnish and erect all structural steel.
- B. All cutting and fitting, welding and bolting of structural steel members.
- C. Loose lintels and lintels supported from structural members.
- D. Shop coat of paint on structural steel members and field touch-up.
- E. Temporary bracing of structural steel during erection.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Steel joists.
- B. Miscellaneous metals.

#### 1.4 SUBMITTALS

- A. Six (6) blue-line prints of each sheet of shop drawings required. Contractor shall submit shop drawings directly to the project Architect.
  - 1. Indicate size, material, and strength of members.
  - 2. Show locations and installation procedures.
  - 3. Include details of shear heads, collar channels, camber, shop coats, joints, attachments, and clearances.
  - 4. Prepare setting Drawings, templates, and procedures indicating locations of structural bolts, and fastening holes for other Work.
- B. Submit mill certificates direct to Structural Engineer with shop drawings.
- C. Submit welder's qualification records.

- D. Miscellaneous metals shall be issued as a separate submittal directly to the Architect and not as part of the structural steel submittal.
- E. Where required submit proof of city approval for fabricator and erector.
- F. Submit written certification of domestic origin for bolts.
- G. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

#### 1.5 WARRANTY

- A. Provide written warranty against defects in metals and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the Project.

#### 1.6 QUALITY ASSURANCE

- A. Fabrication and erection of structural steel shall meet or exceed the minimum current requirements of the following standards except where more stringent requirements are indicated in the drawings or specifications:
  - 1. AISC "Code of Standard practice for Steel Buildings and Bridges".
  - 2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including the "Commentary of the AISC Specification", Eighth Edition.
  - 3. AWS D1.1, "Structural Welding Code D1.1".
  - 4. ASTM A-6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use".
  - 5. ASTM A-36, Specification for Structural Steel.
  - 6. ASTM A-123, Specification for Zinc (Hot-Dip Galvanized Coatings on Iron and Steel Products.
  - 7. ASTM A-307, Specification for Carbon Steel Externally Threaded Standard Fasteners.
  - 8. ASTM A-325, Specification for High-Strength Bolts for Structural Steel Joints.
  - 9. ASTM A-436, Specification for Hardened Steel Washers.
  - 10. ASTM A-500, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - 11. ASTM A-563, Specification for Carbon and Alloy Steel Nuts.
- B. Fabricators shall be currently approved by the local code authority for erection of steel structures. Contractor shall submit evidence of city approval with the list of proposed subcontractors for the project.
- C. Each welder performing work on this Project shall be qualified in accordance with American Welding Society Structural Welding Code, AWS D1.1 within 12 months of the commencement of welding on this Project. Welders shall be certified for the position of weld which they are performing. Welding shall be tested as specified under Testing Laboratory Control below.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. GENERAL:
  - 1. All materials shall be new, clean and straight within allowable tolerances. Members damaged, warped or stressed prior to or after erection shall be replaced with new material.
  - 2. All structural steel shall conform to the Standard Specifications of the ASTM for Steel for Bridges and Buildings, A-36 (or ASTM A-500, grade B for square or rectangular tube shapes), unless otherwise indicated on the drawings.
  - 3. Purlins shall be precision roll-formed of 14 ga. or 16 ga. steel with a minimum yield of 55,000 psi. Size and spacing of purlins shall be as indicated on the drawings.

- B. WELDING ELECTRODES: #E60 Series Submerged Arc Grade SA-1, #E70 Series Submerged Arc Grade SA-2.
- C. BOLTS: Comply@ASTMA-307for standard bolts and ASTMA-325 for high-strength bolts, sizes as indicated in the drawings and structural notes. Furnish certification that bolts are domestic origin.
- D. ANCHOR BOLTS:
  - 1. Furnish to the General Contractor all anchor bolts, setting templates and drawings required for complete and accurate installation.
  - 2. Coordinate delivery of anchor bolts for installation by other trades.
- E. GROUT: Premixed, non-shrink, non-metallic type providing a minimum compressive strength of 7,000 psi at 28 days and a maximum initial set time of one hour at 73 degrees F. "Masterflow 713" as manufactured by Master Builders or equivalent by Cormix Construction Chemicals or Sauereisen Cements Co.

### PART 3 - EXECUTION

#### 3.1 FABRICATION

- A. Fabricate the various parts of the steel frame from the materials specified using welded shop connections and bolted field connections. Shop drawings shall be prepared accordingly.
- B. Splicing of members is prohibited without prior approval of the project structural engineer. A member having splice not specifically approved on the shop drawings will be rejected. Spliced members will not be permitted where steel is exposed in finished areas.
- C. Provide holes @ maximum 36" o.c. for 3/8" diameter bolts in all steel where wood nailers occur, unless closer spacing is indicated in the drawings or notations.
- D. All workmanship shall be in accordance with the requirements of the AISC. The workmanship in exposed rigid frames shall be in accordance with the AISC requirements for Architecturally Exposed Structural Steel.

#### 3.2 GALVANIZING

- A. Hot dip galvanize all steel sections which are fully or partially exposed to weather or indicated in the drawings to be galvanized.
- B. All galvanizing shall be done after fabrication of members.
- C. Comply with requirements of ASTM A-384 to protect against warping.
- D. Do not apply silicone protective coating to galvanized steel.

#### 3.3 SHOP PAINTING

- A. Structural steel shall be given one shop coat of the specified paint. Do not shop coat the following members when scheduled to receive sprayed fireproofing:
  - 1. Beam with flange width exceeding 12 inches.
  - 2. Column with flange width exceeding 16 inches.
  - 3. Beam or column with web depth exceeding 16 inches.
- B. Verify with the fireproofing manufacturer the compatibility of the specific proposed primer with the fireproofing material.
- C. All surfaces shall be clean, dry and free from mill scale or rust.

- D. Fabricator shall exercise special care in painting those portions of structural steel which *will* be exposed to view when the building is complete. Sags, run, crawls, and other defects will not be permitted.

### 3.4 DELIVERY AND HANDLING

- A. Contractor shall inspect all material when delivered and store on platforms or racks to keep material off the ground. Keep structural steel clean of dirt and other foreign matter.
- B. Clean all contact and bearing surfaces thoroughly before erection.

### 3.5 ERECTION

- A. The structure shall be erected, plumbed and leveled to the lines and grades indicated on the drawings before final connections are made. Base plates shall be grouted using specified nonshrink grout in accordance with manufacturer's printed directions.
- B. If exposed to View, erection angles, seats, tags shall be removed, etc., plugged, welded and ground smooth.
- C. All welding shall be performed by experienced mechanics and in accordance with the requirements of the American Welding Society Code (A.W.S.).
- D. For cantilever beams, allowance shall be made for deflection when final loads are applied.
- E. No field cuts or holes shall be flame cut. Necessary field holes shall be punched or drilled and slotted. All field steel modifications shall be inspected and approved by the project structural engineer and cost of such modifications shall be the responsibility of the Contractor.
- F. No structural members shall be erected which have been bent or deformed in transit to the site or by storage and handling on the site.
- G. Installed work shall comply with AISC allowable tolerances.

### 3.6 TEMPORARY BRACING

- A. Structural steel shall be temporarily braced as required to resist all wind loads and construction loading for which the structure has been designed.
- B. Structural steel shall be braced as the structure is erected and structure shall not be left overnight without adequate bracing.

### 3.7 WELDING

- A. All welds and the adjacent spattered areas shall be cleaned by sandblasting, wire brushing, chipping or other non-damaging means for removal of excess weld metal. Exposed welds shall be ground smooth. Welds in galvanized material shall be touched up after cleaning with "ZRC" cold galvanizing.
- B. Meet requirements of American Welding Society, "Code for Arc and Gas Welding in Building Construction".
- C. Meet requirements of American Welding Society, "Qualifications of Welding Procedures and Operators".

- D. Meet requirements of American Safety of Testing Materials, "Specifications for Iron and Steel Arc Welding Electrodes", A233-43T.

### 3.8 TESTING LABORATORY CONTROL

#### A. GENERAL:

1. Three copies of mill certificates attesting to the physical and chemical characteristics of the steel shall be transmitted to the Owner's independent testing laboratory upon request. In the event that mill certificates are not submitted, the Owner's testing laboratory shall perform physical and chemical tests in accordance with ASTM requirements, all at the Contractor's expense.
2. Contractor shall submit to the Owner's testing laboratory the certificates from an independent testing laboratory attesting to each welders' qualifications in accordance with A.W.S. requirements.
3. Where structural steel is fabricated outside of the greater Houston area, fabricator shall pay the travel and daily subsistence expense of the Owner's laboratory technician.
4. The Owner's independent testing laboratory shall be the sole judge as to whether materials and erection of structural steel meets the requirements of these specifications. Materials and installation not meeting specified requirements shall be removed and replaced at the Contractor's expense.

#### B. TESTING OF WELDS:

##### 1. Shop Welds:

- (a) An independent testing laboratory retained by the steel fabricator shall perform a visual inspection of a minimum of 10% of all structural steel shop welds. Any additional testing required by the Contractor shall be paid for by the Contractor. Any additional testing required by the fabricator shall be paid for by the fabricator.
- (b) Where the structural drawings indicate shop welded connections to be tested, 100% of such welds shall be tested by the fabricators independent testing laboratory using ultrasonic or radiographic methods.
- (c) Structural steel shall not be shipped until the laboratory testing reports have been reviewed by the structural engineer.
- (d) Inspection of shop welding of bar joists is at the fabricator's option.

##### 2. Field Welds:

- (a) All field welds to be tested shall be tested by the Owner's independent testing laboratory using ultrasonic or radiographic methods. Such testing shall be paid from the Testing Allowance.
- (b) Test 100% of all field welds of the types indicated on the structural drawings to be tested.
- (c) 100% of the following types of field welds shall be tested whether or not indicated on the drawings to be tested: full moment connections in rigid frames, welded beam splices, and welded column splices.
- (d) 15%-20% of all other types of structural steel field welds shall be visually inspected by the Owner's testing laboratory. Any additional testing required by the Contractor shall be paid for by the Contractor.
- (e) All field welds which are indicated on the Structural Drawings to be tested shall be identified with the welder's initials in chalk or wax crayon.

##### 3. Retesting:

- (a) All welds rejected after testing shall be repaired and retested at the Contractors expense, whether shop welds or field welds. Shop weld retesting shall be performed by the fabricators independent testing laboratory and field weld retesting shall be performed by the Owner's independent testing laboratory.
- (b) If more than 10% of the required numbers of tested shop welds fail testing, an additional 20% of the welds shall be tested. If more than 10% of these welds fail, another 20% of

the welds shall be tested. This procedure shall continue until either all welds are tested, or less than 10% of the welds fail in the last 20% tested.

3.9 FIELD TOUCHUP

- A. After erection, all structural steel shall be cleaned of rust and touched up with the specified shop coat paint.
- B. Steel shall be touched up wherever the shop coat has been damaged by handling, or during erection or by welding.
- C. All erection nuts and bolts shall be wire brushed and painted.
- D. Upon completion of this erection, any exposed structural steel shall be made ready for finish painting.

END OF SECTION

SECTION 05 41 00 — LIGHT GAGE METAL FRAMING SYSTEMS AND GYPSUM SHEATHING

PART 1 - GENERAL

1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

- A. Furnish and install exterior metal stud framing as shown on the drawings and specified herein.
- B. Furnish and install water resistant gypsum board sheathing at exterior face of exterior metal studs.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Masonry.
- B. Interior drywall systems.
- C. Wall Insulation.
- D. Dampproofing and Waterproofing.
- E. Exterior plaster (stucco).

1.4 SUBMITTALS

- A. Submit manufacturer's product data describing all materials.
- B. Submit manufacturer's certification of structural properties, only for products to be used in the project.

1.5 WARRANTY

- A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.6 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be delivered in manufacturer’s original packaging and stored flat in a covered, dry area providing protection from damage and exposure to the elements.
- B. Damaged or deteriorated materials shall be removed from the premises.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. STUDS AND FRAMING: Unimast, Clark Dietrich, Maverick Steel Co., Dale Industries, Delta Metals, Bostwick, American Studco Inc.
- B. GYPSUM BOARD SHEATHING: United States Gypsum Co., National Gypsum Co., Domtar Gypsum, Inc. Georgia Pacific, Temple Inland.

2.2 MATERIALS

- A. STRUCTURAL STUDS AND RUNNERS: Galvanized “Cee” studs in sizes and gauges as indicated in the drawings. Unless otherwise indicated in the drawings, minimum gauge shall be 16 gauge and the following structural properties shall apply:

SIZE	ABOUT MAJOR AXIS X-X			ABOUT MINOR AXIS Y-Y		
	lx	Sx	rx	ly	Sy	ry
3-5/8”	.906	.500	1.430	.139	.142	.614
4”	1.145	.572	1.566	.147	.143	.615
6”	3.016	1.005	2.262	.180	.149	.595
8”	6.071	1.518	2.923	.201	.152	.565

- B. SHEATHING FASTENERS: Unimast self-drilling screw fasteners (bugle head).
- C. SHEATHING: Fire resistant gypsum board with treated water resistant gypsum core surfaced with water repellant paper both faces –1/2” x 4’ x 8’ with tongue and groove joint design at long edges. Meet requirements of ASTM C-79. Provide 5/8” thick rated X core where specifically indicated on the drawings.
- D. All metal studs, track, and bridging shall be formed from ASTM A-446 commercial grade steel having a minimum yield of 33,000 psi for 18 gauge and lighter members and 50,000 psi for 16 gauge and heavier members.
- E. All framing components shall be galvanized. Tracks, runners, bridging and bracing shall match grade and gauge of studs.



PART 3 - EXECUTION

3.1 GENERAL

- A. Install studs plumb and in plane, without twist. System installation shall be in accordance with AISI Design Manual for "Light Gauge Cold Formed Steel".
- B. All framing components shall be cut tight against abutting members. Members shall be held firmly in position until properly fastened.
- C. All attachments of axial loaded framing components shall be welded in accordance with the American Welding Society's "Recommended Practices for Resistance Welding" and shall transfer the imposed load into the adjoining member. Use no splices in axial loaded members.
- D. Attachments of framing components not subject to axial loads may be welded or screw fastened.
- E. Members shall be braced as required to resist all wind loads and construction loading for which the system has been designed. System shall be braced as erected and shall not be left overnight without adequate bracing.
- F. Framing components used to frame openings shall be of a size and type to transfer any load imposed on the opening into the members adjacent to the opening. Additional framing shall be provided adjacent to the opening to carry the load imposed.
- G. Welds in galvanized material shall be coated with "ZRC" cold galvanizing after wire brushing.

3.2 ERECTION

- A. TRACK FASTENING: Secure metal floor track to concrete floor slab with Type "A" or "B" fasteners spaced as scheduled in the table below. For determining unbraced wall height, ceiling does not qualify as bracing.
  - 1. Type "A" fastener – minimum 5/32" diameter x 1-1/4" long powder actuated fasteners. Hilti #DS32P10 or Ramset #2335.
  - 2. Type "B" fastener – minimum 1/4" diameter x 2" long drilled sleeve anchor. Hilti sleeve anchor or Ramset "Thunder Nail".
  - 3. Demonstrate to the Architect that fasteners can be driven full length into concrete slab tight to stud track.
  - 4. Use similar fasteners (and spacing) suitable for steel at overhead track or weld track to overhead steel at 12" o.c.
  - 5. At track splices use anchored channel inserts or fully weld.

Spacing Schedule for Type A & B Fasteners

MAX. SPACING OF FASTENERS	*MAX. UNBRACED WALL HEIGHT	
	TYPE A	TYPE B
24"	7.4 FT.	8.3 FT.
16"	11.1 FT.	12.4 FT.
12"	14.8 FT.	16.5 FT.
8"	24.9 FT.	24.9 FT.
6"	29.7 FT.	33.2 FT.

\*NOTE: Ceiling at wall does not reduce unbraced wall height.

- B. **STUD FASTENING:** Each stud shall be fastened to top and bottom track (prior to gypsum board sheathing or interior wall finish) using one of the following two methods:
1. **Screw fastening:** One self-drilling screw at the front and back faces of the top and bottom tracks for each stud (4 fasteners per stud.)
  2. **Welding:** One weld at the front face of the top and bottom tracks for each stud (2 welds per stud).
  3. **Additional:** The above minimum fasteners are required regardless of any additional bracing or intermediate fastening which may be indicated in the drawings or required.
- C. **BRIDGING:** Provide bridging at all exterior stud walls whether or not indicated in the drawings. Unless more stringent requirements are indicated in the drawings provide the following:
1. **Wind loading resistance only:** Provide multiple bridging rows spaced 5'-0" o.c. vertically maximum.
  2. **Axial loaded members:** For stud lengths less than 10 feet, provide 2 rows of bridging at third points. For stud lengths 10 feet and greater, provide multiple bridging rows spaced 42" o.c. vertically maximum.
- D. **SHEATHING INSTALLATION:** Apply sheathing panels horizontally with the "v" edge turned up. Install with joints and penetrations tight and neatly fit. Stagger end joints over studs with screws spaced at maximum 12" centers at each stud and at 12" o.c. along top and bottom runners.

END OF SECTION

## SECTION 05 50 00 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Work under this section shall include all labor, materials, equipment, and accessories necessary for the fabrication and installation of all miscellaneous metal work as indicated in the drawings and as specified herein.
- B. The items listed herein are not necessarily inclusive of all items required to be furnished.

#### 1.3 SECTION REQUIREMENTS

- A. Submittals: Shop Drawings showing details of fabrication and installation.

### PART 2 - PRODUCTS

#### 2.1 METALS

- A. GENERAL: For the fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled or stamped trade names, and rough edges or finish.
  - 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 2. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
  - 3. Rolled Steel Floor Plate: ASTM A 786/A 786M.
  - 4. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
  - 5. Round steel tubing and pipe are sized differently. Tubing is designated by OD and wall thickness. Pipe is designated by NPS and weight or schedule number.
  - 6. Steel Pipe: ASTM A 53, standard weight (Schedule 40), black finish.
  - 7. Shop Primer:

- a. Typical: Red Oxide or Zinc Chromate Primer conforming to Federal Specification TT-P-664C (no lead). Verify compatibility with specified finish paint.
  8. Galvanizing: Hot-dip process per ASTM A-123.
  9. Bolts: Comply with ASTM A-307 for standard bolts and ASTM A-325 for high strength bolts. Furnish certification that bolts are domestic origin.
  10. Pipe: Conform to ASTM A-53, Schedule 40 for steel pipe and ASTM B-429, Schedule 40 for aluminum pipe.
- B. FABRICATED ITEMS: Items listed below represent principal items of miscellaneous metal fabrications required for the project. Contractor shall furnish items listed and all miscellaneous metal items indicated in the drawings or required for a complete installation.
1. Steel Pipe Railings: Schedule 40 x 1-1/2" diameter steel pipe. Provide smooth radiused bends without deformation. Provide end caps at all wall returns. Grind all welds smooth. Provide top rails in continuous lengths. Provide shop primer coat of paint compatible with schedule finish coat. Provide with cast steel wall brackets as manufactured by Julius Blum & Co. or approved equivalent.

## 2.2 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

## 2.3 FABRICATION

- A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.
- B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.
- C. Fabricate steel pipe columns with steel base and top plates drilled for anchor and connection bolts and welded to pipe with continuous fillet weld same size as pipe wall thickness.
  1. Provide 1/2-inch (12-mm) base plates with four 5/8-inch (16-mm) anchor bolts and 1/4-inch (6-mm) top plates.

## 2.4 STEEL AND IRON FINISHES

- A. Hot-dip galvanized steel fabrications at exterior locations.
- B. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," and paint with a rust-inhibitive primer complying with performance requirements of FS TT-P-664.

## 2.5 PAINT AND FINISHES

- A. Shop prime all metal fabrications, except aluminum or stainless steel items. Shop prime galvanized items only where scheduled for finish paint. Remove rust, scale, oil, grease and other deleterious materials before application of shop paint. Provide a uniform minimum dry film thickness of 2.0 mils. Provide full coverage of joints, corners, and edges.

- B. Separate dissimilar metals to protect against electrolysis. Apply a bituminous coating of approximately 30 dry mils thickness, tape or other suitable permanent separator on concealed contact surfaces of dissimilar metals.

### PART 3 - EXECUTION

- 3.1 GENERAL: Install all items as indicated in the drawings and approved shop drawings. Coordinate installation with all affected trades. Attach members firmly in proper position that is level, plumb, and parallel to adjoining construction (except where slope is indicated).
- 3.2 EXPANSION JOINT COVERS: Where void is constructed in concrete slab for installation of joint cover assembly, provide reinforcing projecting from vertical walls of void into grout fill to prevent separation between concrete void and grout.

END OF SECTION

## SECTION 06 10 00 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Provide and install all rough carpentry, formwork, wood framing, blocking, wood furring, hardboard and related fasteners as indicated in the drawings or as required to complete the indicated construction.
- B. Install all related hardware and fasteners. Provide and install wood furring and/or trim for acoustical panels.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Cast-in place concrete
- B. Painting
- C. Finish hardware

#### 1.4 SECTION REQUIREMENTS

- A. Submittals manufacturer's printed literature describing wood preservatives treatment system and certifying that system meets all current requirements for applicable Federal, State and local governing agencies.
- B. Submittals manufacturer's printed literature describing fire retardant treatment system, any structural or usage limitations, and certifying that system meets all current requirements for applicable Federal, State and local governing agencies.

#### 1.5 WARRANTY

- A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.6 DELIVERY AND STORAGE

- A. Deliver and store lumber, plywood and hardwood on sills and cover for protection.

1.7 QUALITY ASSURANCE

- A. All lumber and plywood shall be grade marked by Southern Pine Inspection Bureau, West Coast Lumber Inspection Bureau, American Plywood Association, or Western Wood Products Association.
- B. All lumber and plywood shall be marked with producing manufacturer's trademark.
- C. Certificate of inspection issued by grading association for bundled lumber and plywood may substitute for individual piece marking.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Dressed lumber, S4S, [19] [15] percent maximum moisture content for 2-inch (38-mm) thickness or less, marked with grade stamp of inspection agency.

2.2 TREATED MATERIALS

- A. Preservative-Treated Materials: AWPA C2 lumber and AWPA C9 plywood, labeled by an inspection agency approved by ALSC's Board of Review. After treatment, kiln-dry lumber and plywood to 19 and 15 percent moisture content, respectively. Treat indicated items and the following:
  - 1. Wood members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Concealed members in contact with masonry or concrete.
  - 3. Wood framing members less than 18 inches (460 mm) above grade.
  - 4. Wood floor plates installed over concrete slabs directly in contact with earth.
- B. Fire-Retardant-Treated Materials: AWPA C20 lumber and AWPA C27 plywood, interior Type A treatment, labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Use treated lumber and plywood with bending strength, stiffness, and fastener-holding capacities that are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions.

2.3 LUMBER

- A. Miscellaneous Lumber: No. 3 or Standard grade of any species for nailers, blocking, and similar members as indicated on drawings.

2.4 MISCELLANEOUS PRODUCTS

- A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.

1. Power-Driven Fasteners: CABO NER-272.
  2. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- B. Metal Framing Anchors: Hot-dip galvanized steel of structural capacity, type, and size indicated.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. COORDINATION: Coordinate work with other trades and provide cutting and patching required to accommodate the work. Verify all dimensions by taking field measurements to ensure proper fit. Accurately cut framing and blocking, and fit true to line and level, avoiding shims and wedges.
- B. Fit rough carpentry to other construction; scribe and cope for accurate fit. Correlate location of furring, blocking, and similar supports to allow attachment of other construction.
- C. ANCHORING AND FASTENTING: Use largest practicable fasteners for each type of work. Bolt nailers and blocking to steel, masonry or concrete members using bolts of proportionate strength to members attached. Unless otherwise noted in the drawings use 3/4" diameter bolts at maximum 4'-0" centers. Use concealed fasteners in finish work, set nails and use flathead countersunk screws.
- D. WOOD BLOCKING: Install fire-retardant tread wood blocking between metal studs where wall-supported drinking fountains, casework, railings, and other equipment is attached. Install between studs for toilet partitions systems and toilet accessories where anchored to wall. Use minimum 2 x 4 dimension where not indicated otherwise in the drawings.

END OF SECTION



## SECTION 06 16 43 - GYPSUM SHEATHING

### PART 1 GENERAL

#### 1.00 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.01 SUMMARY

- A. Section Includes: Fiberglass-mat faced, moisture and mold resistant gypsum sheathing.
- B. Related Sections:
  - 1. Section 05 41 00 Structural Metal Stud Framing.
  - 2. Section 06 10 00 Rough Carpentry.
  - 3. Section 09 21 16 Gypsum Board Assemblies.

#### 1.02 REFERENCES

- A. ASTM International (ASTM):
  - 1. ASTM C473 Standard Test Methods for Physical Testing of Gypsum Panel Products.
  - 2. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 3. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
  - 4. ASTM C1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  - 5. ASTM C1280 Standard Specification for Application of Gypsum Sheathing.
  - 6. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
  - 7. ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
  - 8. ASTM E72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
  - 9. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
  - 10. ASTM C1396 Standard Specification for Gypsum Board
- B. Gypsum Association (GA): GA-253 Application of Gypsum Sheathing.

#### 1.03 SUBMITTALS

GYPSUM SHEATHING

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- A. Product Data: Manufacturer's specifications and installation instructions for each product specified.

#### 1.04 WARRANTY

- A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay) commencing with the date of installation of the product in such structure.
- B. Manufacturer's Warranty:
  - 1. Five years against manufacturing defects from the date of purchase of the product for installation
  - 2. 12 years against manufacturing defects when used as a substrate in architecturally specified EIFS.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Georgia-Pacific Gypsum LLC:
  - 1. Fiberglass-Mat Faced Gypsum Sheathing: DensGlass Sheathing.
  - 2. Fiberglass-Mat Faced Gypsum Sheathing, Type X for Fire Rated Designs: DensGlass Fireguard Sheathing.
- B. Size:
  - 1. Thickness: 5/8 inch.
  - 2. Width: 4 feet.
  - 3. Length: 8 feet.
  - 4. R-Value: (ASTM C518) 0.67
- C. Substitutions will be in accordance with Section 01 25 00.

#### 2.02 ACCESSORIES

- A. Screws: ASTM C1002, corrosion resistant treated.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verification of Conditions:
  - 1. Inspection: Verify that project conditions and substrates are acceptable, to the installer, to begin installation of work of this section.

#### 3.02 INSTALLATION

- A. General: In accordance with GA-253, ASTM C1280 and the manufacturer's recommendations.
  - 1. Manufacturer's Recommendations:
    - a. Current "Product Catalog", Georgia-Pacific Gypsum.

#### 3.03 PROTECTION

- A. Protect gypsum board installations from damage and deterioration until date of Substantial Completion.

END OF SECTION

## SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

### PART 1- GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of 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. Interior standing and running trim and rails.
  - 2. Wood cabinets (casework).
  - 3. Laminate clad cabinets (plastic-covered casework).
  - 4. Cabinet tops (countertops) and plastic-covered chair rails.
  - 5. Flush wood paneling.
  - 6. Interior door frames (jambs).
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 6 Section 'Rough Carpentry' for furring, blocking, and other carpentry work that is not exposed to view.
  - 2. Division 6 Section 'Finish Carpentry' for carpentry exposed to view that is not specified in this section.
  - 3. Division 6 Section 'Exterior Architectural Woodwork' for exterior woodwork.
  - 4. Division 8 Section "Flush Wood Doors" for doors specified by reference to architectural woodwork standards.
  - 5. Division 9 Section "Painting" for final finishing of installed painted finish architectural woodwork.

#### 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

- B. Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
- C. Fire-retardant treatment data for material impregnated by pressure process to reduce combustibility. Include certification by treating plant that treated materials comply with requirements.
- D. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- E. Samples for initial selection purposes of the following in form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of material indicated.
  - 1. Plastic laminate (standard and premium selections).
- F. Samples for verification purposes of the following:
  - 1. Lumber with or for transparent finish, 50 square inches, for each species and cut, finished on one side and one edge.
  - 2. Veneer leaves representative of and selected from flitches to be used for transparent finished woodwork.
  - 3. Wood veneer faced panel products, with or for transparent finish, 8-1/2 inches by 11 inches, for each species and cut with one half of exposed surface finished, with separate samples of unfaced panel product used for core.
  - 4. Lumber and panel products with factory-applied opaque finish, 8- 1/2 inches by 11 inches for panels and 50 square inches for lumber, for each finish system and color, with one half of exposed surface finished.
  - 5. Laminate clad panel products, 8-1/2 inches, by 11 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
  - 6. Corner pieces as follows:
    - a. Cabinet front frame joints between stiles and rail as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
    - b. Miter joints for standing trim.
  - 7. Exposed cabinet hardware, one unit of each type and finish.
- G. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.
- H. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

#### 1.04 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. **Single-Source Responsibility:** Arrange for production by a single firm of architectural woodwork with sequence matched wood veneers.
  - 1. Include the veneering of wood doors in the single-firm production, where veneer matching extends across wood doors.

- C. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.
- D. Installer Qualifications: Arrange for installation of architectural woodwork by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.
- E. AWI Quality Standard Comply with applicable requirements of “Architectural Woodwork Quality Standards” published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.
- F. Hardware Coordination Distribute copies of approved schedule for cabinet hardware specified in Division 8 Section “Door Hardware” to manufacturer of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in ‘Project Conditions.’

#### 1.06 PROJECT CONDITIONS

- A. Environments1 Conditions: Obtain and comply with Woodwork Manufacturer’s and Installer’s coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.
- B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.
  - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

### PART 2- PRODUCTS

#### 2.01 HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high pressure decorative laminates (standard and premium selections) which may be incorporated in the work include:
  - 1. Formica Corp.
  - 2. Nevamar Corp.
  - 3. WilsonArt

## 2.02 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:
1. Hardboard ANSI/AHA A135.4
  2. High Pressure Laminate: NEMA LD 3.
  3. Medium Density Fiberboard: ANSI A208.2.
  4. Particleboard ANSI A208.1
  5. Softwood Plywood PS 1.
- B. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:
1. Particleboard: NPA 8.
  2. Medium Density Fiberboard: NPA 9.
  3. Hardwood Plywood: HPMA FE.
- C. Fire-Retardant Particleboard: Where indicated, provide panels complying with the following requirements that have fire-retardant chemicals bonded to softwood particles at time of panel manufacture to achieve products identical to those tested for flame spread of 20 or less and for smoke developed of 25 or less per ASTM B 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.
1. For 45-lb-density panels and thicknesses of 3/4 inch and less, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of elasticity and screw-holding capacity on face and edge shall be 300,000 psi, 250 lb, and 225 lb, respectively.
  2. For 44-lb-density panels and thicknesses of 13/16 inch to 1-1/4 inch, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of rupture, modulus of elasticity, internal bond, linear expansion, and screw-holding capacity on face and edge shall be 1300 psi, 250,000 psi, 60 psi, 0.50 percent, 250 lb, and 175 lb, respectively.
  3. Product: Subject to compliance with requirements, provide "Duraflake FR" by Duraflake Div.; Willamette Industries, Inc.

## 2.03 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.
- B. 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 less than 1 inch in nominal thickness: 1/16 inch.
  2. Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.
- C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to minimum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

- D. Factory-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. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

#### 2.04 FIRE-RETARDANT-TREATED LUMBER

- A. General: Where indicated, pressure impregnate lumber with fire-retardant chemicals of formulation indicated to produce materials with fire performance characteristics specified.
- B. Fire-Retardant Chemicals: Use chemical formulations specified that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated lumber from untreated lumber.
  - 1. Organic Resin-Based Formulation: Exterior type per AWPA C20 consisting of organic-resin solution, relatively insoluble in water, thermally set in wood by kiln drying.
  - 2. Low-Hygroscopic Formulation: Interior Type A per AWPA C20.
- C. Fire Performance Characteristics: Provide materials identical to those tested for the following fire performance characteristics per ASTM test methods indicated by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify treated lumber with classification marking of inspecting and testing organization in the form of separable paper label or, where required by authorities having jurisdiction, of imprint on lumber surfaces that will be concealed from view after installation.
  - 1. Surface Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for 30 minutes with no evidence of significant combustion.
    - a. Flame Spread: 25.
    - b. Smoke Developed: 50.
- D. Mill lumber after treatment, within limits set for wood removal that does not affect listed fire performance characteristics, using a woodworking plant certified by testing and inspecting organization.
- E. Mill lumber before treatment and implement special procedures during treatment and drying processes that are needed to prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- F. Kiln-dry woodwork after treatment to levels required for untreated woodwork. Maintain moisture content required by kiln drying before and after treatment.
- G. Discard treated lumber that does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective lumber.
- H. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Low-Hygroscopic Formulation (Type A):
    - a. "Flameproof LHC"; Osmose Wood Preserving, Inc.
    - b. "Dricon"; Hickson Corporation.

#### 2.05 STANDING AND RUNNING TRIM AND RAILS FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 300.



- B. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.
- C. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- D. Grade: Premium.
- E. Lumber Species: Birdseye Maple, half round.

#### 2.06 STANDING AND RUNNING TRIM AND RAILS FOR OPAQUE FINISH

- A. Quality Standard: Comply with AWI Section 300.
- B. Grade: Premium.
- C. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.
- D. Assemble casing in plant except where limitations of access to place of installation require field assembly.
- E. Lumber Species: Any dosed-grain hardwood listed in referenced woodworking standard.

#### 2.07 WOOD CABINETS (CASEWORK) FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 400 and its Division 400A Wood Cabinets.”
- B. Grade: Premium.
- C. AWI Type of Cabinet Construction: Flush overlay.
- D. Wood Species for Exposed Surfaces: Maple, rotary cut veneer.
  - 1. Grain Matching: Run and match grain vertically for drawer fronts, doors, and fixed panels.
  - 2. Matching of Veneer Leaves: Slip match.
  - 3. Veneer Matching Within Panel Face: Balance match.
- E. Wood Species for Semiexposed Surfaces: Match species and cut indicated for exposed surfaces.

#### 2.08 LAMINATE CLAD CABINETS (PLASTLC.COVERED CASEWORK)

- A. Quality Standard. Comply with AWI Section 400 and its Division 400B ‘Laminate Clad Cabinets.’”
- B. Grade: Premium.
- C. AWI Type of Cabinet Construction: Flush overlay, unless otherwise indicated.
- D. Laminate Cladding High pressure decorative laminate complying with the following requirements:
  - 1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
    - a. Provide selections made by Architect from laminate manufacturer’s full range of standard and premium colors and finishes in the following categories:

- (1) Solid colors.
  - (2) Patterns.
2. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.
    - a. Horizontal Surfaces Other Than Tops: GP-50 (0.050-inch nominal thickness).
    - b. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).
    - c. Edges: GP-50 (0.050-inch nominal thickness).
  3. Semiexposed Surfaces: Provide surface materials indicated below:
    - a. High pressure laminate, GP-28.

## 2.09 CABINET HARDWARE AND ACCESSORY MATERIAL.8

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section 'Door Hardware.'
- B. Cabinet Hardware and Miscellaneous Item Schedule:
  1. Adjustable Shelf Standard.
    - a. Manufacturer/Model No.: Knape & Vogt/No. 255.
    - b. Size/Type: 5/8" wide x 3/16" deep, recessed.
    - c. Finish: Bright zinc plate.
    - d. Remarks: 1/2" vertical adjustment.
  2. Adjustable Shelf Support:
    - a. Manufacturer/Model No.: Knape & Vogt/No. 256.
    - b. Finish: Bright zinc plate.
    - c. Remarks: For use with No. 255 standard.
  3. Slotted Shelf Standard:
    - a. Manufacturer/Model No.: Knape & Vogt/No. 51.
    - b. Size/Type: 3/4" x 3/8" x length shown, surface mount, heavy duty.
    - c. Finish: Bright nickel plate.
    - d. Remarks: 1-5/8" vertical adjustment.
  4. Adjustable Shelf Bracket:
    - a. Manufacturer/Model No.: Knape & Vogt/No. 52.
    - b. Size/Type: 1 1/2" wide x shelf depth.
    - c. Finish: Bright nickel plate.
    - d. Remarks: For use with No.51 standard.
  5. Drawer Slide: (Typical)
    - a. Manufacturer/Model No.: Grant/No. 329.
    - b. Size/Type: Full extension, length to suit drawer.
    - c. Finish: Zinc plate.
    - d. Remarks: 100 lb. rating.
  6. Drawer Slide: (To 4-1/2" drawer depth)

- a. Manufacturer/Model No.: Grant/No. 328.
  - b. Size/Type: Full extension, length to suit drawer.
  - c. Finish: Zinc plate.
  - d. Remarks: 50 lb. rating.
7. Knobs (at Suites Level):
- a. Forms + Surfaces Model No. HC430 Series, sizes as selected by Architect from manufacturers standards.
  - b. Finish: Anodized black matte.
8. Wire Pulls:
- a. Manufacturer/Model No.: Stanley/No. 4483112
  - b. Size/Type: 3-1/2" center wire pulls.
  - c. Finish: US 28D.
9. Concealed Hinges:
- a. Manufacturer/Model No.: Stanley/No. 1510.
10. Continuous Hinges:
- a. Manufacturer/Model No.: Stanley/No. STS311-1/4.
  - b. Size/Type: 1-1/2" wide x height of door.
  - c. Finish: US 32.
  - d. Remarks: Provide matching countersunk screws, 2" o.c., both sides.
11. Door Catch (Magnetic type)
- a. Manufacturer/Model No.: Stanley/No. SP4L
  - b. Size/Type: 2" x 1-1/4" case size.
  - c. Finish: Aluminum.
  - d. Remarks: One per leaf to 48", two per leaf to 84".
12. Cabinet Lock
- a. Manufacturer/Modal No.: National/No. C-8053.
  - b. Size/Type: Disc tumbler cam lock.
  - c. Finish: US 26D or US 32D.
  - d. Remarks: Furnish two keys per lock; keyed to Building Standard.
13. Sliding Glass Door Locks: K&V 965NP, keyed to building system.
14. Track, Upper Guide & Sheaves: Stylmark Model No. 810005 Assembly, 204-Ri clear anodized finish.
- C. Hardware Standard Comply with ANSI/BEMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BIIMA numbers or referenced to this standard.
- D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA code number indicated.
1. Dark Oxidized Satin Bronze, Oil Rubbed, on Bronze Base: BHMA 613 and matching Architect's sample.
  2. Satin Chromium Plated, Brass or Bronze Base: BHMA 626.

3. Satin Chromium Plated, Steel Base: BHMA 652.
  4. Satin Stainless Steel, Stainless Steel Base: BHMA 630.
- E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSJ/BHMA A156.9.
- F. Clear Tempered Float Glass for Shelves: ASTM C 1048, Condition A, style I, type I, quality q3, class 1, seamed at edges before tempering, 1/4-inch thick unless otherwise indicated.

#### 2.10 ARCHITECTURAL CABINET TOPS (COUNTERTOPS) AND CHAIR RAILS:

- A. Quality Standard: Comply with AWI Section 400 and its Division 400C.
- B. Type of Top and Chair Rail: High pressure decorative laminate complying with the following:
1. Grade: Custom.
  2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:
    - a. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
      - (1) Provide selections made by Architect from manufacturer's full range of standard and premium colors and finishes in the following categories:
        - (a) Solid colors.
        - (b) Patterns.
      - b. Grade: GP-50 (0.050-inch nominal thickness).
      - c. Edge Treatments:
        - (1) Plastic Laminate Edge Treatment: Same as laminate cladding on horizontal surfaces.
        - (2) Wood Edge Treatment: Lumber edge for transparent finish, with matching wood species and cut to be determined.

#### 2.11 FLUSH WOOD PANELING FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 500 and its Division 500A.
- B. Grade: Premium.
- C. Veneer Species: Birdseye Maple half round.
- D. Matching of Adjacent Veneer Leaves: Slip match.
- E. Veneer Matching Within Panel Face: Best match.
- F. Fire Performance Characteristics: Provide paneling composed of panels of wood veneer density and fire-retardant particleboard that are identical in construction to units tested for the following surface burning characteristics per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify panels with appropriate markings of applicable testing and inspecting organization on surfaces that will be concealed from view after installation.
1. Flame Spread: 75 or less.
  2. Smoke Developed: 40 or less.

#### 2.12 INTERIOR DOOR FRAMES FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 900B.
- B. Grade: Premium.
- C. Lumber Species: Maple, rotary cut veneer.

2.13 CLOSET AND UTILITY SHELVING:

- A. Quality Standard: Comply with AWI Section 600.
- B. Shelving for Painted Finish (By Section 09 91 00): Comply with the following requirements:
  - 1. Grade: Economy.
  - 2. Shelving Material: Maple faced veneer core plywood.
  - 3. Lumber: Ponderosa Pine or Poplar.

2.14 FASTENERS AND ANCHORS

- A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
  - 1. For metal framing supports, provide screws as recommended by metal framing manufacturer.
- B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.15 FACTORY FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

- A. Quality Standard: Comply with AWI Section 1500 unless otherwise indicated.
- B. General: The entire finish of interior architectural woodwork is specified in this section, regardless of whether factory applied or applied after installation.
  - 1. Factory Finishing: To the greatest extent possible, finish architectural woodwork at factory. Defer only final touch-up, cleaning, and polishing until after installation. Painted finish by Section 09 91 00 except prime coat.
- C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.
- D. Transparent Finish for Closed-Grain Woods: Comply with requirements indicated below for grade, finish system, staining, effect, and sheen.
  - 1. Grade: Premium.
  - 2. AWI Finish System #5: Catalyzed polyurethane.
  - 3. Staining for Cherry Only: Match approved sample for color.
  - 4. Effect: Open grain (not filled).
  - 5. Sheen: Dull satin 15-20 deg.

- E. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen:
  - 1. Grade: Premium.
  - 2. AWI Finish System #11: Catalyzed polyurethane.
  - 3. Color: Match Architect's sample.
  - 4. Sheen: Medium-gloss rubbed effect 35-45 deg.

## 2.16 MISCELLANEOUS ACCESSORIES

- A. Steel Countertop Support Bracket: provide prefinished steel bracket supports at locations as shown on drawings. Brackets shall be by A&M Hardware (888) 647-0200 [info@aandmhardware.com](mailto:info@aandmhardware.com) Other equal products may be provided if and as specifically approved by Architect by substitution request during bidding period.

## PART 3- EXECUTION

### 3.01 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.
- C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

### 3.02 INSTALLATION

- B. Quality Standard. Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.
- C. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.
- D. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood. Handle, store, and install fire- retardant-treated wood to comply with recommendations of chemical treatment manufacturer including those for adhesives where are used to install woodwork.
- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- G. Standing and Running Trim and Rails: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners.

- H. Cabinets: Install without distortion so that 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 the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish
- I. Tops: Anchor securely to base units and other support systems as indicated.
- J. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips and by blind nailing on backup strips, splined-connection strips, and similar associated trim and framing. Do not face nail unless otherwise indicated.
- K. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.
- L. Refer to the Division 9 sections for finishing of painted architectural woodwork.

### 3.03 ADJUSTMENT AND CLEANING

- A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

### 3.04 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

END OF SECTION

## SECTION 07 01 50.19 - PREPARATION FOR RE-ROOFING

### PART 1 – GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

#### 1.1 SCOPE OF WORK

- A. Remove existing membrane, gravel, base flashings, sheet metal, vent stack flashings, down to the lightweight insulating fill deck substrates. Replacement of all damaged wood components. Patching and repairing of lightweight insulating concrete

#### 1.2 RELATED SECTIONS

- A. Division 6, Section “Rough Carpentry”.
- B. Division 7, Section “Modified Bitumen Sheet Roofing”.
- C. Division 7, Section "Flashing & Sheet Metal"

#### 1.3 PRE-INSTALLATION CONFERENCE

- A. Refer to Section 07 50 00.
- B. Review installation procedures and coordination required with related work.

#### 1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not remove existing roofing membrane or damaged decking when weather conditions threaten the integrity of the building contents or intended continued occupancy. Maintain continued temporary protection prior to installation of new roofing system.

#### 1.5 PROTECTION

- A. It shall be the Contractor's responsibility to respond immediately to correction of roof leakage during construction. A 4-hour time limit shall be given from the time of notification of emergency conditions. In the event of water penetration during rain or storm, the Contractor shall provide for repair or protection of building contents and interior. If the Contractor does not respond or cannot



be contacted, the Owner will effect repairs or emergency action and Contractor shall be back-charged for all expenses and damages, if any.

#### 1.6 SCHEDULING

- A. Schedule work to coincide with commencement of installation of new roofing system.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Patching Material: Zono-Patch, Pyrofill or approved equal.
- B. Temporary Protection: Sheet polyethylene. Provide weights to retain sheeting in position.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Roofing Contractor to verify existing site conditions.
- B. Verify that existing roof surface is clear and ready for work of this Section.

#### 3.2 MATERIALS REMOVAL

- A. Remove all gravel, membrane, cant strips, expansion joint, base flashings and any other items shown on the drawings. The complete removal of all nails to leave a smooth even surface for re-roofing.
- B. Under certain conditions, it will be necessary and desirable to incorporate one or more of the following methods for removal of dirt, silt, gravel, debris, roof membrane and insulation from the roof surface in order to preserve the ecology, eliminate unsightly conditions, and protect building surfaces:
  - 1. Roof vacuum systems.
  - 2. Crane and hopper with dump truck system.
  - 3. Enclosed chutes with protective shrouds on building and ground surfaces.
- C. All debris dumped from the roof shall be transported from the roof via chutes into dumpsters or trucks, and this debris shall be removed from the premises when vehicles are full. No debris shall be transported from the area being worked over an existing finished roof without an underlayment of 3/4" plywood.
- D. All roof equipment not in use or left filled will be parked on the column lines on 3/4" plywood.
- E. Contractor shall provide tie-ins at the end of each day's work. Area of tie-in shall be spudded clean of all existing gravel and or tied into existing polyurethane foam.

#### 3.3 PATCHING

- A. Perform all patching and repairing of insulating concrete using Zono-Patch or other materials approved for patching lightweight insulating concrete decks.

3.4 TEMPORARY PROTECTION

- A. Provide temporary protective sheeting over uncovered deck surfaces.
- B. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights or temporary fasteners.
- C. Provide for surface drainage from sheeting to existing drainage facilities.
- D. Do not permit traffic over unprotected deck surface.

END OF SECTION

## SECTION 07 10 00 — DAMPPROOFING AND WATERPROOFING

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Provide and install below-grade waterproofing.
- B. Provide and apply dampproofing on weather side of inside wythe of all exterior masonry cavity walls.
- C. Provide and apply dampproofing and joint taping on weather side of gypsum board sheathing.
- D. Provide and install membrane waterproofing (flashing) at exterior walls as indicated in the drawings and specified herein.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Unit masonry.
- B. Gypsum sheathing.
- C. Flashing at roof.
- D. Plastic membrane under slab-on-grade.
- E. Waterstops.
- F. Metal thru-wall flashing.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's printed literature describing each material, restrictions, and manufacturer's recommended procedures. Submit samples of each material.

- B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

#### 1.5 WARRANTY

- A. Provide written warranty against defects in materials and workmanship for the Work under this section for a period of one year after the date of Substantial Completion of the Project.

#### 1.6 QUALITY ASSURANCE

- A. Waterproofing company shall have a minimum of 3 years experience in the dampproofing and waterproofing of building structures of similar size and scope as this project.
- B. Retain at the job site a properly calibrated gauge for use by the Architect to verify applied thickness of materials.

### PART 2 - PRODUCTS

#### 2.1 WALL MATERIALS

- A. MEMBRANE FLASHING: 40 mil thick polyethylene backed SBS modified bitumen self-adhering black membrane; "Protecto Flash" as manufactured by Protecto Wrap Co. or "Perm-A-Barrier" as manufactured by W.R. Grace and Co. or "Blueskin SA" as manufactured by Henry Company. Membrane shall comply with the following:
  - 1. Tensile Strength: ASTM D412; 1400 psi.
  - 2. Elongation: ASTM D412; 200% min.
  - 3. Water Absorption: ASTM D570; 0.1% max.
- B. DAMPPROOFING: Non-asbestos emulsion type coating No. 352 over No. 207 adhesive primer, as manufactured by Gulf States Asphalt or approved equivalent by Henry Company, Karnak, W.R. Meadows, Celotex, or Sonneborn. Comply with ASTM D1227, Type 1.
- C. SHEATHING TAPE: 4" wide glass fabric scrim complying with ASTM D1668 or 40 mil thick polyethylene backed SBS modified bitumen self-adhering tape as manufactured by Protecto Wrap Co. or equivalent by W.R. Grace and Co or Henry Company. Verify compatibility of tape with proposed dampproofing.

#### 2.2 BELOW GRADE WATERPROOFING:

- A. WALLS: "Hydrocide Liquid Membrane 5000T", one part cold applied elastomeric, modified urethane. Trowel applied, non-sag, as manufactured by Sonneborn or approved equivalent by Toch Bros. or Tremco or Henry Company.
- B. SLABS: "Hydrocide Liquid Membrane, HLM 5000" Cold Applied Seamless Elastomeric, Modified Urethane for use between concrete seal slab and concrete slab-on-grade as manufactured by Sonneborn or approved equivalent by Toch Bros. or Tremco or Henry Company.
- C. PROTECTION BOARD: Water-resistant, semi-rigid panel composed of a core of asphalt and inorganic mineral filler particles, bottom reinforcing cover of asphalt-saturated felt and top cover of fiber glass mat weather-coated with a bond-breaking film, as manufactured by W.R. Meadows, Inc or Henry Company.

- D. INSIDE ELEVATOR PIT: "Sonoblock" cementitious base slurry as manufactured by Sonneborn-Contech.
- E. WATERSTOPS: Reference concrete section.

### 2.3 SHOWER PANS:

- A. MEMBRANE SHOWER PAN: 30 mil thick synthetic, heavy-duty, flexible membrane PVC sheet, Nervastral 300.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Contractor shall inspect exterior face of all masonry cavity walls to ensure that all penetrations and joints are completely filled prior to dampproofing operations beginning.

### 3.2 MEMBRANE FLASHING

- A. Prime concrete and masonry surfaces scheduled to receive membrane flashing using flashing manufacturer's recommended primer to ensure good adhesion.
- B. WALL FLASHINGS: Shall be installed above all openings occurring in an exterior wall, at base of exterior wall, and at wall interruptions by columns, beams, slabs, spandrels and other locations as indicated in the drawings. Flashing shall extend to within 1" of outside face of wall, shall be continuous and shall extend through cavity and be turned up to the top first course above finish floor on face of inner wythe, and to extend 1" minimum into back up or inner wythe. End laps to be 9" and side laps 6".
- C. STEEL STRUCTURE: Cover all steel columns or beams in exterior walls not protected by dampproofed concrete block or sheathing. Cover steel completely with membrane flashing lap 6" on to masonry on each side of columns. Conform and adhere to steel shapes not fireproofed. Cover all protruding angles or miscellaneous steel.
- D. FRAMES: Install at exterior window and door frames and other locations as indicated in the drawings.
- E. SHEATHING: Wrap all corners of gypsum board sheathing. See drawings for other details.

### 3.3 SHEATHING TAPE: Use one of the following systems:

- A. Imbed and cover glass fabric scrim tape in dampproofing mastic at all joints, cracks and penetrations at gypsum board sheathing.
- B. Apply specified self-adhering tape continuously over all joints, cracks and penetrations prior to beginning dampproofing operations.

### 3.4 DAMPPROOFING

- A. Spray or brush apply dampproofing coating to weather side of all gypsum sheathing and primed concrete block back-up at exterior masonry cavity walls in accordance with the following:
  - 1. Primer: Minimum ½ gallon material per 100 sq. ft. of wall surface.
  - 2. Coating: Minimum 2/32" (62.5mils) dry film thickness and minimum 5 gallons material per 100 sq. ft.
- B. Cover all corners and work thoroughly into all joints, cracks, or crevices. Finished coating shall be monolithic and free of pin holes or cracks. Seal cracks, voids and joints at dissimilar materials with glass fabric embedded in dampproofing coating.
- C. Seal around penetrations including all masonry anchors.
- D. Dampproofing shall be applied only when temperature is at 50 degrees F. and rising or above, and when no rain is forecast for the 24 hour period following application. No dampproofing shall be covered by masonry prior to observation by the Architect. All dampproofing shall dry for a minimum of 24 hours prior to being covered by finish masonry.

### 3.5 BELOW GRADE WATERPROOFING

- A. LIQUID MEMBRANE:
  - 1. Install liquid membrane systems at earth side of all below grade walls, between sub-slab ("mud-slab") and structural slab, and all outside surfaces of elevator pit. Allow concrete work to cure a minimum of 14 days. All surfaces shall be smooth, dry, sound and free of honeycombs. Concrete shall be free of curing and parting compounds, wax or other foreign materials.
  - 2. Static joints or cracks less than 1/8" wide shall be sealed with "HLM" as manufactured by waterproofing manufacturer. Material shall fill and over-lap the edges of the joint to a width of 4" on both sides and shall have a minimum surface thickness of 55 (+5) mils.
  - 3. Immediately prior to application of membrane, remove all dust and dirt by use of high-pressure air, by brushing with a soft broom or vacuum cleaning.
  - 4. Apply material at a rate of 4 gallons per 100 square feet of surface to produce a membrane of 55 (+5) mil thick. Carefully control application to avoid runs and sags of fresh material.
  - 5. Apply membrane to prestripped areas at cracks, joints, intersections, penetrations, etc., to provide a minimum total thickness of 110 mils over these areas. Mask any membrane edge exposed to view to provide a straight clean edge.
  - 6. Before the membrane attains a final set, verify the applied thickness by use of a mil-thickness gauge. Where readings indicate a thickness less than specified, immediately apply additional membrane to produce required thickness.
  - 7. Following the application of the membrane, place protection boards over the membrane waterproofing at walls receiving backfill. Use membrane material as required to adhere protection boards. Boards shall be firmly in place with joints closely butted and sealed with gusset tape before backfilling is started.
  - 8. Protect membrane during construction. Any punctures or cuts in the membrane shall be patched and sealed in the manner described above for sealing joints in the sheeting.

### 3.6 SHOWER PANS

- 1. Ensure that surfaces receiving shower pan are clean, thoroughly dry and free from rough surfaces and sharp projections.
- 2. One-ply of 30 mil sheet shall be applied over concrete surface by embedding it in a coat of Nerva-Plast mastic trowel-applied at a rate of 40 sq. ft. per gallon. Turn up perimeter a minimum of 4".
- 3. Seal joints with 3" and final 2" wide strips of Nervastral tape in accordance with manufacturer's recommendations. Preform all corners and make without joints.
- 4. Roll entire horizontal area with 50 to 100 lb. Roller. Set corners and turn-ups with rubber roller.

END OF SECTION

## SECTION 07 21 00 - BUILDING INSULATION

### PART 1 - GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Polystyrene foam insulation
  - 2. Open cell spray foam insulation
  - 3. Chicken Wire
  - 4. Fiberglass roll or batt insulation
  - 5. Polyencapsulated Batt Insulation
  - 6. Fiberboard ceiling insulation underlayment
- B. Related Sections include the following:
  - 1. Section 09 21 16.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.
- D. Research/Evaluation Reports: For foam-plastic insulation.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by 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 plastic insulation as follows:
  - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

### PART 2 - PRODUCTS

#### 2.1 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. Extruded-Polystyrene Board Insulation:
    - a. DiversiFoam Products.
    - b. Dow Chemical Company.
    - c. Owens Corning.
    - d. Tenneco Building Products.

#### 2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.



1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:
  1. Type X, 1.30 lb/cu. ft.
- C. Open Cell Spray Foam Insulation:
  1. Icynene LD-R-50
  2. Demilec Sealection 500
  3. Application: Exterior Walls and other locations as indicated on plans.
- D. Polyencapsulated Batt Insulation
  1. Johns Manville
  2. Owens Corning
  3. Certainteed

Encapsulated, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

  1. Roof/Ceiling Cavity: R-19
  2. Exterior Walls: R-19
- E. Batt or Roll Insulation:
  1. Johns Manville
  2. Owens Corning
  3. Certainteed

General: Insulation shall be fine fiber, flexible, resilient glass fiber blanket. Moisture absorption shall be less than .2% by volume.

1. Interior Stud Walls: 3 5/8" x 16" wide x 96" sound attenuation batts "R" factor 11. Unfaced.
2. Interior Stud Walls: 6" x 16" wide x 96" sound attenuation batts "R" factor 19. Unfaced
3. Above Acoustical Ceilings: 6" x 24" wide x 96" thermal batt insulation kraft faced fiberglass. "R" factor 19

#### AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- B. Chicken Wire: Provide as support for encapsulated batt insulation attached to the underside of metal building roof z girts.
- C. Fiberboard ceiling insulation underlayment: Provide over scheduled ceilings as substrate to apply sprayed foam insulation. Provide Celotex or equivalent product.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Review and insure chemical compatibility of cavity wall dampproofing membrane and cavity rigid insulation board prior to installation.

### 3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.
- B. Close off openings in cavities receiving poured-in-place insulation to prevent escape of insulation. Provide bronze or stainless steel screens (inside) where openings must be maintained for drainage or ventilation.

### 3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturers written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.
- C. Extend insulation in thickness indicated 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. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are required to make up total thickness.

### 3.4 INSTALLATION OF FOAM INSULATION

- A. Per manufacturer's instructions. Installation by approved applicator only.

### 3.5 INSTALLATION OF CAVITY WALL INSULATION

- A. On units of plastic insulation, install small pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, as recommended by manufacturer. Fit courses of insulation between confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against sheathing.

### 3.6 INSTALLATION OF POLYENCAPSULATED BATTS

- A. Encapsulated batts at vertical wall surfaces are to be attached with self tapping screws where attached at z girts. Batt's at metal stud wall shall form fit to cavity.

### 3.7 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method 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. Set vapor-retarder-faced units with vapor retarder to warm side of construction. Do not obstruct ventilation spaces, except for firestopping.
  - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- C. Apply spray foam insulation in strict compliance with insulation manufacturers' written recommendations by manufacturer approved applicator only. 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 it even with studs by using method recommended by insulation manufacturer.

END OF SECTION

## SECTION 07 21 29 - SPRAY FOAM INSULATION

### PART 1 GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply

#### 1.2 SECTION INCLUDES

- A. Open Cell Spray Foam Insulation.

#### 1.3 RELATED SECTIONS

- A. Section 03 30 00 - Cast-In-Place Concrete.
- B. Section 07 10 00 - Dampproofing and Waterproofing: Insulation installed with waterproofing systems.
- C. Section 07 26 00 - Vapor Retarders: Vapor retarder materials.
- D. Section 07 27 00 - Air Barriers: Air seal materials.
- E. Section 07 24 00 - Exterior Insulated Finish Systems EIFS.

#### 1.4 REFERENCES

- A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- B. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- C. ASTM C 1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
- D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building

Materials.

- E. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
- F. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- G. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- H. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- I. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
- J. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- K. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

1.5 PERFORMANCE REQUIREMENTS

- A. Conform to applicable code for flame and smoke, concealment, and over coat requirements.

1.6 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with a minimum of ten years experience manufacturing products in this section shall provide all products listed.
- B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years experience successfully installing insulation on projects of similar type and scope as specified in this section.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Architect.
  - 2. Do not proceed with remaining work until workmanship is approved by Architect.
  - 3. Refinish mock-up area as required to produce acceptable work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Storage: Store materials in dry locations with adequate ventilation, protected from freezing rain, direct sunlight and excess heat and in such a manner to permit easy access for inspection and handling. Store at temperature between 55 and 80 degrees F (12.7 to 26.6 degrees C).
- C. Handling: Handle materials to avoid damage.

#### 1.9 PRE-APPLICATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

#### 1.10 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

#### 1.11 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not apply insulation when substrate temperatures are under 40 degrees F (4.4 degrees C) prior to installation.
- C. Surfaces must be dry prior to application of spray foam. Excess humidity may cause poor adhesion, and result in product failure.
- D. To avoid overspray, product should not be applied when conditions are windy.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: CertainTeed Corp., Insulation Group, which is located at: 750 E. Swedesford Rd. P. O. Box 860 ; Valley Forge, PA 19482-0860; Toll Free Tel: 800-233-8990; Fax: 610-341-7940; Email: [request info](mailto:request@certainteed.com); Web: [certainteed.com/CertainTeed/Pro/Design+Professional/Insulation](http://certainteed.com/CertainTeed/Pro/Design+Professional/Insulation)
- B. Substitutions: Approved Equal.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00.

#### 2.2 SPRAY FOAM INSULATION

- A. Insulation: Polyurethane water-blown type Open Cell Foam: CertainTeed CertaSpray Open Cell Foam is a low density, MDI-based semi-rigid polyurethane foam:
1. Physical and Mechanical Properties:
    - A. Core Density: 0.45-0.55 pcf when tested in accordance with ASTM D 1622.
    - B. Thermal Resistance: 3.6 when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft<sup>2</sup>- degrees F)/Btu.
    - C. Open Cell Content: Greater than 95 percent when tested in accordance with ASTM D 2842.
    - D. Compressive Strength: Greater than 2.4 psi when tested in accordance with ASTM D 1621.
    - E. Tensile Strength: 5.2 psi when tested in accordance with ASTM D 1623.
    - F. Water Absorption: Less than 30 percent by volume when tested in accordance with ASTM D 2842.
    - G. Dimensional Stability: Less than 12 percent by volume when tested in accordance with ASTM D 2126 at 75 degrees F/95 percent RH, 28 Days.
    - H. Water Vapor Transmission: 33 perm/inch when tested in accordance with ASTM E 96.
    - I. Air Permeability: 0.013 when tested in accordance with ASTM E 283 at 5-1/2 inch thickness, L/s/m<sup>2</sup>.
    - J. Fungi Resistance: Pass, with no growth when tested in accordance with ASTM C 1338.
  2. Fire performance
    - A. Flame Spread: Less than 25 when tested in accordance with ASTM E 84.
    - B. Smoke: Less than 350 when tested in accordance with ASTM E 84.
  3. Thermal Performance: Tested in accordance with ASTM C 518 and/or ASTM C 177 at 75 degrees F (24 degrees C) mean temperature.
    - A. Thickness 1 inch (25 mm), R-Value 3.6 (h-ft<sup>2</sup>-degreesF)/Btu (0.6 (m<sup>2</sup>-degreesC)/W).
    - B. Thickness 1-12 inches (38 mm), R-Value 5.4 (h-ft<sup>2</sup>-degreesF)/Btu (1.0 (m<sup>2</sup>-degreesC)/W).
    - C. Thickness 2 inches (51 mm), R-Value 7.2 (h-ft<sup>2</sup>-degreesF)/Btu (1.3 (m<sup>2</sup>-degreesC)/W).
    - D. Thickness 2-12 inches (64 mm), R-Value 9.0 (h-ft<sup>2</sup>-degreesF)/Btu (1.6 (m<sup>2</sup>-degreesC)/W).
    - E. Thickness 3 inches (76 mm), R-Value 10.8 (h-ft<sup>2</sup>-degreesF)/Btu (1.9 (m<sup>2</sup>-degreesC)/W).
    - F. Thickness 3-12 inches (89 mm), R-Value 12.6 (h-ft<sup>2</sup>-degreesF)/Btu (2.2 (m<sup>2</sup>-degreesC)/W).
    - G. Thickness 4 inches (102 mm), R-Value 14.4 (h-ft<sup>2</sup>-degreesF)/Btu (2.5 (m<sup>2</sup>-degreesC)/W).
    - H. Thickness 4-12 inches (114 mm), R-Value 16.2 (h-ft<sup>2</sup>-degreesF)/Btu (2.9 (m<sup>2</sup>-degreesC)/W).
    - I. Thickness 5 inches (127 mm), R-Value 18.0 (h-ft<sup>2</sup>-degreesF)/Btu (3.2 (m<sup>2</sup>-degreesC)/W).
    - J. Thickness 5-12 inches (140 mm), R-Value 19.8 (h-ft<sup>2</sup>-degreesF)/Btu (3.5 (m<sup>2</sup>-degreesC)/W).
    - K. Thickness 6 inches (152 mm), R-Value 21.6 (h-ft<sup>2</sup>-degreesF)/Btu (3.8 (m<sup>2</sup>-degreesC)/W).

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that all exterior and interior wall, partition, and floor/ceiling assembly construction has been completed to the point where the insulation may correctly be installed.
- C. Verify that substrate and cavities are dry and free of any foreign material that will impede application.
- D. Verify that mechanical and electrical services in ceilings, walls and floors have been installed and tested and, if appropriate, verify that adjacent materials are dry and ready to receive insulation.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Mask and protect adjacent surfaces from overspray or dusting.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Product must be installed according to local code, and must be applied by a qualified applicator.
- B. Apply insulation by spray method, to uniform monolithic density without voids.
- C. Apply to minimum cured thickness as indicated on the Drawings or as scheduled at the end of this Section.
- D. Apply insulation to seal voids at steel joist ends to prevent wind scouring of ceiling insulation.
- E. Do not install spray foam insulation in areas where it will be in contact with equipment or materials with operating temperatures of 180 degrees F (82 degrees C) or greater.
- F. Where building is designed to meet the specific air tightness standards of the Energy Star Program, apply insulation as recommended by manufacturer to provide airtight construction. Apply sealant to joints between structural assemblies as specified in Division 7.
- G. Patch damaged areas.

### 3.4 FIELD QUALITY CONTROL

- A. Inspection will include verification of insulation and density.



### 3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

### 3.6 SCHEDULES

- A. For the following locations, apply the average cured thickness indicated.
  - 1. Interior surface of exterior basement walls: \_\_\_\_\_ inches.
  - 2. Thermal insulation around main drain: \_\_\_\_\_ inches.
  - 3. Garage ceiling between joists and over air ducts: \_\_\_\_\_ inches.
  - 4. Thermal insulation within interior ceilings: \_\_\_\_\_ inches.
  - 5. Thermal insulation within interior walls: \_\_\_\_\_ inches.
  - 6. Cathedral ceilings: \_\_\_\_\_ inches.
  - 7. Unvented roof spaces: \_\_\_\_\_ inches.
  - 8. Voids in overhangs such as bay windows and cantilevered floors: \_\_\_\_\_ inches.
  - 9. Exterior above grade walls: \_\_\_\_\_ inches.
  - 10. Floor headers: \_\_\_\_\_ inches.

END OF SECTION

SECTION 07 22 00 - ROOF AND DECK INSULATION

PART 1. GENERAL

1.0 Coordination

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 Scope of Work:

- A. Provide all labor, equipment, and materials to install rigid thermal insulation and Dens Deck Prime recovery board over vented base sheets, ONLY where indicated on the drawings. Install cants, edge strips where indicated on drawings.

1.2 Related Sections:

- A. Division 6 "Rough Carpentry"
- B. Division 7 "Preparation for Re-roofing"
- C. Division 7 "Coal Tar Modified Bitumen Roofing"

1.3 Submittals:

- A. Samples and product literature for all products listed.

1.4 Delivery Storage and Handling:

- A. Deliver materials in manufacturer's original unopened packages, dry, undamaged, seals and labels intact.
- B. Store all insulation delivered to the site in enclosed trailers.

1.5 Environmental Requirements:

- A. Apply insulation only when the weather conditions are in compliance with the roof system limitations.
- B. Protect the installed insulation from water penetration at the end of each day's work.
- C. Application of the roof system shall immediately follow the installation of the roof insulation as it

is installed.

## PART 2. PRODUCTS

2.1 General: (Provide as listed or approved equal)

A. When a particular make or trade name is specified, it shall be indicative of a standard required.

2.2 Materials:

A. Polyisocyanurate Insulation Board: 1.5 inch with fiberglass reinforced facers. Johns Manville, E'NRG'2, LTTR-value: 9.0. Size: Four feet by four feet(4'x4')

B. Recoveryboard: 1/2-inch woodfiber as indicated on plans.

C. Insulation Adhesive: Cold applied dual component polyurethane adhesive Insul-Loc HR.

D. Roof Board Joint Tape: Six (6) inches wide glass fiber mat with adhesive compatible with insulation board facers.

E. Steel Deck Fasteners: Olympic, CR334 CR-10 coated #10 fasteners with 3-inch steel plates.

F. Cant Strips: Fiberglass, Glass Cant.

G. As required by the membrane manufacturer.

## PART 3. EXECUTION

3.1 Examination:

A. Examine substrate surfaces to receive roof and deck insulation and associated work and conditions under which insulation will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. Verify deck and surfaces are clean, smooth, dry, free of depressions or irregularities prior to beginning installation of materials.

C. Verify roof openings, curbs, pipes, sleeves, ducts, penetrations or vents through roof are solidly set, wood nailing strips are in place.

D. Verify all specifications related to Carpentry, have been followed prior to beginning installation of insulation. Beginning installation means acceptance of substrate.

3.2 Protection:

A. During execution of work covered by this Section, the Contractor shall provide protection for roof insulation from water and wind penetration at the end of each day's work.

B. Protect the roof insulation in areas that will receive excessive traffic with a surface protection such as plywood.

C. All workmen shall wear clean, soft rubber-soled shoes for any application work where they may be walking on the in-place insulation.

3.3 Installation:

- A. Ensure all surfaces are clean, dry, free of dirt, debris, oils, loose or embedded gravel and other contaminants that may inhibit adhesion.
- B. Over Steel Deck: Mechanically attach the first layer of rigid insulation to the substrate using specified fasteners and plates applied at 3-ft<sup>2</sup> maximum contributory area per fastener, in accordance with Factory Mutual Approval Guide.
- C. Over vented base sheet, apply insulation adhesive directly to the substrate using a ribbon pattern with one half (1/2) inch to three quarter (3/4) inch wide beads, using either the pail or an automatic applicator, at a rate of one (1) gallon per one hundred (100) square feet. Use two (2) gallons per one hundred (100) square feet to adhere to smooth BUR.
- D. Immediately place insulation boards into wet adhesive. Do not slide boards into place. Do not allow the adhesive to skin over before installing insulation boards.
- E. Briefly step each board into place to ensure contact with the adhesive. Substrates with irregular surfaces may prevent the insulation board from making positive contact with the adhesive. Relief cuts or temporary weights may be required to ensure proper contact.
- F. All boards shall be cut and fitted where the roof deck intersects a vertical surface. The boards shall be cut to fit a minimum of one quarter (1/4) inch away from the vertical surface.
- G. Embed recovery board in adhesive after first layer has been attached as recommended by insulation manufacturer. Stagger end joints of boards so all open joints will be eliminated. Walk in each piece of insulation and leave boards completely adhered to base felt or deck. Each insulation board shall be butt firmly against adjoining panels. All open joints shall be eliminated.
- H. Trim surface of insulation where necessary at roof drains so completed surface is flush with ring of drain.
- I. Cant Strips/Tapered Edge/Crickets: Install preformed 45-degree fiberglass cant strips at junctures of vertical surface. Provide preformed, tapered edge/crickets where indicated on the drawings.

END OF SECTION

## SECTION 07 25 00 - WEATHER BARRIERS

### PART 1 – GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.1 SECTION INCLUDES

- A. Weather barrier membrane
- B. Seam Tape
- C. Flashing
- D. Fasteners

#### 1.2 REFERENCES

- A. ASTM International
  - 1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
  - 2. ASTM C1193; Standard Guide for Use of Joint Sealants
  - 3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
  - 4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
  - 5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
  - 6. ASTM E96; Test Method for Water Vapor Transmission of Materials
  - 7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
  - 8. ASTM E2178; Test Method for Air Permeance of Building Materials
- B. AATCC – American Association of Textile Chemists and Colorists
  - 1. Test Method 127 Water Resistance: Hydrostatic Pressure Test
- C. TAPPI
  - 1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
  - 2. Test Method T-460; Air Resistance (Gurley Hill Method)

#### 1.3 SUBMITTALS

- A. Refer to Section 01 33 00 Submittal Procedures.

- B. Product Data: Submit manufacturer current technical literature for each component.
- C. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inch.
- D. Quality Assurance Submittals
  - 1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
  - 2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
  - 3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.
- E. Closeout Submittals
  - 1. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

#### 1.4 QUALITY ASSURANCE

- A. Qualifications
  - 1. Installer shall have experience with installation of weather barrier assemblies under similar conditions.
  - 2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.
  - 3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.
- B. Mock-up
  - 1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.
    - a. Mock-up size: 10 feet by 10 feet.
    - b. Mock-up Substrate: Match wall assembly construction, including window opening.
    - c. Mock-up may not remain as part of the work.
  - 2. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.
- C. Pre-installation Meeting
  - 1. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, Engineer, Consultant, Installer, Owner's Representative, and Weather Barrier Manufacturer's Designated Representative.
  - 2. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01 60 00 Product Requirements.
- B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store weather barrier materials as recommended by weather barrier manufacturer.

## 1.6 SCHEDULING

- A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.
- B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

## 1.7 WARRANTY

- A. Refer to Section 01 78 36 Warranties.
- B. Special Warranty
  - 1. Special weather-barrier manufacturer's warranty for weather barrier assembly for a period of ten (10) years from date of final weather barrier installation.
  - 2. Approval by weather barrier manufacturer for warranty is required prior to assembly installation.
  - 3. Warranty Areas: [Describe specific areas of work protected and areas of work excluded as required by project conditions].

## PART 2 - PRODUCTS

### 2.1 WEATHER BARRIER

- A. A non-perforated, nonwoven, non-absorbing, breathable membrane that resists air flow, bulk water and wind driven rain and channels water and moisture to the outside of the building envelope. It has microscopic pores that allow moisture vapor to escape from inside walls.
- B. Physical Properties
  - 1. Spunbonded polyolefin membrane.
- C. Performance Characteristics:
  - 1. Air Penetration: 0.001 cfm/ft<sup>2</sup> at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677.
  - 2. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
  - 3. Water Penetration Resistance: Minimum 280 cm when tested in accordance with AATCC Test Method 127.
  - 4. Basis Weight: Minimum 2.7 oz/yd<sup>2</sup>, when tested in accordance with TAPPI Test Method T-410.
  - 5. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
  - 6. Tensile Strength: Minimum 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
  - 7. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
  - 8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 10, Smoke Developed: 10.

### 2.2 ACCESSORIES

- A. Seam Tape: As recommended by the weather barrier manufacturer.
- B. Fasteners:
  - 1. Steel Frame Construction

- 1-5/8 inch rust resistant screw with 2-inch diameter plastic cap or manufacturer approved 1-1/4" or 2" metal gasketed washer
  2. Wood Frame Construction  
Nail Caps: #4 nails with large 1-inch plastic cap fasteners.
  3. Masonry Construction  
Masonry tap-con fasteners with Caps: 2-inch diameter plastic cap fasteners.
- C. Sealants
1. Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions.
  2. Products: Sealants recommended by the weather barrier manufacturer.
- D. Adhesives:
1. Provide adhesive recommended by weather barrier manufacturer.
  2. Products: Adhesives recommend by the weather barrier manufacturer.
- E. Primers:
1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
  2. Products: Primers recommended by the flashing manufacturer.
- F. Flashing
1. Flexible membrane flashing materials for window openings and penetrations recommended by manufacturer.
  2. Straight flashing membrane materials for flashing windows and doors and sealing penetrations such as masonry ties, etc. recommended by manufacturer.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

### 3.2 INSTALLATION – WEATHER BARRIER

- A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.
- B. Install weather barrier prior to installation of windows and doors.
- C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.
- D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.



- E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.
- F. Window and Door Openings: Extend weather barrier completely over openings.
- G. Overlap weather barrier
  - 1. Exterior corners: minimum 12 inches.
  - 2. Seams: minimum 6 inches.
- H. Weather Barrier Attachment:
  - 1. Steel or Wood Frame Construction: Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommend fasteners, space 12-18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.
  - 2. Masonry Construction: Attach weather barrier to masonry. Secure using weather barrier manufacturer recommend fasteners, space 12-18 inches vertically on center and 24 inches maximum horizontally. Weather barrier may be temporarily attached to masonry using recommended adhesive, placed in vertical strips spaced 24 inches on center, when coordinated on the project site.
- I. Apply flashing to weather barrier membrane prior to installing cladding anchors.

### 3.3 SEAMING

- A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.
- B. Seal any tears or cuts as recommended by weather barrier manufacturer.

### 3.4 OPENING PREPARATION (for use with non-flanged windows - all cladding types)

- A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.
- B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

### 3.5 FLASHING (for use with non-flanged windows - all cladding types)

- A. Cut flexible flashing a minimum of 12 inches longer than width of sill rough opening.
- B. Cover horizontal sill by aligning flexible flashing edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.
- C. Fan flexible flashing at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.
- D. Apply 9-inch wide strips of flashing at jambs. Align flashing with interior edge of jamb framing. Start flashing at head of opening and lap sill flashing down to the sill.
- E. Spray-apply primer to top 6 inches of jambs and exposed sheathing.
- F. Install flexible flashing at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2 inches.
- G. Coordinate flashing with window installation.
- H. On exterior, install backer-rod in joint between window frame and flashed rough framing. Apply sealant at jambs and head, leaving sill unsealed. Apply sealants in accordance with sealant manufacturer's instructions and ASTM C1193.
- I. Position weather barrier head flap across head flashing. Adhere using flashing over the 45-degree seams.

- J. Tape top of window in accordance with manufacturer recommendations.
- K. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C1193.

### 3.6 OPENING PREPARATION (for use with flanged windows)

- A. Cut weather barrier in a modified "I-cut" pattern.
  - 1. Cut weather barrier horizontally along the bottom of the header.
  - 2. Cut weather barrier vertically 2/3 of the way down from top center of window opening.
  - 3. Cut weather barrier diagonally from bottom of center vertical cut to the left and right corners of the opening.
  - 4. Fold side and bottom weather barrier flaps into window opening and fasten.
- B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

### 3.7 FLASHING (for use with flanged windows)

- A. Cut flexible flashing a minimum of 12 inches longer than width of sill rough opening.
- B. Cover horizontal sill by aligning flexible flashing edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.
- C. Fan flexible flashing at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.
- D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.
- E. Install window according to manufacturer's instructions.
- F. Apply strips of flashing at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.
- G. Apply strip of flashing as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.
- H. Position weather barrier head flap across head flashing. Adhere flashing over the 45-degree seams.
- I. Tape head flap in accordance with manufacturer recommendations.
- J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

### 3.8 FIELD QUALITY CONTROL

- A. Notify manufacturer's designated representative to obtain required periodic observations of weather barrier assembly installation.

### 3.9 PROTECTION

- A. Protect installed weather barrier from damage.

END OF SECTION

## SECTION 07 26 16 - UNDER-SLAB VAPOR BARRIER

### PART 1 – GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.1 SUMMARY

- A. Products supplied under this section:
  - 1. Vapor barrier and installation accessories for installation under concrete slabs.
- B. Related sections:
  - 1. Section 03 30 00 Cast-in-Place Concrete
  - 2. Section 07 26 00 Vapor Retarders

#### 1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM E1745- 11Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
  - 2. ASTM E1643- 11Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. Technical Reference - American Concrete Institute (ACI):
  - 1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

#### 1.3 SUBMITTALS

- A. Quality control/assurance:
  - 1. Summary of test results per paragraph 9.3 of ASTM E 1745.
  - 2. Manufacturer's samples and literature.
  - 3. Manufacturer's installation instructions for placement, seaming and penetration repair instructions.
  - 4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. Vapor barrier shall have all of the following qualities:
  - 1. Maintain permeance of less than 0.01 Perms [grains/(ft<sup>2</sup> · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
  - 2. Other performance criteria:
    - a. Strength: ASTM E1745 Class A.
    - b. Thickness: 15 mils minimum
- B. Vapor barrier products:
  - 1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
  - 2. Substitutions will be in accordance with Section 01 25 00.

### 2.2 ACCESSORIES

- A. Seams :
  - 1. Stego Tape by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
- B. Penetrations of Vapor barrier:
  - 1. Stego Mastic by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
  - 2. Stego Tape by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
- C. Perimeter/edge seal:
  - 1. Stego Crete Claw by Stego Industries LLC, (887) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
  - 2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
  - 3. StegoTack Tape (double sided) by Stego Industries LLC, (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).

## PART 3 – EXECUTION

### 3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
  - 1. Level and compact base material.

### 3.2 INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643.
  - 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
  - 2. Extend vapor barrier over footings and grade beams to a distance acceptable to the structural engineer or stop at impediments such as dowels and waterstops.
  - 3a. Seal vapor barrier to slab perimeter/edge using Stego Crete Claw and remove dirt, debris, and mud from Crete Claw prior to concrete placement.  
OR
  - 3b. Seal vapor barrier to footing/grade beam with double sided tape, termination bar, or both.
  - 4. Overlap joints 6 inches and seal with manufacturer's tape.
  - 5. Apply tape/Crete Claw to a clean and dry vapor barrier.
  - 6. Seal all penetrations (including pipes) per manufacturer's instructions.

7. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
8. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

END OF SECTION

## SECTION 07 31 13 - ASPHALT SHINGLES

### PART 1 GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 SECTION INCLUDES

- A. Asphalt roofing shingles.
- B. Leak barrier and moisture shedding roof deck protection.
- C. Metal flashing associated with shingle roofing.
- D. Attic ventilation.

#### 1.3 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: Framing, wood decking and roof sheathing.
- B. Section 07 62 00 - Flashing and Sheet Metal: Sheet metal flashing not associated with shingle roofing; gutters and downspouts.

#### 1.4 REFERENCES

- A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- C. ASTM B 370 - Standard Specification for Copper Sheet and Strip for Building Construction.
- D. ASTM D 3462 - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
- E. UL 790 - Tests for Fire Resistance of Roof Covering Materials.

- F. UL 997 - Wind Resistance of Prepared Roof Covering Materials.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data : Manufacturer's data sheets on each product to be used, showing compliance with requirements.
- C. Selection Samples: Two complete sets of color cards representing manufacturer's full range of available colors and patterns.
- D. Manufacturer's installation instructions, showing required preparation and installation procedures.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the roofing system products specified in this section, with minimum of 25 years experience.
- B. Pre-Installation Meeting: Conduct a pre-installation meeting not more than 2 weeks after the start of the roofing project and before start of roofing installation.
  - 1. Contractor shall schedule and arrange meeting and meeting place and notify attendees.
  - 2. Mandatory Attendees: Roofing installer and manufacturer's steep slope technical representative (not sales agent).
  - 3. Optional Attendees: Owner's representative, Architect's representative, prime Contractor's representative.
  - 4. Review all pertinent requirements for achieving the warranty specified below and set schedule for final warranty inspection.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened labeled packaging until ready for installation.
- B. Store products in a covered, ventilated area, at temperature not more than 110 degrees F (43 degrees C); do not store near steam pipes, radiators, or in sunlight.
- C. Store bundles on flat surface to maximum height recommended by manufacturer; store rolls on end.
- D. Store and dispose of solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

#### 1.8 WARRANTY

- A. Provide GAF Materials Corporation Smart Choice Limited Lifetime Warranty.



## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: GAF Materials Corporation; 1361 Alps Rd., Wayne, NJ 07470. ASD. Toll Free Tel: (888) 532-5767. Tel: (888) 532-5767. Fax: (973) 628-3866. Website: <http://www.gaf.com>.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00.

### 2.2 SHINGLES

- A. Heavyweight, granule surfaced, self sealing asphalt shingle with a strong fiberglass reinforced Micro Weave core and a mineral granule surfacing. Dovetail cut tabs and bold shadow lines provide a slate appearance with a 6 inch (191 mm) exposure. Meets ASTM D 3018, ASTM D 3161, and ASTM D 3462; UL 790 Class A rated with UL 997 Wind Resistance Label. Lifetime warranted Timberline Armorshield II Shingles by GAF.
- B. Color:
  - 1. As selected by Architect from manufacturer's full range.

### 2.3 HIP AND RIDGE SHINGLES

- A. High profile self sealing hip and ridge cap shingle matching the color of selected roof shingle. Each bundle covers approx. 20 lineal feet (6.01 m). Timbertex Distinctive Ridge Cap Shingles by GAF.
- B. Ridge cap shingle field fabricated from the same color and type of field shingle. Each bundle covers approx. 33 lineal feet (10.06 m).

### 2.4 UNDERLAYMENT

- A. Leak Barrier:
  - 1. Self-adhering, self sealing, bituminous leak barrier surfaced with fine, skid-resistant granules. Each Roll contains approx. 150 sq ft (14 sqm), 65 lbs (29.9 kg), 36 inches by 50 feet (914 mm by 15.24 m) or 200 sf (23 sqm), 85 lb (38.6 kg), 36 inches by 66.7 feet (914 mm by 20.33 m). 58 mils (1.5 mm) thick. WeatherWatch by GAF.
- B. Roof Deck Protection:
  - 1. #30 Roofing Underlayment: Water repellent breather type cellulose fiber building paper. Meets or exceeds the requirements of ASTM D 4869 Type II.

### 2.5 ASSOCIATED PRODUCTS

- A. Fasteners
  - 1. Standard round wire shingle type, zinc-coated steel or aluminum; 10 to 12 gauge (3.416 mm to 2.657 mm for steel) (2.588 mm to 2.052 mm for aluminum), barbed or deformed shank, with heads 3/8 inch (9.5 mm) to 7/16 inch (11 mm) in diameter; length sufficient to penetrate at

least 3/4 inch (19 mm) into solid wood or just through plywood or oriented strand board.

B. Roofing Cement:

1. Asphalt Plastic Roofing Cement meeting the requirements of ASTM D 4586 Type I or II.

C. Metal Flashing:

1. 24 gauge (0.607 mm) hot-dip galvanized steel sheet, complying with ASTM A 653/A 653M, G90/Z275.
2. Use metal flashings at:
  - A. Eave edges.
  - B. Rake edges.
  - C. Step flashing at chimneys, side walls and dormers.
  - D. Valleys.

## 2.6 VENTILATION

A. Ridge Vent:

1. Flexible ridge ventilator designed to allow the passage of air from attics. Provides 16.9 sq. inches (10903 sqmm) NFVA (Hand Nail) and 14.1 sq. inches (9097 sqmm) NFVA (Nail Gun) per lineal foot. Cobra Ridge Vent, by GAF.

B. Soffit Vents:

1. GAF Cobra Fascia Vent: Provide soffit vents unless already existing or to be installed by others.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until roof deck has been properly prepared.
- B. If roof deck preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean deck surfaces thoroughly prior to installation of leak barrier and underlayment.
- B. At areas to receive leak barrier, fill knot holes and cracks with latex filler.

### 3.3 UNDERLAYMENT INSTALLATION

- A. Install using methods recommended by manufacturer in accordance with local building code.
- B. Eaves:
  1. Place eave edge metal flashing tight with fascia boards; lap joints 2 inches (50 mm) and seal with plastic cement; nail at top of flange.

- C. Valleys:
1. Install leak barrier at least 36 inches wide centered on valley; lap ends 6 inches (150 mm) and seal.
  2. Where valleys are indicated to be "open valleys", install metal flashing over leak barrier before roof deck underlayment is installed; DO NOT NAIL THROUGH flashing; secure by nailing at 18 inches (457 mm) on center just beyond edge of flashing so that nail heads hold down edge.
- D. Roof Deck:
1. Install one layer of roof deck underlayment over entire area not protected by eave or valley membrane; run sheets horizontally lapped so water sheds; nail in place.
  2. On roofs sloped at more than 4 in 12, lap horizontal edges at least 2 inches (50 mm) and at least 2 inches (50 mm) over eave protection membrane.
  3. On roofs sloped between 2 in 12 and 4 in 12, lap horizontal edges at least 19 inches (480 mm) and at least 19 inches (485 mm) over eave protection membrane.
  4. Lap ends at least 4 inches (100 mm); stagger end laps of each layer at least 36 inches (915 mm).
  5. Lap underlayment over valley protection at least 6 inches (150 mm).
- E. Penetrations:
1. At vent pipes, install a 24 inch (610 mm) square piece of leak barrier lapping over roof deck protection; seal tightly to pipe.
  2. At vertical walls, install leak barrier extending at least 6 inches (150 mm) up the wall and 12 inches (305 mm) on to the roof surface lapping over roof deck protection.
  3. At skylights and roof hatches, install leak barrier up the sides of the frame and 12 inches (305 mm) on to the roof surface on all sides, lapping over roof deck underlayment.
  4. At chimneys, install leak barrier around entire chimney extending at least 6 inches (150 mm) up the wall and 12 inches (305 mm) on to the roof surface lapping over roof deck protection.

### 3.4 INSTALLATION OF SHINGLES

- A. Install in accordance with manufacturer's instructions and requirements of local building code.
1. Avoid breakage of shingles by avoiding dropping bundles on edge, by separating shingles carefully (not by "breaking" over ridge or bundles), and by taking extra precautions in temperatures below 40 degrees F (4 degrees C).
  2. Handle carefully in hot weather to avoid damaging shingle edges.
  3. Secure with 4 to 6 nails per shingle; use number of nails required by manufacturer or by code, whichever is greater. Nails must be long enough to penetrate through plywood or OSB, or 3/4 inch (19 mm) into dimensional lumber
- B. Install hip and ridge shingles as required by the manufacturer.
1. At ridges, install hip and ridge shingles over ridge or ridge vent material;
- C. Make valleys using "open valley" technique:
1. Snap diverging chalk lines on metal flashing, starting at 3 inches (75 mm) each side of top of valley, spreading at 1/8 inch per foot (9 mm per meter) to eave.
  2. Run shingles to chalk line.
  3. Trim last shingle in each course to match chalk line; do not trim shingles to less than 12 inches (305 mm) width.
  4. Apply 2 inches (50 mm) wide strip of plastic cement under ends of shingles, sealing to metal flashing.

### 3.5 VENTILATION

- A. Ridge Vent:
  - 1. Cut continuous vent slot through sheathing, stopping 6 inches (150 mm) from each end of ridge.
  - 2. On roofs without ridge board, make slot 2 inches (50 mm) wide, centered on ridge.
  - 3. On roofs with ridge board, make two slots 1-3/4 inches (89 mm) wide, one on each side.
  - 4. Install ridge vent material full length of ridge, including uncut areas.
  - 5. Butt ends of lengths of ridge vent material and join using plastic cement.
  - 6. Install eave vents in sufficient quantity to equal or exceed the ridge vent area, calculated as specified by manufacturer.
  - 7. Install ridge shingles over ridge vent material; use nails of specified length; do not drive nails home, leaving 3/4 inch (19 mm) slot open between ridge and roof shingles.

### 3.6 PROTECTION

- A. Stage work progress so that traffic is minimized over completed roofing.
- B. Protect installed products until completion of project.

### 3.7 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. Furnish quantity not less than 5 percent for each color, pattern and type of asphalt shingle installed.

END OF SECTION

**SECTION 07 42 00**  
**PERFORATED METAL WALL PANELS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Perforated and fabricated architectural metals.
- B. Related Sections:
  - 1. Division 1 Section: Submittal Procedures.
  - 2. Division 1 Section: Quality Control.
  - 3. Division 1 Section: Closeout Submittals.
  - 4. Division 3 Section: Cast-in-Place Concrete: Installation of Anchors.
  - 5. Division 4 Section: Masonry Anchorage and Reinforcement: Installation of Anchors.
  - 6. Division 5 Section: Metal Fabrications.
  - 7. Division 5 Section: Metal Stairs and Ladders.

**1.02 REFERENCES**

- A. ASTM International:
  - 1. ASTM B209 Standard Specification for Aluminium and Aluminium-Alloy Sheet and Plate.

**1.03 SUBMITTALS**

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures.
- B. Product Data: Submit manufacturer's product data and installation instructions for custom perforated metal architectural designs, including manufacturer's SPEC-DATA® product sheet. Include material, finish, available thicknesses and opening sizes.
- C. Drawings:
  - 1. Submit shop drawings detailing installation procedures, including layout, dimensions, anchorage, reinforcement, connections, supports and support placement.
- D. Samples:
  - 1. Submit 12" x 12" sample of perforation pattern in required material thickness. Sample to include formed edges per system design and finish as specified.
- E. Quality Assurance:
  - 1. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
  - 2. Manufacturer's Instructions: Manufacturer's installation instructions.
- F. Manufacturer's Field Reports: Indicate and interpret test results for compliance with performance requirements.
- G. Closeout Submittals: Submit the following:
  - 1. Warranty: Warranty documents specified herein.
  - 2. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

#### **1.04 QUALITY ASSURANCE**

A. Qualifications:

1. Fabricator Qualifications: Fabrication performed in quality controlled manufacturing environment by experienced fabricators with references indicating multiple satisfactory experiences fabricating perforated metals as required for this project.

#### **1.05 DELIVERY, STORAGE & HANDLING**

A. General: Comply with Division 1 Product Requirements.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery, Storage and Protection:

1. Deliver materials in original sealed manufacturer's packaging.
2. Store materials in dry, secure location.
3. Store in accordance with manufacturer's written instructions.

#### **1.06 WARRANTY**

A. Project Warranty: 1 year manufacturer's warranty on fabrications and material

1. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

2.B. Finish Warranty: 5 year warranty (Anodized finish)

#### **1.07 WASTE MANAGEMENT & DISPOSAL**

A. Deposit packaging materials in appropriate container onsite for recycling or reuse.

B. Avoid using landfill waste disposal procedures when recycling facilities are available.

### **PART 2 PRODUCTS**

#### **2.01 PERFORATED ARCHITECTURAL METALS**

A. Manufacturer: Hendrick Architectural, 1 Seventh Ave., Carbondale, PA 18407; Telephone: (877) 840-0881, (570) 282-1010; Fax: (570) 282-1506;

E-mail: [arch@hendrickcorp.com](mailto:arch@hendrickcorp.com); website: [www.hendrickarch.com](http://www.hendrickarch.com).

B. Material:

1. Aluminum: To ASTM B209.
  - a. Thickness: 1/4" thick 5052-H32
  - b. Sheet Size: [\_\_\_\_ × \_\_\_\_]. Max size per span chart
  - c. Shape: Flat panel edges per design details
  - d. Finish: Anodized
  - e. Color: Aluminum.

C. Perforations:

1. Round: 1 inch diameter holes, 23 % open area, Staggered

D. Panel Margins: 1.25" min. margins all 4 sides

E. Fasteners: Per design details and fastener schedule

#### **2.02 PRODUCT SUBSTITUTIONS**

A. Substitutions: No substitutions permitted.

### **PART 3 EXECUTION**

#### **3.01 MANUFACTURER'S INSTRUCTIONS**

- A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and Hendrick Manufacturing Co.'s SPEC-DATA sheet.

#### **3.02 EXAMINATION**

- A. Site Verification of Conditions:
  - 1. Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions.
  - 2. Examine area to receive architectural metalwork for compliance with installation clearances.

#### **3.03 INSTALLATION**

- A. Install in compliance with manufacturer's product data, including product technical bulletins, application and installation instructions.
- B. Erect metalwork square, plumb, straight and true.
- C. Provide suitable means of anchorage as recommended by Hendrick Manufacturing Co.
- D. Match exposed fastening devices to attached metalwork.
- E. Provide components and setting templates to appropriate trades for placement in concrete or masonry.

#### **3.04 FIELD QUALITY CONTROL**

- A. Have manufacturer of products supplied under this Section review Work involved in handling, installation/application and protection of its product[s], and submit written reports in acceptable format to verify compliance of Work with Contract.
- B. Protect installed product's finish surfaces from damage during construction.

#### **3.05 COMPLETION & CLEANUP**

- A. After installation and prior to final acceptance, inspect metalwork for any damage. Repair or replace damaged installed products.
- B. Clean installed products in accordance with Hendrick Manufacturing Co.'s instructions prior to Owner's acceptance. Remove protective coverings.
- C. On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## SECTION 07 42 10 - METAL WALL PANELS

### PART 1 – GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Exposed-fastener, lap-seam metal wall panels.
- B. Related Sections:
  - 1. Division 05 Section "Cold-Formed Metal Framing" for support framing, including girts, studs, and bracing.
  - 2. Division 07 Section "Air Barriers" for continuous air barrier systems.

#### 1.2 DEFINITION

- A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
  - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:



- a. Uniform pressure as indicated on structural Drawings, 130 mph or inland I.

#### 1.4 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 wall panel and accessory.
- B. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.
  1. Include similar Samples of trim and accessories involving color selection.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:
  1. Wall panels and attachments. Prefinished Metal and Acrylic Translucent Panels.
  2. Girts.
  3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
  4. Penetrations of wall by pipes and utilities.
- B. Warranties: Sample of special warranties.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal wall panels to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

- D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

#### 1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

#### 1.10 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### 1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show 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 D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 10 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 PANEL MATERIALS

- A. Factory painted GALVALUME sheets.
  - 1. 24 gauge panel shall conform to Grade 50

2. All Painted galvalume shall be factory coated each side will be coated with 0.2 mils baked on primer before the color coating. Panel shall receive a Kynar 500 Fluoropolymer finish coat on the exposed side. Thickness of the coat will be a nominal 1.0 mils (including primer coat.) A baked on straight polyester wash coat will be applied on the non-exposed side. Thickness of the wash coat will be a nominal 0.5mils (including the primer coat.)

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray 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
2. Joint Sealant: (3 mm) thick. ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 FIELD-INSTALLED THERMAL INSULATION

- A. Metal Building Insulation: glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch- wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.
1. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm when tested according to ASTM E 96, Desiccant Method:
    - a. Composition: Polypropylene faced, scrim reinforced, and kraft-paper backing
  2. Insulation Retainer Strips: 0.019-inch thick, formed galvanized steel or PVC retainer clips colored to match insulation facing.

2.3 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory- applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.4 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- B. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs.
1. 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. Berridge Manufacturing Company.
  - b. MBCI; Div. of NCI Building Systems.
2. Material: Zinc-coated (galvanized) steel sheet, match existing thickness.
- a. Exterior Finish: To be selected by Architect.
  - b. Color: To be selected by Architect.

## 2.5 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
  2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.018-inch minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

## 2.6 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
  - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## 2.7 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 and painted finishes on exposed surfaces from damage by applying a 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 the 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 the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
  1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
  2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
  3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
  4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.
  - 1. Soffit Framing: Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.

### 3.3 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal wall panels.
  - 2. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
  - 3. Install screw fasteners in predrilled holes.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Install flashing and trim as metal wall panel work proceeds.
  - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  - 7. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
  - 8. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  - 9. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Fasteners:
  - 1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
  - 1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal

- side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- E. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
  2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
  3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
  6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
  7. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- F. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.

### 3.4 METAL SOFFIT PANEL INSTALLATION

- A. In addition to complying with requirements of "Metal Wall Panel Installation, General" Article, install metal soffit panels to comply with the requirements of this article.
- B. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

### 3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams

that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

### 3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION



SECTION 07 60 00 - SHEET METAL AND MISCELLANEOUS ACCESSORIES

PART 1 - GENERAL

1.00 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SUMMARY

- A. Section Includes:
  - 1. Provide flashing and sheet metal components for moisture protection.
  - 2. Related accessories.

1.02 SUBMITTALS

- A. Product Data:
  - 1. Submit shop drawings, product data and mockups of all sheet metal.
  - 2. Reference Section 07 53 00 Coal-tar Elastomeric Roofing System

1.03 QUALITY ASSURANCE

- A. Comply with governing local, state, and federal regulations, safety standards, and codes. Provide products of acceptable manufacturers in satisfactory use in similar service for five years. Use experienced installers. Deliver, handle and store materials in accordance with manufacturer's instructions.
- B. Reference Standards: Applicable portions of SMACNA, ASTM and NAAMM publications.

1.04 WARRANTIES

- A. Manufacturer's Product Warranty: Submit manufacturer's standard limited product warranty signed by the manufacturer's authorized official, guaranteeing to correct failures in product which may occur during the warranty period, without reducing or otherwise limiting any other rights to correction which the Owner/Project Consultant may have under the contract documents. Failure is defined to include product failure which leads to interruption of a watertight installation. Correction may include repair or replacement of failed product.

- B. Contractor's Warranty period: For roofing flashing and sheet metal, provide a written warranty which shall warrant work to be free of leaks and defects in materials and workmanship for two (2) years, starting from date of substantial completion.
- C. Defects of the sheet metal occurring during the warranty period shall be promptly corrected by the contractor, and defects of the roofing shall be promptly corrected by the manufacturer at no additional cost to the Owner. Upon notification from the Owner or the Owner's representative that evidence of a defect exists, the responsible party shall immediately inform the Owner's representative of the date on which corrective work will be scheduled, and shall notify the Owner's representative when the corrective work has been completed.

## PART 2 - PRODUCTS

### 2.01 SHEET METAL MATERIAL

- A. Hot-dipped Galvanized Steel for use as counterflashings (where not visible from the ground), pitch pans and expansion joints: Minimum 24-gauge, G-90, hot-dipped galvanized metal, commercial quality, ASTM A 525.
- B. Hot-dipped Galvanized Steel for use as continuous clips: Minimum 22-gauge, G-90, hot-dipped galvanized metal, commercial quality, ASTM A 525.
- C. Prefinished Galvanized Sheet Steel (where visible from the ground): Shall be 24-gauge flat stock, prefinished with Kynar finish meeting ASTM A 446, forty-five and one-half inches to forty-eight inches width by one hundred twenty inches in length (45-1/2" - 48" x 120") for use as new metal edge gravel guard, cover plates, downspouts, gutters, coping and miscellaneous metal. Standard color to be selected by Owner/Project Consultant.
- D. Stainless Steel: QQ-S-766, Class 301, 302, 304, or 316; or ASTM A 167, Type 301, 302, 304, or 316; form and condition most suitable for the purpose.
- E. Aluminum and Aluminum Alloy Plate and Sheet: QQ-A-250; form, alloy, and temper shall be that most suitable for the purpose.
- F. Sheet Lead: QQ-L-201, Grade B.
- G. All existing sheet metal shall be replaced with new metal of like gauge and type, or as specified on drawings.

### 2.02 FASTENERS

- A. Fasteners shall be same metal as flashing/sheet metal, or other non-corrosive metal as recommended by sheet manufacturer for the specific application. Match finish of exposed heads with material being fastened.
- B. Fasteners and fastening plates or bars shall be listed in the FM Global Approval Guide.
- C. Fastener for Brick: Shall be one-fourth inch by two inches (1/4" x 2"), zinc with plated steel or stainless steel nail, one piece unit, flat head.
- D. Screws: Self-taping sheet metal type with neoprene washer, as appropriate.
- E. Pop Rivets: Full stainless steel Series 42 or 44, as appropriate.

- F. Continuous Clip: Concealed hold-down clip type; of same materials as coping, gravel guard, sized to suit application. Use a continuous clip, minimum 22-gauge G-90 galvanized.

#### 2.03 RELATED MATERIAL

- A. Bituminous Paint: Acid and alkali resistant, black color.
- B. Plastic Cement: FS SS-C-153, cutback asphalt type.
- C. Solder: QQ-S-571 composition best suited for purpose; use high tin content, minimum 60/40, for stainless steel and monel alloy.
- D. Copper, Sheet, and Strip: QQ-C-576, ASTM B 370, light cold-rolled temper.
- E. Lead-coated Copper: ASTM B 101, Type I or II, Class A.
- F. Sealant (for Sheet Metal): One-component polyurethane, conforming to requirements of FS TT-S-230C, non-staining and non-bleeding.

#### 2.04 FABRICATION - GENERAL

- A. Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer's instructions and recommendations. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.
- B. Fabricate gravel stops/fascia, gutters/downspouts, counterflashings, pitch pans, expansion joints, and copings with new galvanized sheet metal as specified. Fabricate gravel guard and fascia to size and dimensions as indicated on the drawings. Fabricate light metal coping, gutters and downspouts as indicated.
- C. Form sheet metal on bending brake.
- D. Shape, trim and hand seam metal on bench insofar as practicable.
- E. Form materials with straight lines, sharp angles and smooth curves.
- F. Fold back edges on concealed side of exposed edge to form hem (1/2" minimum).
- G. Weld or solder joints on parts that are to be permanently and rigidly assembled.
- H. Submit sheet metal models for approval by the Owner/Project Consultant.
- I. Limit single-piece lengths to ten feet (10').
- J. Fabricate corner pieces with eighteen inch (18") extensions, metered and sealed by forming as one piece.
- K. Surface sand flange prior to applying any primers on Kynar metal.
- L. Backpaint flashing in contact with masonry or dissimilar materials with bituminous paint.

- M. All sheet metal shall be sealed and watertight.
- N. Metal work should be secured so as to prevent damage from buckling or wind. Where clips are shown, these are to be continuous.
- O. All metal to receive bitumen or adhesive shall be first primed with asphalt primer.
- P. All prefinished metal shall be sanded and/or abraded prior to receiving primer.
- Q. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges are to be seamed, form seams, and soldered.
- R. Expansion Provisions: Form expansion joints of intermeshing hooked flanges, not less than one inch (1") deep, filled with mastic sealant (concealed within joints).
- S. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with industry standards.
- T. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- U. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

## 2.05 FINISH

- A. Backpaint concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals. Exposed surfaces to be provided with a factory applied fluorocarbon Kynar finish meeting ASTM A 446 and AAMA specification 605.2 for high performance coating.
- B. New 24-gauge hot-dipped galvanized metal shall be painted on all locations visible from the ground with an industrial grade paint to match existing, or standard color selected by Owner/Project Consultant. Galvanized metal surface must be properly prepared by removing all oil, grease, and/or protective mill coatings by solvent cleaning surface in accordance with SSPC-SP1, and according to paint manufacturer's recommendation, to ensure proper adhesion of paint to metal.

## PART 3 - EXECUTION

### 3.01 INSPECTION

- A. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, substrates are smooth and clean and nailing strips located.
- B. Verify membrane termination and base flashings are in place, sealed and secure.
- C. Beginning of installation means acceptance of conditions.

### 3.02 PREPARATION

- A. Field measure site conditions prior to fabricating work. Provide all shop drawings and mock-ups one month prior to installation to the Owner/Project Consultant for approval.
- B. Install starter and edge strips and cleats before starting installation.

### 3.03 INSTALLATION

- A. General: All sheet metal termination to vertical wall shall have a through-wall with receiver installed on masonry walls or prefabricated "Z" bar flashing pre-installed to fluid applied wall finished prior to installation of sheet metal termination. This applies to edge metal, base flashing closures and all vertical surface intersections. Refer to NRCA, SMACNA, and metal manufacturer's guidelines.
- B. Gravel Guard/Fascia:
  - 1. Shall be installed with expansion joints, ten feet (10') on center, one-fourth inch (1/4") expansion leeway, with a cover plate.
  - 2. Secure metal flashings per specifications.
  - 3. Lock seams and end joints.
  - 4. Form sections identical to profiles as shown or approved similar, to match existing building.
  - 5. Fabricate corner pieces with minimum eighteen inch (18"), maximum forty-eight inch (48") extensions, formed and sealed with rivets and sealant, as one piece.
  - 6. Hem exposed edges three-fourths inch (3/4") minimum.
  - 7. Backpaint flashing in contact with masonry or dissimilar materials with bituminous paint. Surface sand before applying primers.
  - 8. Integrate flashing in a manner consistent with detailing.
  - 9. Provide and install continuous clip around perimeter.
  - 10. Shall be fabricated in accordance with all SMACNA provisions.
- C. Coping:
  - 1. All coping shall be manufactured with low profile standing seam metal.
  - 2. Shall be minimum 24-gauge prefinished Kynar installed in ten foot (10') sections maximum with cover plates.
  - 4. Vertical fascia shall extend minimum two and one-half inches (2-1/2") or be minimum one and one-half inches (1-1/2") below bottom of nailer, whichever is greater.
  - 5. Secure metal flashings per specifications.
  - 6. Lock seams and end joints.
  - 7. Form sections identical to profiles as shown or approved similar, to match existing building.
  - 8. Fabricate corner pieces with minimum eighteen inch (18"), maximum forty-eight inch (48") extensions, formed and sealed with rivets and sealant, as one piece.
  - 9. Hem exposed edges three-fourths inch (3/4") minimum.
  - 10. Backpaint flashing in contact with masonry or dissimilar materials with bituminous paint. Surface sand before applying primers.
  - 11. Integrate flashing in a manner consistent with detailing.
  - 12. Provide and install continuous clip, minimum 22-gauge.
  - 13. Shall be fabricated in accordance with all SMACNA provisions.
- D. Expansion Joint Field and at Wall:
  - 1. Shall be as outlined by details, and be in full compliance with all provisions of SMACNA and FM Global requirements for attachment, installation and recommendations.
  - 2. Secure metal flashings per specifications.
  - 3. Lock seams and end joints.

4. Form sections identical to profiles as shown or approved similar, to match existing building.
  5. Fabricate corner pieces with minimum eighteen inch (18"), maximum forty-eight inch (48") extensions, formed and sealed with rivets and sealant, as one piece.
  6. Hem exposed edges three-fourths inch (3/4") minimum.
  7. Backpaint flashing in contact with masonry or dissimilar materials with bituminous paint. Surface sand before applying primers.
  8. Integrate flashing in a manner consistent with detailing.
  9. Provide and install continuous clip around perimeter.
  10. Shall be fabricated in accordance with all SMACNA provisions.
- E. Counterflashing:
1. Saw cut brick mortar joint to receive friction fit reglet and removable counterflashing as detailed and SMACNA Figure 4-3E.
- F. Gutter and Downspout:
1. Fabrication:
    - a) Fabricate gutter and downspout of profile and size indicated.
    - b) Field measure site conditions prior to fabricating work.
    - c) Fabricate with required connection pieces.
    - d) Fabricate section square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance.
    - e) Hem exposed edges of metal.
    - f) Form and seal all metal joints; provide for expansion joints per SMACNA.
  2. Installation:
    - a) Install collector head, downspout, and accessories.
    - b) Join lengths with seams pop riveted and sealed watertight. Flash and seal collector head to downspouts and accessories.
    - c) Seal all metal joints watertight for full metal surface contact.
    - d) Collector Head: SMACNA style profile; submit detail for approval.
    - e) Downspouts: Rectangular profile. Seal all joints, four inches by six inches (4" x 6").
    - f) Support Brackets, Joint Fasteners: Profiled to suit gutters and downspouts.
    - g) Anchorage Devices: SMACNA requirements. Type recommended by fabricator.
    - h) Collector Head Support: Kynar. Color and Finish to match, as recommended by SMACNA.
    - i) Downspout Supports: Straps, Kynar. Color and Finish to match.
- G. Overflow Scupper, Collector Head and Downspout:
1. Fabrication:
    - a) Fabricate overflow scupper, collector head and downspout of profile and size indicated, taking care that the roof drain leader fits properly into the back of the collector head. Seal the pipe to the collector head for watertightness.
    - b) Field measure site conditions prior to fabricating work.
    - c) Fabricate with required connection pieces.
    - d) Fabricate section square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance.
    - e) Hem exposed edges of metal.
    - f) Form and seal all metal joints; provide for expansion joints per SMACNA.
  2. Installation:

Install collector head, downspout, and accessories.

    - a) Join lengths with seams pop riveted and sealed watertight. Flash and seal collector head to downspouts and accessories.
    - b) Seal all metal joints watertight for full metal surface contact.
    - c) Collector Head: SMACNA style profile; submit detail for approval.

- d) Downspouts: Rectangular profile. Seal all joints, four inches by six inches (4" x 6").
- e) Support Brackets, Joint Fasteners: Profiled to suit gutters and downspouts.
- f) Anchorage Devices: SMACNA requirements. Type recommended by fabricator.
- g) Collector Head Support: Kynar. Color and Finish to match, as recommended by SMACNA.
- h) Downspout Supports: Straps, Kynar. Color and Finish to match.

H. Pitch Pans:

- 1. Install pitch pans of 24-gauge galvanized steel according to NRCA standards, minimum of six inches by six inches (6" x 6").
- 2. Pitch pans shall be fabricated to minimum of four inches (4") above the finished roof membrane. Seams of pitch pans shall be soldered.
- 3. Mastic shall be applied under pitch pan flange a minimum of one-half pound (1/2#) per linear foot.
- 4. All metal flanges shall be primed with asphalt primer prior to flashing installation. Inside of pitch pan shall be cleaned and primed as required by pitch pan sealant manufacturer.
- 5. All projections enclosed in pitch pans shall be cleaned in any manner suitable and coated with a rust inhibitive coating as approved by the Owner/Project Consultant. Coating shall be allowed to dry prior to pitch pan fill.
- 6. Base of pitch pans shall be filled with grout or cementitious binder to proper height and allowed to cure.
- 7. Top finish fill shall be self-leveling, one-part urethane, with maximum fill to within three-eighths inch (3/8") of top of pitch pan sides.
- 8. Strip metal flange of pitch pan with one strip of Type IV fiberglass felt set in hot bitumen extending from the outer edge of the flange a minimum of three inches (3") inward to base of pitch pan.
- 9. Strip in fiberglass felt with .060 inch coal-tar elastomeric membrane flashing set in hot asphalt extending from the outer edge of the Type IV fiberglass underlayment a minimum of three inches (3") inward to the base of the pitch pan.

I. Bonnets/Hoods:

- 1. Fabricate and install above all pitch pans, where necessary, or reinstall as applicable, metal bonnets over all pitch pans, NO EXCEPTIONS.
- 2. Bonnets/Hoods shall be manufactured with metal compatible with metal to which bonnet is to be attached.
- 3. On beams and other steel, weld in place bonnets fabricated from one-fourth inch (1/4") steel plate.
- 4. Draw band bonnets fabricated from 22-gauge galvanized steel may be used on circular projections.

3.04 FINISH

- A. Backpaint concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals. Exposed surfaces to be provided with a factory applied fluorocarbon Kynar finish meeting ASTM A 446 and AAMA specification 605.2 for high performance coating.

END OF SECTION

## SECTION 07 61 13 - NEW STANDING SEAM METAL ROOF SYSTEM

### PART 1 – GENERAL

#### 1.00 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.01 RELATED WORK

- A. Section 07 41 00 – Roofing Panels
- B. Section 07 53 00 - Coal-tar Elastomeric Roofing System
- C. Section 07 60 00 - Sheet Metal and Miscellaneous Accessories

#### 1.02 INSTALLER QUALIFICATIONS

- A. Roofing installer must be:
  - 1. Currently prequalified with the Owner in accordance with Owner's prequalification requirements.
  - 2. Currently in good standing with the manufacturer.
  - 3. Installer must be an experienced single firm specializing in the type of roofing repair and/or removal and replacement work required, employing only experienced workers for the class of work in which they are employed, having at least five (5) years successful experience on projects similar in size and scope and acceptable as applicators by the Owner's representative.
  - 4. Contractor must have successfully completed previous projects warranted by the manufacturer.
- B. It shall remain each Bidder's responsibility to determine his current status with the manufacturer's certification plan.

#### 1.03 QUALITY ASSURANCE

- A. Applicator/Installer:
  - 1. Must be acceptable to roof material manufacturer for the manufacturer's warranty requirements.
  - 2. Must be an experienced single firm specializing in the type of roofing repair and/or removal and replacement work required, employing only experienced workers for the class of work in which they are employed, having at least five (5) years successful experience on projects similar in size and scope and acceptable as applicators by the Owner's representative.



- B. Testing Laboratory Services: Test results shall meet or exceed established standards.
- C. Underwriters Laboratories, Inc.; Roofing Covering: Class A fire hazard classification.
- D. Factory Mutual: Wind uplift requirements

#### 1.04 REFERENCES (INCLUDING LATEST REVISIONS)

- A. American Society for Testing and Materials:
  - 1. ASTM A 792 Finish Application on Metal Wall Panels
  - 2. ASTM B 209 - 90, Specification for Aluminum and Aluminum Alloy Sheet and Plate
  - 3. ASTM C 719 - 86, Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cycle Movement (Hockman Cycle)
  - 4. ASTM C 794 - 80 (1986), Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
  - 5. ASTM C 920 - 87, Specification for Elastomeric Joint Sealants
  - 6. ASTM A 361 - 90, Sheet Steel, Zinc-Coated (Galv.) by the Hot-Dip Process for Roofing and Siding
  - 7. ASTM C 177, Test for Thermal Laboratory Services
  - 8. ASTM C 728, Perlite Thermal Insulation Board
  - 9. ASTM D 523 Reflective Finish on Metal Roof Panels
- B. Federal Specifications:
  - 1. LLL-I-535B
  - 2. SS-A-701B
  - 3. SS-C-153
  - 4. SS-C-153C
  - 5. SS-R-620B
  - 6. TT-C-498C
  - 7. TT-P-320D
  - 8. TT-S-00227E
  - 9. TT-S-00230C
  - 10. SS-S-001534 (GSA-FSS)
  - 11. L-P-375
- C. Industry Standards:
  - 1. The National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual
  - 2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) - Architectural Sheet Metal Manual

#### 1.05 SUBMITTALS

- A. Samples and Manufacturer's Submittals: Submit prior to delivery or installation.
  - 1. Samples of all roofing system components including all specified accessories.
  - 2. Submit samples of proposed warranty complete with any addenda necessary to meet the warranty requirements as specified.
  - 3. Submit latest edition of manufacturer's specifications and installation procedures. Submit only those items applicable to this project.
  - 4. A written statement from the roofing materials manufacturer approving the installer, specifications and drawings as described and/or shown for this project and stating the intent to guarantee the completed project.
- B. Shop Drawings: Provide manufacturer's approved details of all perimeter conditions, projection conditions, and any additional special job conditions which require details other than indicated in the drawings.

- C. Maintenance Procedures: Within ten days of the date of Substantial Completion of the project, deliver to the Owner three copies of the manufacturer's printed instructions regarding care and maintenance of the roof.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original packaging with all labels intact and legible, including labels indicating storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.
- B. Manufacturer's packaging and/or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be minimum acceptable for exterior coverings. All materials stored as above shall be minimum of four inches (4") off the substrate, and the tarpaulin tied off with rope.
- C. Deliver materials requiring fire resistance classification to the job with labels attached and packaged as required by labeling service.
- D. Deliver materials in sufficient quantity to allow continuity of work.
- E. Handle and store material and equipment in such a manner as to avoid damage. Liquid products shall be delivered sealed, in original containers.
- F. Handle rolled goods so as to prevent damage to edge or ends.
- G. Select and operate material handling equipment so as not to damage existing construction or applied roofing.
- H. Moisture-sensitive products shall be maintained in dry storage areas and properly covered. Provide continuous protection of materials against wetting and moisture absorption. Store roofing and flashing materials on clean raised platforms with weather protective covering when stored outdoors.
- I. Store rolled goods on end.
- J. Protect materials against damage by construction traffic.
- K. The proper storage of materials is the sole responsibility of the contractor and any wet or damaged roofing materials shall be discarded, removed from the project site, and replaced prior to application.
- L. Comply with fire and safety regulations, especially with materials which are extremely flammable and/or toxic. Use safety precautions indicated on labels.
- M. Products liable, such as emulsions, to degrade as a result of being frozen shall be maintained above 40° F in heated storage.
- N. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form.

#### 1.07 SITE CONDITIONS

- A. Job Condition Requirements:
  - 1. Apply roofing in dry weather.
  - 2. Do not apply roofing when ambient temperature is below 40° F (4° C).

3. Proceed with roofing work only when weather conditions are in compliance with manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with specifications.
  4. For further information regarding roofing material manufacturer's recommendations for project conditions, refer to the manufacturer's published application manual.
  5. All surfaces to receive new roofing shall be smooth, dry, and free from dirt, debris, and foreign material before any of this work is installed. Competent operators shall be in attendance at all times equipment is in use. Materials shall be stored neatly in areas designated by the Owner. Load placed on the roof at any point shall not exceed the safe load for which the roof is designed.
  6. The contractor shall take all necessary precautions to protect the roof mat and deck from damage. The contractor shall be responsible for repairing all new areas of damage caused by the negligence of the contractor, at the contractor's expense. The Owner's on-site representative shall determine damage caused by contractor negligence.
  7. Follow insurance underwriter's requirements acceptable for use with specified products or systems.
  8. All kettles shall have an automatic thermostat control, and temperature gauge, all in working order.
  9. Surface and air temperatures should be a minimum 45° F during applications of cleaner and waterproof coating and remain above 45° F for a minimum of four (4) hours following applications. Verify compatibility of cleaner with coatings, paints, primers and joint sealers specified. Advise Owner's representative of any problems in this regard prior to commencing cleaning operations.
  10. Temporary Sanitary Facilities: The contractor shall furnish and maintain temporary sanitary facilities for employees' use during this project. These will be removed after the completion of the project. All portable facilities shall comply with local laws, codes, and regulations.
- B. Protection of Work and Property:
1. Work: The contractor shall maintain adequate protection of all his work from damage and shall protect the Owner's and adjacent property from injury or loss arising from this contract. He shall provide and maintain at all times any OSHA required danger signs, guards, and/or obstructions necessary to protect the public and his workmen from any dangers inherent with or created by the work in progress. All federal, state, and city rules and requirements pertaining to safety and all EPA standards, OSHA standards, NESHAP regulations pertaining to asbestos as required shall be fulfilled by the contractor as part of his proposal.
  2. Twenty-four Hour Call: The contractor shall have personnel on call 24 hours per day, seven (7) days per week for emergencies during the course of a job. The Owner's project manager is to have the 24 hour numbers for the contact. Contractor must be able to respond to any emergency call and have personnel on-site within two (2) hours after contact. Numbers available to the Owner's project manager are to be both home and office numbers for:
    - a) Job Foreman
    - b) Job Superintendent
    - c) Owner or Company Officer
- C. Damage to Work of Others: The contractor shall repair, refinish, and make good any damage to the building or landscaping resulting from any of his operation. This shall include, but is not limited to, any damage to plaster, tile work, wall covering, paint, ceilings, floors, or any other finished work. Damage done to the building, equipment, or grounds must be repaired at the successful contractor's expense holding the Owner harmless from any other claims for property damage and/or personal injury.
- D. Measurements: It will be the contractor's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the contractor shall be responsible for the correctness of same. Any drawings supplied are for reference only.

- E. Cleaning and Disposal of Materials:
  - 1. Contractor shall keep the job clean and free from all loose materials and foreign matter. Contractor shall take necessary precautions to keep outside walls clean and shall allow no roofing materials to remain on the outside walls.
  - 2. All waste materials, rubbish, etc., shall be removed from the Owner's premises as accumulated. Rubbish shall be carefully handled to reduce the spread of dust. A suitable scrap chute or hoist must be used to lower any debris. At completion, all work areas shall be left broom clean and all contractor's equipment and materials removed from the site.
  - 3. All bituminous or roofing related materials shall be removed from ladders, stairs, railings, and similar parts of the building.
  - 4. Debris shall be deposited at an approved disposal site.

#### 1.08 WARRANTY

- A. Roofing - Manufacturer: Project shall be installed in such a manner that the material manufacturer will furnish a written twenty (20) year labor and materials watertight warranty from the date of substantial completion of the completed project.
- B. Project shall be completed in such a manner that the material manufacturer shall furnish a standard twenty (20) year warranty on the product finish against oxidation failure.
- C. Roofing - Contractor: The contractor, jointly with any subcontractors employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the building will be and remain waterproof for a two (2) year warranty period, after the Owner accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the contractor and his subcontractors, if any, to make good the requirements of the warranty.
- D. Warranty repairs shall be performed by a certified installer. The repairs shall be performed in accordance with the manufacturer's written instructions and recommended procedures so as to not void the warranty. Repair of the system, including materials and labor, shall be done at no cost to the Owner.
- E. During the proposal period each Bidder shall make arrangements with the material manufacturer to provide the required warranty. Refer to paragraph 1.05 SUBMITTALS in this section for requirements concerning submittals of warranty.

#### PART 2 - PRODUCTS

##### 2.01 GENERAL

- A. All materials shall be furnished, specified, or approved in writing by the manufacturer issuing the warranty.
- B. Samples of all materials used on the project, which are not supplied by the membrane manufacturer, shall be submitted to the membrane manufacturer for written approval prior to work starting.
- C. All materials used on the project shall be asbestos free.

##### 2.02 FELTS

- A. Shall be Underwriters Laboratory approved and listed in the FM Global Approval Guide.

2.03 UNDERLAYMENT MEMBRANE

- A. Membrane shall be nominal sixty (60) mil in overall thickness consisting of forty-five (45) mil thick calendared coal-tar elastomeric membrane thickness with fifteen (15) mil thick backing of styrene butadiene styrene (SBS) adhesive with a selvage edge. The self-adhering membrane shall be a high-performance elastomeric membrane incorporating DuPont™ Elvaloy□ KEE (ketone ethylene ester), extended with coal-tar pitch and reinforced with polyester fibers.
- B. The self-adhering membrane shall meet the following physical properties: Elongation 170%, ASTM D 412; Tensile Strength 1600 lbs/in<sup>2</sup>, ASTM D 412; Tear Strength 300 ppi, ASTM D 624; Density @ 70° F, 80 lbs/ft<sup>3</sup>; Low Temperature Flexibility, Pass, 37-GP-56M; and Water Absorption less than 0.1%, 37-GP-56M. Roll shall have one and one-half inch (1-1/2") wide dry lap for hot-air welding.

2.04 UNDERLAYMENT FLASHING MEMBRANE

- A. Flashing shall be same base material as the finish ply self-adhered coal-tar elastomeric membrane (CTEM) and be installed using the design principles set forth in the National Roofing Contractors Association Manual and attached details.

2.05 END LAP MEMBRANES

- A. Shall be a sixty (60) mil overall calendared thickness membrane. The membrane shall be a high performance elastomeric membrane incorporating a DuPont™ Elvaloy□ KEE (ketone ethylene ester), extended with coal-tar pitch and reinforced with polyester fibers.
- B. End lap splice strip shall be the same type material as the finish ply membrane not to exceed nominal 60 mils in overall calendared thickness. Strips shall be nine inches (9") by forty-two inches (42") long. All four edges shall have a minimum one and one-half inch (1-1/2") wide dry lap for hot-air welding.

2.06 CAULKS

- A. Sealant for use at coping joints, reglet joints, etc., shall be a one-component urethane non-sag, gun grade sealant designed for use in active exterior joints, and shall meet or exceed Federal Specification No. 1 TT-S-00230C, Type II, Class A, ASTM C 920. Where joint surfaces are contained or are contaminated with bituminous materials, provide manufacturer's modified-type sealant (modified with coal-tar or asphalt as required).

- B. To seal the leading edge of the CTEM membrane, to bond CTEM at terminations with metal, and for open CTEM seam repair, sealant shall be a thermosetting, solvent free, non-slump, self-fixturing, multipurpose structural sealant which shall meet the following physical and performance properties.

Properties

Specific Gravity	1.62 (13.5 lbs./gallon)
Viscosity degrees F.	800,000 cps Brookfield RTV, TF spindle, 4 rpm 70
Shear Strength (ASTM D-1002)	300 psi+ (7 day ambient cure)
Elongation @ break (ASTM D-412)	300% (7 day ambient cure)
Hardness Shore A (ASTM C-661)	50 – 55 (14 day ambient cure)
Tack free time (ASTM C-679)	35 minutes
Low temperature flex	Minus 20 degrees F: PASS
Slump (sag) (ASTM C-639)	Zero slump
Shrinkage (ASTM D-2453)	No measurable shrinkage (14 day cure)
Service temperature	-40 degrees F to 200 degrees F

2.07 PITCH PAN SEALANT

- A. Shall be one-part, self-leveling polyurethane sealant meeting Federal Specification No. TT-S-00230C, Type I, Class A, ASTM C 920, Type S, Grade P, Class 25, for use in new pitch pans.

2.08 CANT STRIP

- A. Shall be wood fiber where used for non-structural purposes. Shall be treated solid wood where used for structural purposes meeting NRCA, Factory Mutual and Underwriters Laboratory guidelines. If solid wood cant is used where insulation exists, cant is to be toe nailed into treated solid wood nailer the same height as insulation.

2.09 FASTENERS

- A. Shall be Factory Mutual approved and as recommended by the manufacturer for the specific application.
- B. Fastener for Brick: Shall be one-fourth inch by two inch (1/4" x 2"), zinc with plated steel or stainless steel nail, one piece unit, flat head.
- C. Fastener for Wood Deck: Shall be an annular threaded shank with a galvanized round cap of appropriate length for use in attaching base sheets to wooden substrates.
- D. Fastener for Miscellaneous Metal Roof Application: Shall be a #12 fastener, fluorocarbon coated, with CR-10 coating. A minimum .200 diameter shank and .250 diameter thread. To be used with round pressure plates or bar, and having a fluorocarbon CR-10 coating, when subjected to thirty (30) Kesternich cycles (DIN 50018) shows less than 10% red rust which surpasses Factory Mutual Approval Standard 4470. Fasteners, plates, and/or bars shall be listed in the Factory Mutual Approval Guide.

2.10 WOOD

- A. All nailers, wooden cants and wooden curbs shall be treated lumber as required by NRCA, Factory Mutual and Underwriters Laboratory and installed according to NRCA and Factory Mutual guidelines.

2.11 ASPHALT ROOF PRIMER

- A. Quick-dry asphalt-based primer for priming of asphalt roof surfaces.

Applicable Federal Specification	SS-A-701B
ASTM	D 41
Flash Point	105° F
Viscosity at 80° F (ASTM D 217)	50-60 K.U.
Weight per gallon	7.4 pounds
Drying time (to touch)	Min. 4 hours

2.12 STYRENE, BUTADIENE, STYRENE (SBS) PRIMER

- A. SBS primer made from natural resins, solvent and synthetic rubber. For application on concrete, metal or wooden substrate.

2.13 ASPHALT FLASHING CEMENT

- A. Designed for laying-up cold process roof membrane flashings where fast-setting adhesive is required.

Applicable Federal Specification	SS-C-153C, Type I
ASTM	D 4586
Flash Point	105° F (41° C)
Weight per gallon (approximate)	10.8 lbs.
Viscosity @ 77° F (25° C) (ASTM D 217)	230-330
% Non-Volatile (Fed. Test Method 141)	68% Min.
% Specially Processed Bitumen	42% Min.
% Total Solids, by Volume	60% Min.
Cured film thickness of 1 gal./15 sq. ft.	75 Mils
Drying time	2 to 3 days
Service Temperature, Extended Exposure	-40° to +180° F
Resistance to Oils & Solvents	Poor
Resistance to Sunlight	Good
Resistance to Chemicals	Good
Effects of Weathering	Slight chalking
Water Resistance	
Under Good Drainage Conditions	Excellent
Under Continuous Submersion	Fair

2.14 KRAFT SHEATHING PAPER

- A. Minimum 28-pound kraft sheathing or red rosin paper for use as separator sheet.

2.15 STANDING SEAM ROOF PANELS

- A. Panels:

1. Shall be prefinished Galvalume™ UL 90 rated, 24-gauge, eighteen inch (18") seam sheet made up of 55% aluminum, 1.6% silicon and the balance zinc as described in ASTM specification A792.
2. Factory fabricates panel with integral continuous interlocking standing seam without need for separate seam covers. **Field formed panels will not be acceptable.**
3. Sealant shall be high grade, hot-melt elastomeric sealant in top edge of female seam cap, designed to seal against adjacent male panel leg.
4. All held panels shall be continuous, no exceptions.

5. Panel Fabrication:
    - a) Provide factory formed panel width of 18" with 1 3/4" high x 3/8" wide standing seam.
    - b) Provide panels in full length from ridge to eave.
    - c) Vertical striations (shadowline) to be furnished on all panels over sixteen inches (16") wide.
  6. Seams:
    - a) Panel cap shall have pitched bottom edge hook elements to ease installation of cap over clips.
    - b) Provide factory sealant inside female seam to aid in resistance of leaks and to provide panel-to-panel seal while allowing expansion and contraction movement.
  7. Seam Size:
    - a) Male leg: 1 1/2" high
    - b) Female cap: 1 3/4" high x 3/8" wide
- B. Clip/Fastener Assemblies:
1. UL 90 Requirements:
    - a) Fasteners: Manufacturer's standard #10 – 16 x 1" long self-drilling, self-tapping pancake head Phillips drive screws for metal; noncorrosive base material.
  2. Standard Clip: 24-gauge galvanized steel, 33 ksi yield strength, and 2" long single fastener type.
  3. Standard Fasteners: Same as UL 90 fasteners specified above.
  4. Clips:
    - a) Provide UL listed (standard) clip designated to allow panels to thermally expand and contract.
    - b) Fabricate clips with embossments that raise underside of panels above substrate to allow underside ventilation and prevent clip deformation.
    - c) Fabricate clips with structurally embossed outstanding legs to prevent distortion to wind uplift forces.
  5. Nailable Substrate Fasteners: #10 – 12 x 1" long A-Point fastener, pancake head Phillips drive screws for plywood; noncorrosive base material.
- C. Accessories:
1. Provide manufacturer's standard accessories and other items essential to completeness of standing seam roof installation.
  2. Provide nylon seam end plugs for clean termination of panel.
  3. Gutters and downspouts will be fabricated to the same gauge and specification as panel and match metal profile of the details herein.
- D. Field Sealant:
1. Color coordinated primerless silicone or high grade, nondrying butyl as recommended by panel manufacturer.
  2. Do not use sealant containing asphalt.
- E. Engineer panels to use concealed anchors that permit expansion and contraction. Exposed fasteners in roofing panels will not be permitted.
- F. Provide factory eave panel notch for eave termination (to be utilized with joggle cleat detail).
- G. Panel Finish:
1. Full strength 70% Kynar 500® coating baked on for 15 minutes at 450° F to dry-film thickness of 1.0 mil.
  2. 15% reflective gloss (ASTM D 523). (Low Gloss).
  3. 0.3 mil baked on epoxy primer.
  4. Standard Color: To match existing standing seam roof in place.



2.16 LEAD JACKS

- A. Shall be four pound (4#) lead, and of dimensions required to completely cover existing plumbing stack.

2.17 TERMINATION/PRESSURE BARS

- A. Aluminum strip shall be extruded channel bar with a mill finish, width one inch (1"), thickness  $0.100" \pm .008"$ , leg height one-fourth inch (1/4") top and bottom, leg angle ninety degrees (90°), for perimeter and curb anchorage, having predrilled holes six inches (6") on center, as manufactured by Olympic Fasteners, or approved equal.

2.18 DELIVERY AND STORAGE

- A. All materials shall be delivered with appropriate carton and can labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.

2.19 PRECAUTIONS

- A. Some of the indicated materials are extremely flammable and/or toxic. Use precautions indicated on can and carton labels.

2.20 MULTI-COMPONENT POLYURETHANE SEALANT

- A. Except as otherwise indicated, provide manufacturer's standard, non-modified, 2-or-more-part, polyurethane-based, elastomeric sealant; complying with either ASTM C 920, Type M, Class 25, or FS TT-S-00227E, Class A; self-leveling grade/type where used in joints of surfaces subject to traffic, otherwise non-sag grade/type.
- B. Durability: Less than 0.5 square inch adhesion/cohesion loss for three (3) samples of both mortar and aluminum; ASTM C 719 test procedure.
- C. Adhesion in Peel: Fifteen pound (15#) peel strength and ten percent (10%) maximum loss of bond to substrate; ASTM C 794.
- D. Bituminous Modification: Where joint surfaces contain or are contaminated with bituminous materials, provide manufacturer's modified type sealant which is compatible with joint surfaces (modified with coal-tar or asphalt as required).

2.21 EXPANDED POLYETHYLENE JOINT FILLER

- A. Provide flexible, compressible, closed-cell, polyethylene of not less than 10 psi compression deflection (25%); except provide higher compression deflection strength as may be necessary to withstand installation forces and provide proper support for sealants, surface water absorption of not more than 0.1 pounds per square foot.

2.22 JOINT PRIMER/SEALER

- A. Provide type of joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed.

2.23 BOND BREAKER TAPE

- A. Provide polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.

2.24 SEALANT BACKER ROD

- A. Provide compressible rod stock of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, non-absorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant application temperature as indicated.

2.25 MISCELLANEOUS MATERIALS

- A. Other materials shall be as specified or of the best grade for the proposed use as recommended by the manufacturer.

PART 3 - EXECUTION

3.01 REFERENCE

- A. The manufacturer's Technical Specifications shall be considered a part of this specification and should be referred to for more specific application procedures and recommendations.
- B. Application of materials shall be in strict accordance with the manufacturer's recommendations except where more stringent requirements are shown or specified. In the instance of a conflict between these specifications and those of the manufacturer, the more stringent specifications shall take precedence.
- C. General Installation:
  1. Protect adjacent areas with tarpaulin or other durable materials.
  2. Contractor shall prevent overspray, and be responsible for parking lot areas and/or adjoining areas not part of this contract.
  3. Contractor shall be responsible for sealing, as required, all openings that may allow bitumen migration or drippage, i.e. pitch dams, envelopes, and filler strips.
  4. Prepare surfaces according to manufacturer's or applicator's published instructions. All metal that is to receive bitumen, or come in contact with bitumen or adhesive, shall be first primed with appropriate primer. Any prefinished galvanized sheet steel that is to receive bitumen, or come in contact with bitumen or adhesive, shall be scored, scuffed or abraded before receiving primer application.
  5. Use cleaning materials or primers necessary to render an acceptable surface/substrate.
  6. All surfaces/substrates shall be clean and dry prior to application of materials.
  7. Prior to application of membrane, all foreign matter, gravel, etc., shall be removed from the insulation and/or substrate. Gravel or debris between the insulation/substrate and plies is not acceptable.
  8. Ambient temperature shall be 50° F and rising.
  9. All plies shall be laid in the direction of maximum roof slope, working from bottom of slope toward ridge.

10. Any self-adhered membranes shall be picture framed on all roof areas as the system is being applied. The outer edge of the picture frame sheet shall extend approximately two inches (2") above the top of the cant. All end laps of the field sheets of the self-adhered coal-tar elastomeric membrane shall lap the picture frame sheet a minimum of eight inches (8") or the picture frame sheet side laps shall lap the field sheet a minimum of eight inches (8").
11. Wrinkles, buckles, kinks, and fishmouths are not acceptable when laying felt and membrane.
12. Dry voids of felt on felt or membrane on membrane are not acceptable.
13. Where deteriorated base flashing is removed, primed cant strips shall be installed at the intersection of the deck and the vertical surfaces. All flashings shall be mechanically top-fastened with a termination bar a minimum of six inches (6") on center at the top leading edge, and be a minimum of eight inches (8") in height from finished membrane.
14. On slopes greater than one inch (1") in twelve inches (12"), refer to NRCA and/or manufacturer's guidelines for backnailing procedures and follow the more stringent guidelines for all specified materials.
15. All base sheet applications and surfaces that are to receive the self-adhered membranes shall be primed with a fast drying asphaltic primer. Except when self-adhered membrane is to be installed over a CTEM surface.

### 3.02 NAILERS

- A. Wooden nailers shall be installed at gravel stops or drip edges on outside perimeter of building according to NRCA, Factory Mutual and Underwriters Laboratory guidelines.
- B. All Construction: Nailers shall be the same height as the new insulation being installed where required. Nailers shall be raised if necessary by anchoring an additional nailer of appropriate height to the existing nailer if the existing nailer is not to be replaced. All existing nailers and new nailers, if required, shall be installed according to Factory Mutual and Underwriters Laboratory Guidelines.

### 3.03 APPLICATION OF UNDERLAYMENT

- A. The fiberglass base sheet shall be primed with asphalt based primer in accordance with manufacturer's recommended procedures and allowed to thoroughly dry.
- B. Unroll self-adhered membrane and allow to relax a minimum of two hours at 70° F plus temperature or longer if temperature is below 70° F. If after the period of relaxation, the membrane is not to be immediately installed, cover the membrane with white polyethylene tarp or release paper until ready for installation. All membrane applications shall be applied parallel with slope, no exceptions.
- C. Slide the membrane in place aligning with three inch (3") lap line. Fold second half of relaxed roll over the first half of relaxed roll. Kiss cut the release paper at the fold, taking care not to cut the adhesive and/or membrane, install two feet (2') of self-adhered membrane pulling release paper low to roof line. Roll excess release paper on unused core and pull low to the roof surface removing the release paper while simultaneously setting the remainder of the self-adhered membrane in place. Upon completion, fold first half of membrane over installed second half and repeat procedure. The end laps of the finish ply membrane shall be a minimum of three inches (3").
- D. Immediately following the laying of the self-adhering membrane, it shall be rolled in the width direction using a minimum seventy pound (70#) linoleum roller. This will prevent excessive entrapment of air beneath the membrane. The rolling is in the width direction and with the laps so as not to buck the laps.
- E. Position the next roll of self-adhering membrane adjacent to the membrane already applied so that there is a three inch (3") side lap. The membrane has a one and one-half inch (1-1/2") dry lap; therefore, the three inch (3") side lap will comprise one and one-half inch (1-1/2") adhered lap and one and one-half inch (1-1/2") welded lap.

- F. End laps of membrane shall be a minimum three inches (3"). If possible, lay the end laps in line.
- G. Picture frame all roof areas with self-adhered coal-tar elastomeric membrane (CTEM) as finish membrane ply is being applied. Rectangular type projections should also be picture framed.

### 3.04 LAP SPLICE

- A. Self-adhered coal-tar elastomeric membrane (CTEM) shall be installed as above with three inch (3") side laps. End laps shall be a minimum three inches (3") and in line if possible.
- B. Hot-Air or Solvent Welded Side Laps:
  - 1. WELDING OF SIDE LAPS SHALL BE DONE DAILY.
  - 2. Clean the laps of any bituminous adhesive, dirt, or contaminants to ensure clean, dry, hot-air welded seams. All seams shall have a three inch (3") minimum width, with a one and one-half inch (1-1/2") hot-air weld, and welded the same day the membrane is laid.
  - 3. Using either a Leister Variant hot air automatic welding machine or a Leister High Pressure 220/240, 42V double insulated hand-held blower with slot nozzle, weld the three inch (3") laps together. When using a hand-held hot-air welder, the seams should be pressed together using a hand-held roller. The speed and temperature settings of the welding equipment can be affected by the weather conditions at the site of application, therefore, these parameters should be set by the contractor by using two (2) pieces of self-adhered coal-tar elastomeric membrane (CTEM). Minimum width of hot-air weld one and one-half inches (1-1/2").
  - 4. Lay the laps together and apply pressure to the welded seam to ensure full adhesion.
  - 5. Allow the seams to set fully, and probe the entire length for voids. Reseam voids immediately with a hot-air gun and roller.
- C. End Laps: A piece of double sided adhesive tape two inches (2") wide shall be installed so that the end of the three inch (3") lap of the top roll is centered in the middle of the tape and the double sided adhesive tape extends two inches (2") beyond the sides edges of the membrane. A piece of coal-tar elastomeric membrane (CTEM) which is four inches (4") longer and four inches (4") wider than the double sided adhesive tape shall be applied so the coal-tar elastomeric membrane (CTEM) lap strip is centered over the double sided adhesive tape. The two inch (2") dry lap around the perimeter of the coal-tar elastomeric membrane (CTEM) lap strip shall be heat-welded to the field of the self-adhered coal-tar elastomeric membrane (CTEM).

### 3.05 PERIMETER FASTENING

- A. Wood nailers are required for perimeter gravel stops or drip edges. Field membrane and all plies shall be mechanically fastened to nailer on twelve inch (12") centers maximum.

### 3.06 FLASHING - GENERAL

- A. Flashings shall be installed using the self-adhered coal-tar elastomeric membrane (CTEM) flashing, with length of run not to exceed the width of the material roll.
- B. Wooden nailers or curbs shall be installed at all edges and openings in the roof, mechanically fastened to the deck. The nailers should be of exterior grade timber, and of the same thickness as any insulation to be used on the roof.
- C. Cant strips shall be installed at the intersection of the deck and all vertical surfaces.
- D. The roofing field membrane shall extend up over and to the top of cant strips at all vertical intersections or out to the roof's edge.

- E. All existing substrates receiving flashing membrane shall be clean and primed with asphalt primer, prior to application.
- F. Flashing membrane shall always be installed with Type IV glass felt as an underlayment. The Type IV glass felt shall be set in hot asphalt.
- G. Self-adhered CTEM sheet shall always be installed with self-adhered CTEM as an underlayment.
- H. All flashings shall be mechanically fastened with a termination bar a maximum of six inches (6") on center, be a minimum of eight inches (8") above finished roof height, extend a minimum of nine inches (9") onto the field of horizontal roof membrane, and not exceed the width of the material roll.
- I. All surface mounted flashings terminated with a pressure bar shall have an additional surface mounted counterflashing installed immediately above the pressure bar. The counterflashing shall extend a minimum of two and one-half inches (2-1/2") below the pressure mounted termination bar. Both the top edge of the surface mounted termination bar and the surface mounted counterflashing shall be sealed with a liberal bead of sealant.
- J. All vertical flashing lap seams of the self-adhered coal-tar elastomeric membrane (CTEM) shall be hot-air welded. NOTE: Clean lap area of any bituminous adhesive prior to welding.
- K. The self-adhered ply sheet shall extend a minimum of two inches (2") beyond the top edge of the cant. The self-adhered flashing underlayment should then be applied from a minimum of eight inches (8") above the finished roof line down the vertical extending a minimum of nine inches (9") out onto the field of the roof. The finish ply membrane shall then be installed so as to extend from the field of the roof to a minimum of two inches (2") beyond the top edge of the cant. Following the installation of the finish ply membrane a minimum of two inches (2") above the cant, the top self-adhered flashing membrane shall be installed from a minimum of eight inches (8") above the finished roof line down the vertical extending a minimum of nine inches (9") out onto the field of the roof. All exposed vertical flashing and all exposed horizontal flashing laps shall be hot-air welded.
- L. All flashing membrane shall be hot mopped to the vertical flashing and to field of roof membrane; hot-air weld vertical laps. NOTE: All bitumen shall be removed from hot-air weld area.
- M. All flashing membrane shall be self-adhered to the vertical flashing, horizontal laps, and to field of roof membrane; hot-air weld vertical laps.
- N. Flashing laps shall be minimum three inch (3") width, no maximum.
- O. Hot-air weld of flashing lap shall be minimum one and one-half inch (1-1/2") width, no maximum.
- P. Any flashing extending further than eighteen inches (18") up onto a vertical surface shall be terminated at eighteen inch (18") height intervals and be mechanically fastened at the top with a termination pressure bar. The additional height needed to be flashed will have a second piece of self-adhered coal-tar elastomeric membrane (CTEM) and Type IV fiberglass felt underlayment installed in hot asphalt lapping the terminated lower sheet by six inches (6"). The new piece shall be properly fastened with a termination bar.
- Q. The self-adhered coal-tar elastomeric flashing sheets shall be run up the wall in three foot (3') widths and under the coping cap and terminated on the outside of the wall six inches (6") on center, then the coping cap reset. All side laps are to be hot-air welded. The underlayment ply shall be a self-adhered coal-tar elastomeric membrane (CTEM).
- R. All hot-air welded seams/laps shall be tested daily with a probe for integrity, no variance.

- S. **Hot-air Welding Laps:**
1. When using a hand-held hot-air welder, the seams should be pressed together using a hand-held roller. The speed and temperature settings of the welding equipment can be affected by the weather conditions at the site of application, therefore, these parameters should be set by the contractor by using two (2) pieces of self-adhered coal-tar elastomeric membrane (CTEM). Minimum width of hot-air weld one and one-half inches (1-1/2").
  2. Lay the laps together and apply pressure to the welded seam to ensure full adhesion.
  3. Allow the seams to set fully, and probe the entire length for voids. Reseam voids immediately with a hot-air gun and roller.

### 3.07 PROJECTION FLASHINGS

- A. **Plumbing Vents:** Soil vent stack pipes shall receive new lead flashings installed in strict accordance with practices set forth in the NRCA Roofing Manual. The lead shall be carried up and over the top of the stack, and crimped down into the pipe to form a watertight seal. Projections that cannot be sealed thus should be boxed in and flashed as recommended by the roof membrane manufacturer.
- B. **Square Projections:** Lay the self-adhered coal-tar elastomeric membrane (CTEM) up to the projection, and cut membrane so that it will extend twelve inches (12") beyond the projection. Cut a slit in the membrane to correspond with the position of the projection, and lay the membrane in hot asphalt. Apply another layer of membrane in exactly the same fashion, but from the opposite direction. For metal flange-type projections, after doing above, strip in with six inch (6") strips of membrane.
- C. **Round Projections:** Cut membrane square and eighteen inches (18") from perimeter of projection. Slit square membrane with an "X" of proper size to ensure a close fit and positive seal. Place over projection, and adhere to clean membrane already on the roof. Cut a six inch (6") piece of membrane to apply as a collar, and secure with all stainless steel clamp.

### 3.08 STANDING SEAM METAL ROOF

- A. **General:**
1. Examine substrate to ensure it is properly secured and prepared to receive metal roofing.
  2. Ensure substrate is installed flat, free from objectionable warp, wave and buckle.
  3. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. **Standing Seam Roof Installation:**
1. Comply with manufacturer's instructions for assembly, installation and erection in order to achieve weathertight installation. Install in accordance with approved shop drawings.
  2. **Standing Seam System:**
    - a) Install panels in accordance with manufacturer's instructions and recommendations.
    - b) Prior to application of metal roof panels, all underlayment shall be covered with kraft sheathing separator sheet or similar, no exceptions.
    - c) Anchor securely in place using clips and fasteners spaced in accordance with manufacturer's recommendations for design and wind load criteria, minimum wind uplift of FM 1-90 is required or as per the most current published Factory Mutual windspeed map for the area for which the project is located.
    - d) Fully seat adjacent panel to achieve continuous engagement of standing seam joint.
    - e) All panels shall be installed in a workmanlike manner and panels true, straight and watertight.
  3. **Dissimilar Metals:**
    - a) Where sheet metal is in contact with dissimilar metals, execute juncture to facilitate drainage and minimize possibility of galvanic action.

- b) At point of contact with dissimilar metal, coat metal with protective paint or tape which can be placed between metals.
- 4. Field apply sealant to penetrations, transitions and other locations necessary (not standing seam) for airtight, waterproof installation.
- C. Cleaning: Clean exposed surfaces of work promptly after completion of installation.
- D. Protection: Protect work as required to ensure roofing will be without damage at time of final completion.

END OF SECTION

## SECTION 07 92 00 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data and color Samples.

### PART 2 - PRODUCTS

#### 2.1 JOINT SEALANTS

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.
- B. Elastomeric Sealants: Comply with ASTM C 920.
  - 1. Single-component, neutral-curing silicone sealant, Type S; Grade NS; Class 25; Uses T, M, and O, with the additional capability to withstand [50 percent movement in both extension and compression for a total of 100 percent movement] [100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement]. Use for building expansion joints.
  - 2. Single-component, nonsag polysulfide sealant, Type S; Grade NS; Class 12-1/2; Uses NT, M, G, A, and O. For general exterior use.
  - 3. Single-component, neutral-curing silicone sealant, Type S; Grade NS; Class 25; Uses T, NT, M, G, A, and O. For general exterior use.
  - 4. Single-component, nonsag urethane sealant, Type S; Grade NS; Class 25; and Uses NT, M, A, and O. For general exterior use.
  - 5. Single-component, nonsag urethane sealant, Type S; Grade NS; Class 25; Uses T, NT, M, G, A, and O. Use for exterior traffic-bearing joints, where slope precludes use of pourable sealant.
  - 6. Single-component, pourable urethane sealant, Type S; Grade P; Class 25; Uses T, M, G, A, and O. Use for exterior traffic-bearing joints.



7. Single-component, mildew-resistant silicone sealant, Type S; Grade NS; Class 25; Uses NT, G, A, and O; formulated with fungicide. Use for interior sealant joints in ceramic tile, stone, and other hard surfaces in kitchens and toilet rooms and around plumbing fixtures.
- C. Latex Sealant: Single-component, nonsag, mildew-resistant, paintable, acrylic-emulsion sealant complying with ASTM C 834. For interior use only at perimeters of door and window frames.
- D. Acoustical Sealant for Exposed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834. For interior use only at acoustical assemblies.
- E. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound. For interior use only at acoustical assemblies.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with ASTM C 1193.
- B. Comply with ASTM C 919 for use of joint sealants in acoustical applications.

END OF SECTION

## SECTION 07 95 00 - EXPANSION AND SEISMIC JOINT COVERS

### PART 1 — GENERAL

#### 1.01 COORDINATION

- A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

#### 1.02 WORK INCLUDED

- A. Furnish and install complete Expansion Joint Cover Systems.
  - 1. Interior Floor expansion joint covers.
  - 2. Interior Wall expansion joint covers.
  - 3. Interior Ceiling expansion joint covers.
  - 4. Exterior Wall expansion joint covers.

#### 1.03 RELATED WORK

- A. Related work which is specified elsewhere.
  - 1. Cast-In-Place Concrete: Section 03 30 00.
  - 2. Unit Masonry: Section 04 22 00.
  - 3. Structural Steel: Section 05 12 00.
  - 4. Gypsum Wallboard: Section 09 21 16.

#### 1.04 REFERENCES

- A. Publications listed herein are part of this specification to the extent referenced. The criteria established in the specifications shall take precedence over the standards referenced herein.
  - 1. American Society for Testing and Materials (ASTM):
    - a. ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

#### 1.05 DEFINITIONS

- A. Define industry and product terms as necessary.

#### 1.06 SYSTEM DESCRIPTION

- A. Joint covers shall permit unrestrained movement of joint without disengagement of cover.
- B. Allowable load on floor joint cover plate shall be 100 psf uniform load and 300 pounds concentrated load with maximum 12,000 psi stress (6063-T5 aluminum extrusions) at full open position.
  - 1. Deflection shall be 1/16 inch at neutral position.
  - 2. In the absence of load selections the minimum load will apply – 50 psf with 1/8 inch deflection.
- C. Centering Bars shall have [nylon spheres] [pins] which fully engage with the base members' tracks.
- D. Fire rated joint covers shall have been tested by an independent, nationally recognized testing and listing entity in accordance with ANSI/UL No. 263, ASTM E119, UL 2079, or ASTM E1966, including hose stream test, where applicable, at the full rated period. Covers shall be listed with an independent, nationally recognized testing and listing entity. Fire rating shall be not less than the fire rating of adjacent construction.

#### 1.07 QUALITY ASSURANCE

- A. Manufacturer: Obtain joint cover assemblies through one source from a single manufacturer.
  - 1. Manufacturer shall be ISO 9001:2000 Certified.
    - A. The Manufacturer shall have documented management and control of the processes that influence the quality of its products.
    - B. The Manufacturer shall have documented management and control of the processes that influence the quality of its customer service.
  - 2. Manufacturer shall have a minimum of ten (10) years of experience in the fabrication of expansion joint cover assemblies.
- B. Installer: Firm with not less than three (3) years of successful experience in the installation of systems similar to those required by this project and acceptable to the manufacturer of the system.

#### 1.08 SUBMITTALS

- A. Submission must be made within ten (10) working days of the General Contract award to avoid project delay.
  - 1. Submit manufacturer's specifications and technical data, including Material Safety Data Sheets, installation instructions, and, as required, catalog cuts and templates to explain construction and to provide for incorporation of the product into the project.
  - 2. Submit certificates, copies of independent test reports, or research reports showing compliance with fire resistance rating and other specified performance requirements.
  - 3. Submit shop drawings showing complete fabrication details for all joint covers, including required anchorage to surrounding construction, recesses, blocking, backing and connections between similar and dissimilar joint cover assemblies.

4. Submit three (3) 6" samples of the specified system.

#### 1.09 DELIVERY, STORAGE AND HANDLING

- A. Provide temporary protective cover on anodized aluminum finished surfaces.
- B. Deliver joint covers to jobsite in new, clean, unopened crates of sufficient size and strength to protect materials during transit.
- C. Store components in original containers in a clean, dry location.

#### 1.10 SEQUENCING

- A. Submittals shall be completed and approved prior to award of subcontract for system components.
- B. Subcontract for the work of this section shall be planned to allow sufficient time for manufacturer's production and delivery scheduling.

#### 1.11 WARRANTY

- A. Submit manufacturer's warranty that materials furnished will perform as specified for a period of not less than one (1) year when installed in accordance with manufacturer's recommendations.

### PART 2 - PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Furnish and install as noted in specifications and as indicated on drawings, Expansion Joint Cover Types; NBA-1, NBAL-1, 6TW-1, 1C1, 9WC-2, AVL-1, AV-1 manufactured by: Balco, Inc., PO Box 17249, 2626 S. Sheridan, Wichita, KS 67217; phone: 800-767-0082 or (316) 945-9328; fax: (316) 945-0789.
- B. Substitutions: In Accordance with Section 01 25 00 Substitution Procedures.

#### 2.02 MATERIALS

- A. Expansion joint cover systems shall be Balco, Inc. NBA-1, NBAL-1, 6TW-1, 1C1, 9WC-2, AVL-1, AV-1
  1. Aluminum:
    - a. ASTM B221, alloy 6063-T5 for extrusions
    - b. ASTM B209, alloy 6061-T6 for plate
    - c. ASTM B209, alloy 5052-H32 for sheet
  2. Stainless Steel: ASTM A666, alloy 304 for sheet and plate
  3. Centering Bars: shall be spring steel, alloy 1074, and shall have thermoplastic elastomer spheres which fully engage with the base members' tracks
  4. Water Barrier: Flexible EPDM, Class I, ASTM D4637, 45 mils thick (minimum) sheet
  5. Fire Barrier: Metaflex Classic tested in accordance with ASTM E119/ASTM E814,
  6. Fasteners, accessories, sealant and other materials required for complete installation in accordance with the manufacturer's written installation instructions.

#### 2.03 FABRICATION

- A. Fabricate expansion joint cover assemblies as detailed. Provide centering bars, sealing washers, gaskets, splice covers, and closures as necessary for complete installation.
  - 1. Fabricate special transitions and corner fittings as required.
  - 2. Fabricate fire barrier and provide fire-resistant sealant as required for fire-resistant installations.
  - 3. Miter and weld joint systems as applicable.
  - 4. Provide necessary and related parts, devices, water barrier (if specified), anchors, form clips and other items required for water-resistant and fire-resistant installation.
  - 5. Provide corners, tees, transitions, curb risers, etc. assembled with connection [mitered] [interlocking] and secured to ensure proper fit and alignment as applicable.
  - 6. Special conditions shall be shop fabricated.
  - 7. Cover plates shall have a smooth 1/8 inch recessed exposed surface.
  
- B. Shop assemble components and package with anchors and fittings. Provide components in single lengths where possible; minimize site splicing.

## 2.04 FINISHES

- A. Aluminum:
  - 1. Floors and Exterior Walls – Mill finish.
  - 2. Interior Walls and Ceilings – Clear anodized, Class II, AA-M12 C22 A31; 204-R1
  - 3. In contact with concrete – Prime painted.
- B. Steel shall be galvanized in accordance with ASTM A123.
- C. Filler Strips: Gray (standard).

## PART 3 — EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements and blockout dimensions are as shown on shop drawings prior to releasing materials for fabrication by the manufacturer.
- B. Installer shall examine conditions under which work is to be performed and shall notify the contractor in writing of unsatisfactory conditions. Installer shall not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

### 3.02 INSTALLATION

- A. Install expansion joint covers in accordance with the manufacturer's instructions. Align work plumb, level, and flush with adjacent surfaces. Rigidly anchor to substrate. Make allowances for change in joint size due to difference between installation and building operating temperatures.

- B. Set centering bars diagonally at 20 inches on center maximum (or 10 inches on center for heavy-duty models). Centering bars shall be fully engaged with the base members.
- C. Fire Rated Joint Covers: Install fire rated covers to requirements of applicable fire rated design. Install fire barriers and flame sealant as required.
- D. Water Barrier: Provide water barriers at exterior joints and where called for on Drawings. Provide drainage fittings where called for on Drawings.

### 3.03 ADJUSTING AND PROTECTION

- A. Adjust joint cover to freely accommodate joint movement.
- B. Protect the installation from damage by work of other Sections. Where required, remove and store cover plates and install temporary protection over joints. Re-install cover plates prior to Substantial Completion of work.

END OF SECTION

## SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.3 SUMMARY

- A. Section Includes:
  - 1. Standard hollow metal doors and frames.
- B. Related Sections:
  - 1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
  - 2. Division 08 Section "Wood Doors" for wood doors in hollow metal frames.
  - 3. Division 08 Section "Door Hardware (Scheduled by Describing Products)" for door hardware for hollow metal doors and frames.
  - 4. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

#### 1.4 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door design.
  - 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.
- C. Samples for Verification:
  - 1. Samples are only required by request of the architect and for manufactures that are not current members of Steel Door Institute.
  - 2. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
  - 3. For the following items, prepared on Samples about 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:
    - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
    - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.

## 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- B. Preinstallation Conference: Conduct conference at Project site for hollow metal frames requiring electrical knockout boxes to verify installation of conduit on frames.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.



## 1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## 1.9 COORDINATION

- A. Coordinate installation of anchorages 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.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with this section requirements, provide products by one of the following:
  - 1. Amweld Building Products, LLC.
  - 2. Ceco Door Products; an Assa Abloy Group company.
  - 3. Curries Company; an Assa Abloy Group company.
  - 4. Steelcraft; an Ingersoll-Rand company.
  - 5. No Substitution; only material from an SDI member will be allowed on the jobsite unless prior approval is given in accordance with substitution request requirements per General Requirements section.

### 2.2 MATERIALS

- A. Cold-Rolled Steel Sheets: Carbon steel complying with ASTM A 366 (ASTM A 366M), commercial quality, or ASTM A 620 (ASTM A 620M), drawing quality, special killed.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Glazing: Comply with requirements in Division 08 Section "Glazing."

### 2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide 1 3/4" thick beveled and handed doors of design indicated, fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
  - 1. Design: Flush panel

2. Core Construction: Manufacturer's standard polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
  3. Vertical Edges for Single-Acting Doors: Beveled edge
    - a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
  4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
  5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
  6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheets. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 2 and Physical Performance Level A (Heavy Duty), 16 gage (0.053-inch - 1.3-mm-) thick steel faces, with threat side of door exceeding 14 gage (0.067-inch - 1.7-mm-) thick steel, Model 2 (Seamless face and edges).
  2. Provide doors with 22 gage Z-Channels steel stiffeners placed at 6 inches apart with foamed in place polyurethane core.
  3. Provide thermal insulation with calculated R factor of 11.01 per ASTM C518 Standards.
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm-) thick steel, Model 2 (Seamless face and edges).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- ## 2.4 STANDARD HOLLOW METAL FRAMES
- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheets.
1. Fabricate frames with mitered or coped corners.
  2. Fabricate frames as face welded joints and back weld joints continuously, unless otherwise indicated.
  3. Frames for Level 3 Steel Doors: minimum 14 gauge 0.067-inch- (1.7-mm-) thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
1. Fabricate frames with mitered or coped corners.
  2. Fabricate frames as face welded unless otherwise indicated.
  3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
  4. Frames for Level 3 Steel Doors: minimum 16 gauge 0.053-inch- (1.3-mm-) thick steel sheet.
  5. Frames 48-inches and wider in opening width are required to be minimum 14 gauge 0.067-inch- (1.7-mm-) thick steel sheet.

6. Frames for Wood Doors: minimum 16 gauge 0.053-inch- (1.3-mm-) thick steel sheet.
7. Frames for Borrowed Lights: minimum 16 gauge 0.053-inch- (1.3-mm-) thick steel sheet.

- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

## 2.5 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 (50 mm) wide by 10 inches (250 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. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

### B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

## 2.6 STOPS AND MOLDINGS

### A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

### B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

### C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

## 2.7 ACCESSORIES

### A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

### B. Grout Guards: Formed from same material as frames, not less than 0.016 inches (0.4 mm) thick.

## 2.8 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 thickness of metal. 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. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8

### C. Hollow Metal Doors:

1. Exterior Doors:
    - a. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Top of door to be flush and completely sealed joints in top edges of doors against water penetration.
    - b. Provide Polyurethane core.
  2. Glazed Lites: Factory cut openings in doors with applied flush trim to fit.
  3. Astragals: Provide overlapping astragal as noted in door hardware sets in Division 8 Door Hardware on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
  4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 8 Door Hardware.
  5. Seamless Edge: Provide seamless edge on hollow metal doors by intermittently tack welding seam, grinding smooth and finishing edge free from defects and blemishes.
- D. 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. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Continuously backweld joints at exterior frames.
  2. 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.
  3. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops required wider dimension on glass side of frame.
  4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 42-inch and wider with mortise/butt type hinges only at top hinge location to deter against hinge reinforcement sag.
  5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 8 Door Hardware.
  6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops; provide security head screws at exterior locations.
  7. Grout Guards: Weld guard boxes to frame at back of mortise hardware prep in frames at all hinge, strike and other recessed hardware preps regardless of grouting requirements.
  8. Provide A60 Galvannealed coating at frames in restrooms with showers/Jacuzzi, clean areas such as surgery rooms and surgical suites, clean rooms, and soil rooms.
  9. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  10. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry 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) 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 1 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 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
  - 5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
11. Door Silencers: Except on weather-stripped or gasketed doors, drill stops to receive door silencers as follows. Keep holes clear during construction. Silencers to be supplied by frame manufacture regardless if specified in division 8 Door Hardware.
- 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.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricators shop
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 glazed lites are capable of being removed independently.
  3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  4. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
  5. Gap for butted or mitered joints in glass stop should not exceed .0625-inch.
- 2.9 STEEL FINISHES
- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

### PART 3 - EXECUTION

#### 3.1 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. For the record, 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.

#### 3.2 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. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
  - 1. 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.
  - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
  - 3. 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.
  - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

#### 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
  - 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-protection-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 glazing 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 plumbness, squareness, 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 are filled with grout containing antifreezing 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 powder-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 behind 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 grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
  6. Field Supplied Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
  7. Grouting Requirements:
    - a. Do not grout head of frames unless reinforcing has been installed in head of frame.
    - b. Do not grout vertical or horizontal closed mullion members.
  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. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
  2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  3. Smoke-Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply with installation requirements in Division 08 Section "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 (50 mm) o.c. from each corner.
  - a. Secure exterior removable stops with security head screws.

#### 3.4 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 Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION



## SECTION 08 14 16 – FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.3 SUMMARY

- A. Section Includes:
  - 1. Solid-core doors and transom panels with wood-veneer, hardboard or MDF and decorative-laminate faces.
  - 2. Factory finishing wood doors.
  - 3. Factory fitting wood doors to frames and factory machining for hardware.
- B. Related Sections:
  - 1. Division 6 Section "Interior Architectural Woodwork" for requirements for veneers from the same flitches for both wood doors and wood paneling.
  - 2. Division 8 Section "Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
  - 3. Division 8 Section "Glazing" for glass view panels in wood doors.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware.
  - 2. Indicate dimensions and locations of cutouts.

3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For decorative-laminate door faces and factory-finished doors.

D. Samples for Verification:

1. As requested by the Architect for verification, provide factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

E. Warranty: Sample of special warranty.

#### 1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain wood doors from single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors."

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.

#### 1.6 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 and wrap bundles of doors in plastic sheeting.

C. Mark each door on top rail with opening number used on Shop Drawings.

#### 1.7 PROJECT 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 the remainder of the construction period.

#### 1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which 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 in a 42-by-84-inch section.
- b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.

- c. Telegraphing of core construction and delamination of face in decorative laminate-faced doors.
2. Warranty Period for Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

### 2.1 DOOR CONSTRUCTION, GENERAL

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- B. Particleboard-Core Doors:
  1. Particleboard: ANSI A208.1.
- C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
  1. Edge Construction: Provide all fire-rated doors edge construction with intumescent seals concealed by outer stile (Category A). Comply with specified requirements for exposed edges.
  2. 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.
- D. Mineral-Core Doors:
  1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
  2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
  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.

### 2.2 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Graham.
  2. Algoma Hardwoods.
  3. Eggers Industries.
  4. Marshfield Door Systems, Inc.
  5. V-T Industries Inc.
- B. Interior Solid-Core Doors:
  1. Grade: Premium, with Grade A faces.
  2. Species: Select White Birch.
  3. Cut: Rotary Cut.
  4. Match between Veneer Leaves: Book match.
  5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
  6. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.

7. Exposed Vertical Edges: Same species as faces.
8. Core: Particleboard type LD-2, Mineral core.
9. Construction: Five plies. Stiles and rails are bonded to core, and then entire unit abrasive planed before veneering.

## 2.3 LOUVERS AND LIGHT FRAMES

### A. Metal Louvers:

1. Blade Type: Vision-proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked-enamel- or powder-coated finish.

### B. 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. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked-enamel- or powder-coated finish.

### C. Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; with baked-enamel or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

## 2.4 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 requirements in NFPA 80 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, DHI A115-W series standards, 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: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.

## 2.5 FACTORY FINISHING

### A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

- B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
- C. Transparent Finish:
  - 1. Grade: Premium.
  - 2. Finish: WDMA TR-6 catalyzed polyurethane.
  - 3. Staining: As selected by Architect from manufacturer's full range.
  - 4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
  - 1. Verify that 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.

#### 3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
  - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

#### 3.3 ADJUSTING

- A. Operation: Re-hang 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

## SECTION 08 35 13 - ACCORDION FOLDING DOORS

### PART 1 – GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Furnish and install accordion folding partitions as indicated in drawings.
- B. Related Sections include the following:
  - 1. Division 03 Sections for concrete tolerances required.
  - 2. Division 05 Sections for primary structural support, including pre-punching of support members by structural steel supplier per partition supplier's template.
  - 3. Division 06 Sections for wood framing and supports, and all blocking at head and jambs as required.
  - 4. Division 09 Sections for wall and ceiling framing at head and jambs.

#### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified in writing by the partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.
- B. Preparation of the opening shall conform to the dimensions specified, plumb, level, and in accordance to building practices.
- C. Acoustical Performance: Test partitions in an independent acoustical laboratory in accordance with ASTM E90 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

#### 1.4 SUBMITTALS

- A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of partition, component, and accessory specified.
- B. Shop Drawings: Show location and extent of partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

- C. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.
- D. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.

#### 1.5 WARRANTY

- A. Provide written warranty by manufacturer of partitions agreeing to repair or replace any components with manufacturing defects.
- B. Warranty period: Two (2) years.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Clearly mark packages and partitions with numbering systems used on Shop Drawings. Do not use permanent markings on partitions.
- B. Protect partitions during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

### PART 2 – PRODUCTS

#### 2.1 MANUFACTURERS, PRODUCTS, AND OPERATION

- A. Manufacturers: Subject to compliance with requirements, provide product by the following:  
Modernfold, Inc.  
215 West New Road  
Greenfield, IN 46140  
800.869.9685  
[www.modernfold.com](http://www.modernfold.com)
- B. Substitutions: Permitted in accordance with Section 01 25 00 Substitution Procedures.
- C. Products: Subject to compliance with the requirements, provide the following product:
  - 1. Modernfold #800 Accordion Folding Partition.

#### 2.2 OPERATION

- A. Modernfold #800: Manually operated, top supported, accordion folding.

#### 2.3 CONSTRUCTION

- A. Shall consist of steel hinge plates welded to 3/16-inch (5mm) diameter vertical steel rods, with a single row of plates at the bottom and top with intermediate rows at approximately 42-inch (1067mm) on center. Partitions 13'-0" (3048mm) high or over have a double row of hinge plates at the top. A high tensile alloy steel trolley yoke, functioning as a hinge pin at required intervals, supports the frame assembly.

#### 2.4 PARTITION FINISHES

- A. Finish: Factory applied, Class "A" rated material. Finish shall be:
  - 1. Reinforced heavy duty vinyl with woven backing weighing not less than 27 ounces per lineal yard.
- B. Partition Trim: Exposed sweep strips of one consistent color.

## 2.5 HARDWARE

- A. Grip type hand pulls shall be die cast zinc, satin chrome finish. Extruded aluminum or plastic hand pulls will not be accepted.

## 2.6 SUSPENSION SYSTEM

- A. #5 (Modernfold 800 only) Suspension System, track and trolley sizes matched to the size of the partition.
  - 1. Suspension Tracks: Shall be of a continuous "C" channel shaped track, connected to the structural support.
  - 2. Carriers: The accordion folding partition shall be suspended from the track by two-wheel intermediate and four-wheel lead trolley assemblies.

## 2.7 OPTIONS

- B. Pairs of Flexible Sweep Strips: Shall be provided at top and bottom of the partition. Air release for air trapped within the folding partition shall be accomplished during operation by a series of 3/8-inch (9.5mm) diameter holes through the lead post molding.
- C. Jamb-Lock: Backpost to be secured to the wall by the "Jamb-Lock" mechanism concealed within the backpost to provide a quick means of releasing and reattaching the partition for cleaning and decorative purposes.
- D. Locks: Satin chrome handpulls with (select) manufacturer's standard locks or master-keyed locks. Master-keyed cylinders furnished by others. Locks shall be an integral part of the pull; Manually Operated Partitions Only.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. General: Comply with partition manufacturer's written installation instructions, Drawings, and approved Shop Drawings.
- B. Install partitions and accessories after other finishing operations, including painting have been completed.
- C. Defective partitions are not acceptable.

### 3.2 CLEANING AND PROTECTION

- A. Clean partition surfaces upon completing installation of partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer that insure operable partitions are without damage or deterioration at time of Substantial Completion.

### 3.3 ADJUSTING

- A. Adjust partitions to operate smoothly, easily, and quietly throughout entire operational range. Lubricate hardware and other moving parts.

### 3.4 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.5 DEMONSTRATION



- A. Demonstrate proper operation and maintenance procedures to Owner's representative.
- B. Provide Operation and Maintenance Manual to Owner's representative.

END OF SECTION

## SECTION 08 41 13 – ALUMINUM STOREFRONT

### PART 1 - GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.1 SUMMARY

- A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.
- B. Section Includes:
  - 1. Entrance and storefront systems, complete with reinforcing, fasteners, anchors and attachment devices.
  - 2. Aluminum doors complete with hardware.
  - 3. Accessories necessary to complete work.
- C. Related Sections:
  - 1. Section 01 40 00 - Quality Requirements.
  - 2. Section 05 50 00 - Metal Fabrications.
  - 3. Section 06 10 00 - Rough Carpentry.
  - 4. Section 07 92 00 - Joint Sealants.
  - 5. Section 08 71 00 - Door Hardware.
  - 6. Section 08 81 00 - Glass and Glazing.

#### 1.2 REFERENCES

- A. Aluminum Association (AA):
  - 1. DAF-45 Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association (AAMA):
  - 1. 503.1 Test Method for Condensation Resistance of Windows, Doors and Glazed Wall Systems.
  - 2. 701.2 Specifications for Pile Weatherstripping.
  - 3. Manual #10 Care and Handling of Architectural Aluminum From Shop to Site.
  - 4. SFM-1 Aluminum Storefront and Entrance Manual.
- C. American National Standards Institute (ANSI):

1. A117.1 Safety Standards for the Handicapped.

D. American Society for Testing and Materials (ASTM):

1. A36 Structural Steel.
2. B209 Aluminum and Aluminum - Alloy Sheet and Plate.
3. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
4. B308 Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
5. C509 Cellular Elastomeric Pre-formed Gasket and Sealing Material.
6. C864 Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers.
7. E283 Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
8. E330 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
9. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

E. Federal Specifications (FS):

1. TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.

F. Steel Structures Painting Council (SSPC):

1. Paint 12 Cold-Applied Asphalt Mastic (Extra Thick Film).

### 1.3 SYSTEM REQUIREMENTS

A. Design Requirements:

1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
2. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
3. Provide concealed fastening.
4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
6. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
7. Provide for expansion and contraction without detriment to appearance or performance.
8. Assemblies shall be free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.

B. Performance Requirements:

1. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot (0.0003 m<sup>3</sup>/sm<sup>2</sup>) of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf (300 Pa).

2. Water infiltration: No uncontrolled water penetration when tested in accordance with ASTM E 331 at test pressure of 8.0 psf 380 Pa.

C. Thermal Requirements:

1. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees Fahrenheit (82 degrees Celsius) without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
2. Ensure doors function normally within limits of specified temperature range.

D. Structural Requirements, as measured in accordance with ANSI/ASTM E330:

1. Wind loads for exterior assemblies:
  - a. Basic loading:
    - 1) [ ] psf acting inward.
    - 2) [ ] psf acting outward.
2. Deflection: Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures shall not exceed 1/175 of its clear span.

E. Testing Requirements: Provide components that have been previously tested by an independent testing laboratory.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00.

B. Product Data:

1. Submit manufacturer's descriptive literature and product specifications.
2. Include information for factory finishes, hardware, accessories and other required components.
3. Include color charts for finish indicating manufacturer's standard colors available for selection.

C. Shop Drawings:

1. Submit shop drawings covering fabrication, installation and finish of specified systems.
2. Include following:
  - a. Fully dimensioned plans and elevations with detail coordination keys.
  - b. Locations of exposed fasteners and joints.
3. Provide detailed drawings of:
  - a. Composite members.
  - b. Joint connections for framing systems and for entrance doors.
  - c. Anchorage.
  - d. System reinforcements.
  - e. Expansion and contraction provisions.
  - f. Hardware, including locations, mounting heights, reinforcements and special installation provisions.
  - g. Glazing methods and accessories.
  - h. Internal sealant requirements as recommended by sealant manufacturer.
4. Schedule of finishes.

D. Samples:

1. Submit samples indicating quality of finish, in required colors, on alloys used for work, in sizes as standard with manufacturer.
2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.

E. Test Reports:

1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of re-testing. Include other supportive data as necessary.

F. Certificates:

1. Submit manufacturer's certification stating that systems are in compliance with specified requirements.

G. Qualification Data:

1. Submit installer qualifications verifying years of experience.
2. Include list of projects having similar scope of work identified by name, location, date, reference name and phone number.

H. Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility:

1. To ensure quality of appearance and performance, obtain materials for each system from either a single manufacturer or from manufacturer approved by each system manufacturer.

B. Installer Qualifications: Certified in writing by Contractor as qualified for installation of specified systems.

C. Perform Work in accordance with AAMA SFM-1 and manufacturer's written instructions.

D. Conform to requirements of ANSI A117.1 and local amendments.

E. TDI: Door assemblies shall comply with windstorm inland I requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 01 60 00.

B. Protect finished surfaces as necessary to prevent damage.

C. Do not use adhesive papers or sprayed coatings which become firmly bonded when exposed to sun.

D. Do not leave coating residue on any surfaces.

E. Replace damaged units.

1.7 WARRANTY

A. Provide warranties in accordance with the Contract General Conditions.

- B. Provide written manufacturer's warranty, executed by company official, warranting against defects in materials and products for two (2) years from date of Substantial Completion.
- C. Provide written installer's warranty, warranting work to be watertight, free from defective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.
  - 1. Warranty shall cover following:
    - a. Complete watertight and airtight system installation within specified tolerances.
    - b. Completed installation will remain free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.
    - c. System is structurally sound and free from distortion.
    - d. Glass and glazing gaskets will not break or "pop" from frames due to design wind, expansion or contraction movement.
    - e. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Manufacturers
  - 1. YKK AP America, Inc.
  - 2. Vista Wall Architectural Products
  - 3. Kawneer
  - 4. Oldcastle Building Envelope
- B. Substitutions: Submit under provisions of Section 01 25 00, a minimum of 10 days prior to bid date.
- C. Acceptable Entrance Doors:
  - 1. Standard Duty Doors: Model 35D Medium Stile Door YKK AP with Mid-panel panic device system or equivalent by specified manufacturer.
- D. Acceptable Storefront Framing Systems:
  - 1. Framing System: YES 45 FI (2" x 4-1/2") YKK AP or equivalent by specified manufacturer.

### 2.2 FRAMING MATERIALS AND ACCESSORIES

- A. Aluminum:
  - 1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H34 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.
- B. Internal Reinforcing:
  - 1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.

2. Shapes and sizes to suit installation.
  3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.
- C. Anchorage Devices:
1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
- D. Fasteners:
1. Aluminum, non-magnetic stainless steel or other materials warranted by manufacturer to be non-corrosive and compatible with components being fastened.
  2. Do not use exposed fasteners, except where unavoidable for application of hardware.
  3. For exposed locations, provide countersunk Phillips head screws with finish matching items fastened.
  4. For concealed locations, provide manufacturer's standard fasteners.
  5. Provide nuts or washers of design having means to prevent disengagement; deforming of fastener threads is unacceptable.
- E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.
- F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil (0.77 mm) thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.
- G. Glazing Gaskets:
1. Compression type design, replaceable, molded or extruded, of neoprene, or ethylene propylene diene monomer (EPDM).
  2. Conform to ASTM C509 or C864.
  3. Profile and hardness as required to maintain uniform pressure for watertight seal.
  4. Provide in manufacturer's standard black color.
- H. Weatherstripping:
1. Wool pile conforming to AAMA 701.2; or extruded EPDM elastomeric conforming to ASTM C509 or C864.
  2. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.
- I. Internal Sealants: Types recommended by sealant manufacturer.
- J. "Anti-Walk" Edge Blocking: "W" shaped EPDM blocks for use in keeping glazing material stationary under vibration or seismic loading.
- K. Baffles (at weep holes): Type as recommended by system manufacturer and shown in published installation instructions.
- 2.3 GLASS AND GLAZING ACCESSORIES
- A. Refer to Section 08 81 00.

## 2.4 FABRICATION

### A. Coordination of Fabrication:

1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
2. Fabricate units to withstand loads which will be applied when system is in place.

### B. General:

1. Conceal fasteners wherever possible.
2. Reinforce work as necessary for performance requirements and for support to structure.
3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or pre-formed separators which will prevent contact and corrosion.
4. Comply with Section 08 81 00 for glazing requirements.

### C. Aluminum Framing:

1. Provide members of size, shape and profile indicated, designed to provide for glazing from interior.
2. Fabricate frame assemblies with joints straight and tight fitting.
3. Reinforce internally with structural members as necessary to support design loads.
4. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
5. Seal horizontals and direct moisture accumulation to exterior.
6. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
7. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without being detrimental to appearance or performance.
8. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer and FGMA Glazing Manual.
9. Provide tight fitting, injection molded, plastic water deflectors at all intermediate horizontals.

### D. Entrance Doors:

1. Fabricate with mechanical joints using internal reinforcing plates and shear blocks attached with fasteners and by welding.
2. Provide extruded aluminum glazing stops of [square] [beveled and mitered (for single glazing only)] design, [permanently anchored on security side and removable on opposite side.]

### E. Hardware:

1. Receive hardware supplied in accordance with Section 08 71 00 and install in accordance with requirements of this Section.
2. Cut, reinforce, drill and tap frames and doors as required to receive hardware.
3. Comply with hardware manufacturer's templates and instructions.
4. Use concealed fasteners wherever possible.
5. Coordinate mid-panel panic device system with hardware at storefront doors to ensure compatibility.

### F. Welding:

1. Comply with recommendations of the American Welding Society.
2. Use recommended electrodes and methods to avoid distortion and discoloration.



3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

G. Flashings:

1. Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

## 2.5 FINISH

A. Manufacturer's standard colors as selected by Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01 40 00.

B. Verify dimensions, tolerances and method of attachment with other Work.

### 3.2 INSTALLATION

A. Erection Tolerances:

1. Limit variations from plumb and level:

a. 1/8 inch (3 mm) in 10 feet (3 M) vertically.

b. 1/8 inch (3 mm) in 20 feet (6 M) horizontally.

2. Limit variations from theoretical locations: 1/4 inch (6 mm) for any member at any location.

3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch (2 mm) from flush surfaces not more than 2 inches (51 mm) apart or out-of-flush by more than 1/4 inch (6 mm).

B. Install doors and hardware in accordance with manufacturer's printed instructions.

C. Set units plumb, level and true to line, without warp or rack of frame.

D. Anchor securely in place, allowing for required movement, including expansion and contraction.

E. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or pre-formed separators to prevent contact and corrosion.

F. Seal perimeter members as shown on manufacturer's installation instructions or as required for unique job conditions. Set other members with internal sealants and baffles as called for in manufacturer's installation instructions. Use sealants as recommended by sealant manufacturer.

G. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07 92 00.

H. Glazing: Refer to requirements of Section 08 81 00. Utilize "anti-walk" edge blocking on all vertical edges of glazing.

### 3.3 ADJUSTING

A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

### 3.4 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
- B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

SECTION 08 71 00

FINISH HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Work under this section comprises of furnishing hardware specified herein and noted on drawings for a complete and operational system, including any electrified hardware components, systems, controls and hardware for aluminum entrance doors. Any door shown on the drawing and not specifically referenced in the hardware sets shall be provided with identical hardware as specified on other similar openings and shall be included in the General Contractor's base bid. All fire rated door shall be provided with fire rated hardware as required by local code Authority as part of the General Contractor's base bid. The hardware supplier shall verify all cylinder types specified for locking devices supplied as part of the door system with the door manufacturer and/or door supplies.
- B. The General Contractor shall notify the Architect in writing of any discrepancies (five (5) days prior to bid date) that could and/or would result in hardware being supplied that is none functional, hardware specified and/or hardware that has not been specified that will result in any code violations and any door that is not covered in this specification. Failure of the General Contractor to address any such issue could be considered acceptance of the hardware specified and all discrepancies could be corrected at the General Contractor's expense.
- C. Items include but are not limited to the following:
  - 1. Hinges - Pivots
  - 2. Flush Bolts
  - 3. Exit Devices
  - 4. Locksets and Cylinders
  - 5. Push Plates - Pulls
  - 6. Coordinators
  - 7. Closers
  - 8. Kick, Mop and Protection Plates
  - 9. Stops, Wall Bumpers, Overhead Controls
  - 10. Electrified Hold Open Devices
  - 11. Thresholds, Seals and Door Bottoms
  - 12. Silencers
  - 13. Miscellaneous Trim and Accessories

1.02 RELATED DOCUMENTS, drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.03 RELATED WORK specified elsewhere that should be examined for its effect upon this section:

- A. Section 06 20 00 - Finish Carpentry
- B. Section 08 11 13 – Steel Doors and Frames
- C. Section 08 14 16 – Flush Wood Doors
- D. Sections within 08 31 13 – Access Doors
- E. Section within 08 41 13 – Aluminum Entrances, Storefront and Window Framing
- F. Sections within 08 80 00 – Glass and Glazing

- G. Sections within 09 91 00 - Painting
- H. Division 26 – Electrical
- I. Division 28 – Access Control

1.04 REFERENCES SPECIFIED in this section subject to compliance as directed:

- A. NFPA-80 - Standard for Fire Doors and Windows
- B. NFPA-101 - Life Safety Code
- C. ADA - The Americans with Disabilities Act - Title III - Public Accommodations
- D. ANSI-A 117.1 - American National Standards Institute - Accessible and Usable Buildings and Facilities
- E. ANSI-A 156.5 - American National Standards institute -Auxiliary Locks and Associated Products
- F. UFAS - Uniform Federal Accessibility Standards
- G. UL - Underwriter's Laboratories
- H. WHI - Warnock Hersey International, Testing Services
- I. State and Local Codes including Authority Having Jurisdiction
- J. UL10C – Positive Pressure
- K. IBC-2015 – International Building Code
- L. NFPA-70 – International Electrical Code

1.05 SUBMITTALS

- A. HARDWARE SCHEDULES submit copies of schedule in accordance with Division 1, General Requirements. Schedule to be in vertical format, listing each door opening, including: handing of opening, all hardware scheduled for opening or otherwise required to allow for proper function of door opening as intended, and finish of hardware. At doors with door closers or door controls include degree of door opening. Supply the schedules all Finish Hardware within two (2) weeks from date purchase order is received by the hardware supplier.
- B. Submit manufacturer's cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.
- C. Certification of Compliance:
  - 1. Submit any information necessary to indicate compliance to these specifications as required.
  - 2. Submit a statement from the manufacturer that electronic hardware and systems being supplied comply with the operational descriptions exactly as specified.
- D. Submit any samples necessary as required by the Architect.
- E. Templates for finish hardware items to be sent to related door and frame suppliers within three (3) working days of receipt of approved hardware schedule.
- F. Doors and Frames used in positive pressure opening assemblies shall meet UL10C in areas where this specification includes Seals for smoke door.

1.06 QUALITY ASSURANCE

- A. Hardware supplier to be a qualified, Factory Authorized, direct distributor of the products to be furnished. In addition, the supplier to have in their regular employment an AHC or AHC /CDC and/or a person of equivalent experience (minimum fifteen (15) years in the industry) who will be made available at

reasonable times to consult with the Architect/Contractor and/or the Building Owner regarding any matters affecting the finish hardware on this project.

- B. All hardware used in labeled fire or smoke rated openings to be listed for those types of openings and bear the identifying label or mark indicating UL. (Underwriter's Laboratories) approved for fire. Exit devices in non-labeled openings to be listed for panic.

#### 1.07 DELIVERY, HANDLING AND PACKAGING

- A. Furnish all hardware with each unit clearly marked and numbered in accordance with the hardware schedule. Include door and item number for each.
- B. Pack each item of hardware completes with all necessary parts and fasteners.
- C. Properly wrap and cushion each item to prevent scratches and dents during delivery and storage.

#### 1.08 SEQUENCING AND SCHEDULING

Any part of the finish hardware required by the frame or door manufacturers or other suppliers that is needed to produce doors or frames is to be sent to those suppliers in a timely manner, so as not to interrupt job progress.

#### 1.09 WARRANTY

**All finish hardware shall be supplied with a One- (1) year warranty against defects in materials and workmanship, commencing with substantial completion of the project except as follows:**

- 1. All Closers are to have a thirty- (30) year written warranty.**
- 2. All Exit Devices (Grade 1) are to have a three- (3) year written warranty.**
- 3. All ND Series Locksets are to have a ten- (10) year written warranty.**
- 4. All L9000 Series Locksets Locks are to have a three- (3) year written warranty.**
- 5. All Continuous Hinges are to have a ten- (10) year written warranty.**

### PART 2 – PRODUCTS

#### 2.01 FASTENERS

- A. Furnish with finish hardware all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position for a long life under hard use.
- B. Furnish fastenings where necessary with expansion shields, toggle bolts and other anchors designated by the Architect according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer. All closers and exit devices on labeled wood doors shall be through-bolted if required by the door manufacturer. All thresholds shall be fastened with wood screws and plastic anchors. Where specified in the hardware sets, security type fasteners of the type called for are to be supplied.
- C. Design of all fastenings shall harmonize with the hardware as to material and finish.

- D. All hardware shall be installed with the Manufacturers standard screws as provided. The use of any other type of fasteners shall not be permitted. The general contractor shall provide wood blocking in all stud walls specified and/or scheduled to receive wall stops, No Exception.

## 2.02 ENVIRONMENTAL CONCERN FOR PACKAGING

The hardware shall ship to the job site is to be packaged in biodegradable packs such as paper or cardboard boxes and wrapping.

## 2.03 HINGES

- A. All hinges to be of one manufacturer as hereafter listed for continuity and consideration of warranty. Provide one of the following manufacturers Ives, ABH, Zero, Hager, Select or Stanley.
- B. Unless otherwise specified provide five-knuckle, heavy-duty, button tip, full mortise template type hinges with non-rising loose pins. Provide non-removable pins for out swinging doors at secured areas or as called for in this specification (Refer to 3.02 Hardware Sets).
- C. Provide all out-swinging doors with non-removable pins or security studs as called for in 3.02 Hardware Sets. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof.
- D. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof.
- E. Provide size 4½" x 4½" for all 1¾" thick doors up to and including 36 inches wide. Doors over 1¾" through 2¼" thick, use 5" x 5" hinges. Doors over 36 inches use 5" x 4½" unless otherwise noted in 3.02 Hardware Sets.
- F. Were required to clear the trim and/or to permit the doors to swing 180 degrees furnish hinges of sufficient throw.
- G. Provide heavy weight hinges on all doors over 36 inches in width.
- H. At labeled door's steel or stainless steel, bearing-type hinges shall be provided. For all doors equipped with closers provide bearing-type hinges.

## 2.04 LOCK AND LOCK TRIM

- A. All the locksets, latch sets, and trim to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty. Locksets specified are Schlage "ND" series with the Sparta lever and L9000 SL1 as specified. No Substitution.
- B. Provide metal wrought box strike boxes and curved lip strikes with proper lip length to protect trim of the frame, but not to project more than 1/8 inch beyond frame trim or the inactive leaf of a pair of doors.
- C. Mechanical Locks shall meet ANSI Operational Grade 1, Series 1000 & 4000 as specified.
  - 1. Hand of lock is to be field reversible or non-handed.
  - 2. All lever trim is to be through-bolted through the door.

3. Provide all pairs of doors with a ¾" latch bolt throw.
4. Provide all doors specified with sound seal with a 3-3/4" extended back-set.

## 2.05 CYLINDERS AND KEYING

- A. Provide all exterior and interior locks or Exit Devices requiring cylinders keyed to a New Schlage LFIC Everest Master Key System or to the Existing Schlage Everest Master Key System as instructed by the facility representative. All cylinders shall comply with performance requirements of ANSI A156.5. All keys shall be of nickel silver material only. The hardware supplier shall meet with the General Contractor, the Architect and the Facility Owners Representative at the project jobsite to determine all permanent keying requirements. The hardware supplier shall provide One (1) Knox Box if required by the local Fire Marshall. The contractor shall, as required by the local Fire Marshall and the Facility Owner mount the Knox Box.
- B. Cylinders shall be factory keyed and factory maintained as directed by the Building Owner and the Architect. Provide three- (3) keys per cylinder and six- (6) master keys per master used.
- C. Factory stamp all keys "Do not duplicate" and with key symbol as directed by the Building Owner. Visual key control shall be provided on all permanent keys and cylinders.
- D. Provide all locks with construction master keyed cores for the complete duration of construction.

## 2.06 EXIT DEVICES

- A. All exit devices and trim, including electrified items, to be of one manufacturer as hereafter listed and in the hardware sets for continuity of design and consideration of warranty; electrified devices and trim to be the same series and design as mechanical devices and trim.
- B. Exit Devices to be "UL" listed for life safety. All exit devices for labeled doors shall have "UL" label for "Fire Exit Hardware". All devices mounted on labeled wood doors are to be through-bolted or per the manufacturer's listing requirements. All devices shall conform to NFPA 80 and NFPA 101 requirements.
- C. All exit devices to be of a heavy duty, chassis mounted design, with a one-piece removable cover, eliminating necessity of removing the device from the door for standard maintenance and keying requirements.
- D. All trims to be through-bolted to the lock stile case. Lever design to be the same as specified with the lock sets ("Sparta" #17 lever design).
- E. Exit Devices shall be the modern push rail design. All exit devices shall be mounted with sex bolts.
- F. All devices shall carry a three- (3) year warranty against manufacturing defects and workmanship. Exit devices shall be certified by an independent testing lab for a minimum of 1,000,000 cycles.

- G. Furnish roller strikes for all rim and surface vertical rod exit devices. Internal springs shall be coil compression type. Furnish security dead latching for all active latch bolts. Latch bolts to have self lubricating coating to reduce friction and wear. Plated latch bolts not accepted.
- H. All Exit Devices shall be field modifiable as incorporate an Electric Latch Retraction Feature without the purchase of new Panic Exit Hardware.
- J. Exit Devices shall be the Von Duprin "99" series as specified. No Substitution.

## 2.07 SURFACE MOUNTED DOOR CLOSERS

- A. All closers for this project shall be the products of a single manufacturer for continuity of design and consideration of warranty. All door closers shall be mounted as to achieve the maximum degree of opening (trim permitting).
- B. All closers to be heavy duty, surface-mounted, fully hydraulic, rack and pinion action with high strength cast iron cylinder to provide control throughout the entire door opening cycle.
- C. Size all closers in accordance with the manufacturer's recommendations at the factory.
- D. All closers to have adjustable spring power sizes 1 or 2 through 4 or 6 and separate tamper resistant, brass, non-critical regulating screw valves for closing speed, latching speed and back-check control as a standard feature unless specified other wise.
- E. All closer covers to be rectangular, full cover type of non-ferrous, non-corrosive material painted to match closer. Provide closer covers only if provided as a standard part of the door closer package.
- F. Closers shall have heavy-duty arms. All closer arms shall be of sufficient length to accommodate the reveal depth and to insure proper installation. The hardware supplier shall provide all required brackets, spacers or filler plates as required by the manufacture for a proper and functional installation as part of their base bid.
- G. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.
  - 1. All parallel arm mounted closers to be factory indexed to insure proper installation.
  - 2. Furnish heavy-duty cold forged parallel arms for all parallel arm mounted closers.
- H. Provide closers with special application and heavy-duty arms as specified in the hardware sets or as otherwise called for to insure a proper operating, long lasting opening. Drop plates and any additional mounting brackets required for the proper installation of the door closer shall be included in the hardware supplier's base bid.
- I. Finish: Baked on Powder Coated finish shall match other hardware.
- J. Provide and mount all door closers with sex bolts as provided by the manufacturer.



- K. Closers shall be LCN 4040XP and 1460 series as specified or acceptable products manufactured by Sargent 281 series.

## 2.08 AUTOMATIC DOOR OPENERS

- A. All automatic door openers shall be:
  - 1. LCN #9531 STD - Single (Pull Side Mount)
  - 2. LCN #9542 REG - Single (Push Side Mount)
  - 3. LCN #9553 REG2 - Double (Push Side Mount) simultaneous
  - 4. LCN #9553 STD2 - Double (Pull Side Mount) simultaneous
- B. Provide two (2) each Hard-Wired Actuators & Mounting Boxes (8310-853 (T or TWP as specified) x 8310-867F or 8310-867S 4.5" diameter engraved with handicapped logo & push-to-open. Provide Weather Ring 8310-801 for all exterior mounted Actuator's. Provide key operated "On/Off" switches #8310-806K at all Automatic operators.

## 2.09 DOOR STOPS AND HOLDERS

- A. Door stops are to be furnished for every door leaf. Every door is to have a floor, wall, or an overhead stop.
- B. Place doorstops in such a position that they permit maximum door swing, but do not present a hazard of obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors.
- C. Where overhead stops and holders are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass, bronze or stainless steel with no plastic parts as specified. The General Contractor shall provide wood blocking in all stud walls specified and scheduled to receive wall stops.
- D. Finish: Shall match other hardware where available.
- E. Acceptable Products
  - 1. Floor and wall stops as listed in hardware sets. Equivalent products as manufactured by Ives, ABH, Glynn Johnson and Trimco are acceptable.

## 2.09 PUSH PLATES, DOOR PULLS, AND KICKPLATE10

- A. All push plates, door pull, kick plates and other miscellaneous hardware as listed in hardware sets. Equivalent products as manufactured by Ives, ABH, Glynn Johnson and Trimco are acceptable.
- B. Kick plates to be 10 inches high and Mop plates to be 6 inches high, both by 2 inches or 1 inch less than door width (LDW) as specified. They are to be of 16-gauge thick base metal. For door with louvers or narrow bottom rails, kick plate height to be 1 inch less dimension shown from the bottom of the door to the bottom of the louver or glass.
- C. Where required armor plates, edge guards and other protective hardware shall be supplied in sizes as scheduled in the hardware sets.
- D. Finish: Same as other hardware where available.

#### 2.11 FLUSH BOLTS AND COORDINATORS

- A. Provide Flush bolts with Dust Proof Strikes as indicated in the individual hardware sets by Ives, ABH, Glynn Johnson and Trimco are acceptable. Finish shall match the adjacent hardware.

#### 2.12 THRESHOLDS AND SEALS

- A. Provide materials and finishes as listed in hardware sets. National Guard Products has been specified to set a high level of quality, equivalent product by manufactured by Zero, and Pemko shall be acceptable. All thresholds must be in accordance with the requirements of the ADA and ANSI A117.1.
- B. Provide thresholds with wood screws and plastic anchors. Supply all necessary anchoring devices for weather strip and sound seal.
- C. Seals shall comply with requirements of U.B.C. 7-2-97 and UL10C. All thresholds, door bottoms and weather strip inserts shall be a silicone based product as specified in 3.02 Hardware Sets. Other materials used shall be rejected, unless originally specified.
- D. Seals shall comply with the requirements of the Wood Door Manufacturer's certification requirements.
- E. All thresholds shall be provided with none slip coating as specified in the hardware sets.

#### 2.13 FINISHES

- A. Finishes for all hardware are as required in this specification and the hardware sets.
- B. Special care is to be taken to make uniform the finish of all various manufactured items.

#### 2.14 DOOR SILENCERS

- A. Provide door silencers at all openings without gasket. Provide two- (2) each at pair of doors and three- (3) or four- (4) each for each single door (coordinate with the frame manufacturer).

#### 2.15 KEY CABINET

- A. Provide a key cabinet Lund 1200 series (two tag system) for installation by the contractor as instructed by the Architect and Owners Representative. Key Cabinet shall be of such size as to hold 150% of the total number of keys supplied for this project.
- B. The hardware supplier shall assist Owners Representative in the tagging of all keys and instruct the Owners staff as to the proper use of the key cabinet system at the project site. Training shall include industry standard procedures for maintaining a key system. The hardware supplier shall provide Owners Representative two- (2) complete full-size copies of the floor plans complete with the door number and key symbol shown at each door opening. One- (1) copy shall be placed in the key cabinet and one- (1) copy shall be turned over to the

Owners Representative. Training shall be based on eight- (8) hours maximum. The hardware supplier shall send a list of all staff members trained in the proper use of the key cabinet to the Owners Representative and the Architect.

## 2.16 PROPRIETARY PRODUCTS

- A. References to specific products are used to establish quality standards of utility and performance. Unless otherwise approved provide only the specified product.
- B. All other materials, not specifically described, but required for a complete and proper finish hardware installation, are to be selected by the Contractor, subject to the approval of the Architect and the Building Owner.
- C. Architect and the Building Owner reserve the right to approve all the substitutions proposed for this specification. All requests for substitution to be made prior to bid in accordance with Division 1, General Requirements, and are to be in writing, hand delivered to the Architect. Two (2) copies of the manufacturer's brochures and a physical sample of each item in the appropriate design and finish shall accompany requests for substitution.

## PART 3 - EXECUTION

### 3.01 INSTALLATION AND SERVICE ITEMS OF FINISH HARDWARE

- A. All finish hardware shall be installed by an experienced finish hardware installer with at least ten (10) years experience after a pre-installation meeting between the contractor, hardware Manufacturers representative, the hardware supplier, the hollow metal supplier and the wood door supplier. The finish hardware installer shall be responsible for the proper installation and function of all doors and hardware.
- B. The hardware supplier's office and/or warehouse shall be located within a one hundred twenty-five (125) mile radius of the project site as to better service the general contractor and the Facility Owner during this project.
- C. Check hardware against the reviewed hardware schedule upon delivery. Store the hardware in a dry and secure location to protect against loss and damage.
- D. Install finish hardware in accordance with approved hardware schedule and manufacturers' printed instructions. Pre-fit hardware before finish is applied to door; remove and reinstall after finish is complete and dry. Install and adjust hardware so that parts operate smoothly, close tightly, and do not rattle.
- E. Mortise and cutting to be done neatly, and evidence of cutting to be concealed in the finished work. Protect all Finish hardware from scratching or other damage.

### 3.02 HARDWARE SETS

HARDWARE GROUP NO. 001  
FOR USE ON MARK/DOOR #(S):  
A100                      C100

#### EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	ELECTRIC STRIKE	6300 FSE	630	VON

CARD READER

**PROVIDED BY SUPERIOR ALARM AS  
REQUESTED BY THE OWNER  
r.rea@superioralarms.com  
Roger Rey, 956.655.1989. Power supply  
to be provided in bid by Superior  
Alarm.**

-RE-USE ALL EXISTING HARDWARE. COORDINATE NEW ELECTRIC STRIKE WITH  
EXISTING HARDWARE AND SECURITY CONTRACTOR.  
-CONTRACTOR TO INSPECT EXISTING DOOR ASSEMBLY FOR COMPLIANCE WITH  
HURRICANE CODES AND ADVISE ARCHITECT WHETHER ANY ADDITIONAL  
WORK/MATERIAL IS REQUIRED TO MEET APPLICABLE HURRICANE CODES.

HARDWARE GROUP NO. 002

FOR USE ON MARK/DOOR #(S):

B117                      B147

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH

-RE-USE ALL EXISTING HARDWARE.  
-CONTRACTOR TO INSPECT EXISTING DOOR ASSEMBLY FOR COMPLIANCE WITH  
HURRICANE CODES AND ADVISE ARCHITECT WHETHER ANY ADDITIONAL  
WORK/MATERIAL IS REQUIRED TO MEET APPLICABLE HURRICANE CODES.

HARDWARE GROUP NO. 101

FOR USE ON MARK/DOOR #(S):

A101                      A103                      A113                      A116                      A120                      A125  
A134                      B110                      B111                      B125                      B128                      B129  
B130

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53TD SPA	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188S H & J (USE SILENCERS @ NON- RATED DOORS)	BK	ZER

HARDWARE GROUP NO. 103

FOR USE ON MARK/DOOR #(S):

A105                      A106                      A109                      A110                      A119                      A122

A123                      A126                      A129                      A132                      B108                      B109  
B109A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53TD SPA	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 201 – REVISED 07-18-2018

FOR USE ON MARK/DOOR #(S):

B107C                      B113                      B121

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	ELECTRIC STRIKE	8300C-2001M-2006M ( <b>DOOR B121 ONLY</b> )	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188S H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

**CARD READER AT DOOR #B121 PROVIDED BY SUPERIOR ALARM AS REQUESTED BY THE OWNER [R.REA@SUPERIORALARMS.COM](mailto:R.REA@SUPERIORALARMS.COM) ROGER REY, 956.655.1989. SUPERIOR ALARM TO PROVIDE POWER SUPPLY IN BID.**

HARDWARE GROUP NO. 203

FOR USE ON MARK/DOOR #(S):

A107                      A108                      A112                      A115                      A117                      A118  
A121                      A124                      A127                      A133                      B118                      B118A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 203S

FOR USE ON MARK/DOOR #(S):

B112

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	OH STOP	900S SERIES X SIZE & MOUNTING AS REQ	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 341

FOR USE ON MARK/DOOR #(S):

A104	A111	A114	A128	A130	B131
B132	B133				

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S SPA	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188S H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

-LOCKED/UNLOCKED INDICATOR ON OUTSIDE OF DOOR.

HARDWARE GROUP NO. 343

FOR USE ON MARK/DOOR #(S):

A102

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S SPA	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

-LOCKED/UNLOCKED INDICATOR ON OUTSIDE OF DOOR.

HARDWARE GROUP NO. 343B

FOR USE ON MARK/DOOR #(S):

B116

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S SPA	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	ROLLER BUMPER	RB471	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

-LOCKED/UNLOCKED INDICATOR ON OUTSIDE OF DOOR.

HARDWARE GROUP NO. 401

FOR USE ON MARK/DOOR #(S):

A131                      B124

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188S H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

HARDWARE GROUP NO. 403B

FOR USE ON MARK/DOOR #(S):

B113B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	ROLLER BUMPER	RB471	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 501

FOR USE ON MARK/DOOR #(S):

B107                      B107A                      B122                      B123                      B127

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD SPA	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE

1	EA	GASKETING	188S H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
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HARDWARE GROUP NO. 503

FOR USE ON MARK/DOOR #(S):

B114                      B115

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD SPA	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 800AV

FOR USE ON MARK/DOOR #(S):

B102

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	DUMMY PUSH BAR	330-LENGTH AS REQ	626	VON
2	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
2	EA	SURFACE CLOSER	1461 SCUSH X MTG BRKT, SPCR & PLATE AS REQ	689	LCN

HARDWARE GROUP NO. AW714A

FOR USE ON MARK/DOOR #(S):

B100                      B126

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	A110HD R TW8-DOOR HEIGHT AS REQ	628	ABH
1	EA	PANIC HARDWARE	HH-QEL-RX-9947-EO-SNB	626	VON
1	EA	PANIC HARDWARE	HH-QEL-RX-9947-NL-OP-SNB	626	VON
2	EA	CYLINDER HOUSING	20-079/20-059 AS REQUIRED	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	FSIC CONST. CORE	23-030 ICX	622	SCH
2	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
1	EA	SURFACE MOUNTED AUTO OPERATOR	9550 SERIES X MTG AS REQ X ST3596	ANCLR	LCN
2	EA	WEATHER RING	8310-801	PLA	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T	630	LCN
2	EA	FLUSH MOUNT BOX	8310-867F	689	LCN



2	EA	DOOR SWEEP	8197AA-DOOR WIDTH	AA	ZER
1	EA	THRESHOLD	65A-V3-223-FRAME WIDTH	A	ZER
1	EA	KEY SWITCH	653-14-L2	626	SEC
1	EA	POWER SUPPLY	PS904 900-4R 900-4RL	600	VON
		WEATHER STRIP	PROVIDED BY THE ALUMINUM DOOR MFG		

NOTE: VERIFY WINDSTORM "CERTIFICATION" OF SPECIFIED HARDWARE W/DOOR SYSTEM.

**NOTE: 120 VOLT IN LINE POWER REQUIRED AT THE AUTOMATIC OPERATOR AND POWER SUPPLY.**

HARDWARE GROUP NO. B103

FOR USE ON MARK/DOOR #(S):

C112                      C123                      C125

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 HT 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050T SL1 L583-363 TORX XL12-482	630	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	GASKETING	188S ZAG	BK	ZER

HARDWARE GROUP NO. B201

FOR USE ON MARK/DOOR #(S):

B134                      C110

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 HT 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T SL1 TORX XL12-482	630	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188S ZAG	BK	ZER

HARDWARE GROUP NO. B203

FOR USE ON MARK/DOOR #(S):

B135                      B136                      B137                      B138                      B144                      C104  
C108                      C126

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
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3	EA	HINGE	5BB1 HT 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T SL1 TORX XL12-482	630	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	GASKETING	188S ZAG	BK	ZER

HARDWARE GROUP NO. B343

FOR USE ON MARK/DOOR #(S):

B143	B146	C105	C117	C119	C122
C130					

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 HT 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	L9040 SL1 L583-363 TORX XL12-482	630	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	GASKETING	188S ZAG	BK	ZER

-LOCKED/UNLOCKED INDICATOR ON OUTSIDE OF DOOR.

HARDWARE GROUP NO. B403

FOR USE ON MARK/DOOR #(S):

B140	B141	B142	C106	C107	C109
C114	C114A	C114B	C115	C116	C118
C120	C127	C128	C129		

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 HT 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 SL1 TORX XL12-482	630	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	GASKETING	188S ZAG	BK	ZER

HARDWARE GROUP NO. B503

FOR USE ON MARK/DOOR #(S):

C101	C102	C121
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EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 HT 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 SL1 TORX XL12-482	630	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	GASKETING	188S ZAG	BK	ZER

HARDWARE GROUP NO. CYX710A

FOR USE ON MARK/DOOR #(S):

B101

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4 NRP	652	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
2	EA	ELEC DELAYED FIRE EXIT HARDWARE	CXA-9947-L-F-LBR-E996-17-FSE	626	VON
4	EA	CYLINDER HOUSING	20-079/20-059 AS REQUIRED	626	SCH
4	EA	FSIC CORE	23-030	626	SCH
4	EA	FSIC CONST. CORE	23-030 ICX	622	SCH
2	EA	SURFACE CLOSER	1461 SCUSH X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
		CARD READER	<b>PROVIDED BY SUPERIOR ALARM AS REQUESTED BY THE OWNER R.REA@SUPERIORALARMS.COM ROGER REY, 956.655.1989</b>		
1	EA	POWER SUPPLY	PS902 FA900 -COORDINATE POWER SUPPLY REQUIREMENTS WITH SECURITY. OMIT WHERE PROVIDED BY SECURITY. SUPERIOR ALARM TO PROVIDE POWER SUPPLY IN BID.	LGR	SCE

OPERATION DESCRIPTION

- PULL SIDE ENTRY BY THE CARD READER OR KEY OVERRIDE.
- PUSH SIDE EGRESS BY THE CARD READER OR DELAYED EGRESS BY THE PUSH BARS.
- WIRE THE DELAYED EGRESS CHEXIT EXIT DEVICES TO THE FIRE ALARM SYSTEM.
- THE DELAYED EGRESS CHEXIT EXIT DEVICES TO THE FIRE ALARM SYSTEM.
- THE DELAYED EGRESS CHEXIT EXIT DEVICES WILL BECOME FAIL SAFE UPON ACTIVATION OF THE FIRE ALARM SYSTEM.

HARDWARE GROUP NO. CYX710RW.1

FOR USE ON MARK/DOOR #(S):

B103                      B104

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4 NRP	652	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
2	EA	ELEC DELAYED FIRE EXIT HARDWARE	CXA-9947-L-LBR-E996-17-FSE	626	VON
4	EA	CYLINDER HOUSING	20-079/20-059 AS REQUIRED	626	SCH
4	EA	FSIC CORE	23-030	626	SCH
4	EA	FSIC CONST. CORE	23-030 ICX	622	SCH
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	1461 RW/PA X ST1794 ( MOUNT ON PULL SIDE)	689	LCN

		CARD READERS	<b>PROVIDED BY SUPERIOR ALARM AS REQUESTED BY THE OWNER R.REA@SUPERIORALARMS.COM ROGER REY, 956.655.1989</b>		
1	EA	POWER SUPPLY	PS902 FA900 -COORDINATE POWER SUPPLY REQUIREMENTS WITH SECURITY. OMIT WHERE PROVIDED BY SECURITY. SUPPERIOR ALARMS TO INCLUDE POWER SUPPLY IN BID.	LGR	SCE

OPERATION DESCRIPTION

- PULL SIDE ENTRY BY THE CARD READER OR KEY OVERRIDE.
- PUSH SIDE EGRESS BY THE CARD READER OR DELAYED EGRESS BY THE PUSH BARS.
- WIRE THE DELAYED EGRESS CHEXIT EXIT DEVICES TO THE FIRE ALARM SYSTEM.
- THE DELAYED EGRESS CHEXIT EXIT DEVICES TO THE FIRE ALARM SYSTEM.
- THE DELAYED EGRESS CHEXIT EXIT DEVICES WILL BECOME FAIL SAFE UPON ACTIVATION OF THE FIRE ALARM SYSTEM.

HARDWARE GROUP NO. CZ221

FOR USE ON MARK/DOOR #(S):  
B126A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	INSTITUTION LOCK	ND82TD SPA	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	630	VON
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188S H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
2	EA	CARD READERS	<b>PROVIDED BY SUPERIOR ALARM AS REQUESTED BY THE OWNER R.REA@SUPERIORALARMS.COM ROGER REY, 956.655.1989</b>		
2	EA	DESK MOUNT BUTTON	660-PB	628	SCE

OPERATION DESCRIPTION

- ACCESS BY CARD READER OR KEY EITHER SIDE OF DOOR.

HARDWARE GROUP NO. W214

FOR USE ON MARK/DOOR #(S):  
C110A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
2	EA	SURFACE BOLT	SB360 12" T	604	IVE
1	EA	STOREROOM LOCK	ND80TD SPA 14-042	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH X MTG BRKT, SPCR & PLATE AS REQ X ST3596 (ACTIVE LEAF)	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	GASKETING	328AA H & J	AA	ZER
1	EA	ASTRAGAL	43SP	SP	ZER
2	EA	DOOR SWEEP	8198AA LENGTH AS REQ	AA	ZER
1	EA	THRESHOLD	65A LENGTH AS REQ	A	ZER

NOTE: VERIFY WINDSTORM "CERTIFICATION" OF SPECIFIED HARDWARE W/DOOR SYSTEM.

HARDWARE GROUP NO. 403BB – REVISED 07-18-2018

FOR USE ON MARK/DOOR #(S):

B105                      B127a

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	WALL STOP	WS406CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

**END OF SECTION**

## SECTION 08 81 00 — GLASS AND GLAZING

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Glazing for hollow metal doors and frames.
- B. Glazing for aluminum frames.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Hollow metal doors and frames.
- B. Aluminum entrances and storefronts.
- C. Aluminum window systems.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's literature with material and performance descriptions for each type of glass, sealant and glazing accessories.
- B. Submit detailed shop drawings indicating locations, installation and sealing methods.
- C. Submit 12" x 12" physical samples of each type of tinted or wire glass and panel.
- D. Obtain approved shop drawings from hollow metal supplier, aluminum frame supplier, plastic laminate door supplier.
- E. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

#### 1.5 WARRANTY

- A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.
- B. Warranted defects shall include but not necessarily be limited to water infiltration, air infiltration, glass failure due to improper sizing or installation, sealant failure.

#### 1.6 QUALITY ASSURANCE

- A. Glazing contractor shall have a minimum of 3 years experience in the installation of glazing products for projects of similar size and scope as this project.
- B. Each piece of glass shall bear manufacturer's label indicating type.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver glass or panels to the jobsite until openings are ready for glazing.
- B. Deliver glass and panels in manufacturer's original protective packaging. Store in a dry, well ventilated area and take care to prevent condensation on the materials. Keep glass faces separated.

#### 1.8 MINIMUM COMPLIANCE STANDARDS

- A. **SAFETY:** Contractor shall be responsible for meeting all Federal and applicable code requirements for types and locations of glazing regardless of drawing indications. Comply with the current standards of the Consumer Products Safety Commission and Federal Standard 16 CFR 1201 Federal Architectural Glazing Materials Safety Standard.
- B. **INSTALLATION:** Comply with recommendations of Flat Glass Marketing Association – FGMA Glazing Manual.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. **GLAZING SHEETS:** Glazing materials shall conform to the highest qualities as specified in the following standards:
  - 1. Float glass: FS DD-G-451d and ASTM C1036.
  - 2. Float glass, heat strengthened: ASTM C1036 and ASTM C1048.
  - 3. Float glass, tempered: FS DD-G-1403B and ASTM C1036, ASTM C1048, ANSI Z97.1, and Consumer Product Safety Commission 16 CFR 1201.
  - 4. Wired glass: FS DD-G-451, ASTM C1036 and ANSI Z97.1. Misco diamond pattern.
  - 5. Insulating glass: ASTM C1036. Meet industry standards set by the Sealed Insulating Glass Manufacturers Association (SIGMA).
- B. **MISCELLANEOUS**
  - 1. Glazing sealants: FS TT-S-1543A (silicone rubber); FS TT-S-230 (synthetic rubber); FS TT-S-001657 (butyl rubber).
  - 2. Glazing tape: Architectural Aluminum Manufacturer's Association.

## 2.2 MANUFACTURERS

- A. GLASS:
  - 1. Guardian
  - 2. PPG Industries
  - 3. Pilkington.
- B. TEMPERING, LAMINATING AND HEAT STRENGTHENING:
  - 1. Oldcastle
  - 2. Trulite
- C. WIRE GLASS:
  - 1. Pilkington
  - 2. PPG Industries
- D. GLAZING TAPE:
  - 1. TREMCO – tape, shims, setting blocks, edge blocking.
- E. GLAZING SEALANT:
  - 1. TREMCO,
  - 2. General Electric.

## 2.3 MATERIALS: Types as indicated in the drawings.

- A. TEMPERED GLASS: 1/4" clear and solar tint float glass tempered by the vertical or horizontal process and meeting requirements of FS DD-G-1403B.
- B. WIRE GLASS: Shall be 1/4" thick. Polish plate glass reinforced with diamond pattern wire mesh No. 24 gauge minimum, with a mesh not larger than 1".
- C. HOLLOW METAL FRAME AND DOOR GLAZING SYSTEM:
  - 1. Glazing: 1/4" Tempered.
  - 2. Glazing tape: 1/8" x 3/8" x continuous preshimmied butyl tape; Tremco 440.
  - 3. Setting blocks: Neoprene or EPDM in minimum 4" lengths.
  - 4. Edge blocking: Neoprene or EPDM in minimum 4" lengths and sized to allow for 1/8" clear expansion at both vertical edges.
  - 5. Add sealant at exterior glazing.

## 2.4 INSULATING GLASS

- A. Solar Control Tinted Insulated Units
  - 1. Conformance: ASTM C 1172 and complying with testing requirements in CPSC 16CFR-1201 for Category II materials.
  - 2. Overall Thickness: 1 inch (25 mm)
  - 3. Outboard Lite: Bronze float glass.
    - a. Tinted Float Glass: ASTM C 1036, Type I, Class 2, Quality q3.
    - b. Glass Thickness: 1/4 inch (6 mm).
    - c. Heat Treatment: Fully Tempered, ASTM C 1048, Kind FT
  - 4. Interspace: 1/2 inch (12 mm) hermetically sealed air
  - 5. Inboard Lite: Clear float glass.
    - a. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3.
    - b. Glass Thickness: 1/4 inch (6 mm).
    - c. Heat Treatment: Fully Tempered, ASTM C 1048, Kind FT
  - 6. Sealant: Approved by glass manufacturer.



7. Nominal shading coefficient: 0.53

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. **GENERAL:** Install glass without warping, binding or stress. Allow for expansion and contraction of glass due to temperature changes. Do not install sealant with surfaces or ambient temperature below 40 degrees F.
- B. **HOLOW METAL FRAMES AND DOORS:**
  1. Ensure that finish painting of doors and frames is complete.
  2. Cut glazing tape to length and install against permanent stop, flush with face of stop.
  3. Place setting blocks at 1/4 points.
  4. Rest glass on setting blocks and press against stop for full contact and adhesion at perimeter.
  5. Place continuous glazing tape on opposite-face perimeter of glass in same manner described above. Install removable stop; avoid displacement of tape; and exert pressure on tape for full continuous contact.
  6. Knife trim excess of protruding tape (leave recessed for sealant at exterior glazing).
  7. Do not touch glass to metal.
- C. **PLASTIC LAMINATE DOORS:**
  1. Follow procedures specified above for non-rated doors. Metal stops provided by door manufacturer.
  2. Follow recommendations of door manufacturer for rated doors. Metal stops provided by door manufacturer.
- D. **ALUMINUM FRAMES:** Follow door and frame manufacturer's printed instructions for glazing gasketed systems. Provide watertight installation at exterior systems.

#### 3.2 CLEANING AND PROTECTION

- A. During glazing operations, provide sufficient stick-on safety labels or hang streamers on new glazing.
- B. Prior to project closeout, thoroughly clean all glazing inside and out with commercial glass cleaner.
- C. Reglaze any openings where glass is chipped, broken, scratched, pitted or stained.

END OF SECTION

## SECTION 09 21 16 — INTERIOR DRYWALL SYSTEMS

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Provide and install acoustical batt insulation within interior drywall partitions.
- B. Provide and install all interior drywall systems including light gauge metal studs and tracks, horizontal bridging, gypsum wall board and finishing systems, suspended gypsum board ceilings and soffits, furred gypsum board.
- C. Provide and install troweled firestopping system at drywall ceiling and wall penetrations at rated walls.
- D. Provide and install specified corner guards at each wall corner.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Painting
- B. Door frames
- C. Carpentry (wood blocking)
- D. Plaster on metal studs
- E. Mechanical, electrical and plumbing penetrations in rated drywall systems.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's product data describing all materials.
- B. Submit gypsum board finish schedule indicating level of finish proposed per each area. Finish levels shall be levels 1 through 4 as specified herein and defined by "Recommended Specification: Levels of

Gypsum Board Finish" as jointly published by AWCI, CISA, GA, and PDCA. Submit copy of publication with finish schedule.

- C. Submit manufacturers detail drawings and detailed installation methods for fire rated penetrations and filling of voids with specified firestopping system. Submit only those systems applicable to this project.
- D. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

#### 1.5 WARRANTY

- A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.
- B. Warranted defects shall include but not necessarily be limited to cracking, joint tape delamination or tearing, dimpling at fastener heads, bowing or warping of wall board, cracking at metal accessories, acoustical sealant failure.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be delivered in manufacturer's original packaging and stored flat in a covered, dry area providing protection from damage and exposure to the elements.
- B. Damaged or deteriorated materials shall be removed from the premises.
- C. During cold weather installation of gypsum panels and joint finishing, temperatures within the building shall be maintained within the range of 50 degrees to 80 degrees F. Adequate ventilation shall be provided to carry off excess moisture.
- D. Steel framing and related accessories shall be stored and handled in accordance with AISI's "Code of Standard Practice"

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- |   |   |
|---|---|
| <ul style="list-style-type: none"><li>A. <u>Drywall Framing:</u><ul style="list-style-type: none"><li>1. ClarkDietrich Building Systems</li></ul></li></ul>   | <ul style="list-style-type: none"><li>D. <u>Acoustical Sealant:</u><ul style="list-style-type: none"><li>1. TREMCO</li><li>2. Ohio Sealants, Inc.</li></ul></li></ul>     |
| <ul style="list-style-type: none"><li>B. <u>Gypsum Board and Related Accessories:</u><ul style="list-style-type: none"><li>1. United States Gypsum Co.</li><li>2. National Gypsum Co.</li><li>3. Georgia Pacific</li><li>4. Temple Inland</li><li>5. James Hardie</li></ul></li></ul> | <ul style="list-style-type: none"><li>E. <u>Specialty Trims:</u><ul style="list-style-type: none"><li>1. Fry Reglet Corp.</li><li>2. MM Systems Corp.</li></ul></li></ul> |
| <ul style="list-style-type: none"><li>C. <u>Acoustical Batts:</u><ul style="list-style-type: none"><li>1. Owens-Corning</li><li>2. Certainteed</li><li>3. Manville</li></ul></li></ul>  | <ul style="list-style-type: none"><li>F. <u>Corner Guards:</u><ul style="list-style-type: none"><li>1. WallProtex, (877) 880-8115</li></ul></li></ul>                     |

- 2.2 FRAMING: Comply with ASTM C645-09 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C645-09 requirements for metal unless otherwise indicated.
  2. Protective coating: Comply with ASTM C645-09; roll formed from hot dipped galvanized steel; complying with ASTM A1003/A1003M and ASTM A653/A653M G40 (Z120) or having a coating that provides equivalent corrosion resistance. A40 galvanized products are not acceptable.
- A. METAL STUDS: 25 gauge galvanized roll formed, screw channel type studs with minimum 5/16 inch flanges and 1-1/4 inch legs. Provide widths of 1-5/8 inch, 2-1/2 inch, 3-5/8 inch, 4 inches and 6 inches as indicated in the drawings. Provide conduit punchouts at 24" o.c.
1. "EQ" (Equivalent Gauge Thickness) Steel Studs and Runners: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86-2010 (approved February 2010 Effective March 1, 2010) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C645-09.
  2. Non-structural Studs: Cold-formed galvanized steel C-studs, ClarkDietrich Building Systems ProSTUD drywall studs as per ASTM C645-09 for conditions indicated below:
    - a. Flange Size: 1 1/4 inch (32mm)
    - b. Web Depth: As specified on drawings, 1-5/8 inches (41 mm) 2-1/2 inches (64 mm) 3-5/8 inches (92 mm) 4 inches (102 mm) 6 inches (152 mm).
    - c. Member Description: ProSTUD 25 (25ga equivalent drywall stud) 70ksi Minimum Thickness: 0.0150 inches (0.3810mm) Minimum Design Thickness: 0.0158 inches (0.4013mm)
    - d. Member Description: ProSTUD 22 (22ga equivalent drywall stud) 70ksi Minimum Thickness: 0.0179 inches (0.4547mm) Minimum Design Thickness: 0.0188 inches (0.4775mm)
    - e. Member Description: ProSTUD 20 (20ga equivalent drywall stud) 65ksi Minimum Thickness: 0.0220 inches (0.5588mm) Minimum Design Thickness: 0.0232 inches (0.5893mm)
- B. RUNNER CHANNELS: Provide 25 gauge galvanized channels with minimum 1-1/4 inch flanges with hemmed edges, in widths to accommodate stud sizes.
1. Non structural Track: Cold-Formed galvanized steel runner tracks, ClarkDietrich Building Systems ProTRAK drywall track in conformance with ASTM C645-09 for conditions indicated below:
    - a. Flange Size: 1 1/4 inch (32mm)
    - b. Web Depth: Track web to match stud web size.
    - c. Minimum Material Thickness: Track thickness to match wall stud thickness or as per design.
- C. FURRING CHANNELS: Provide 20 gauge galvanized "hat" channels with face width of 1-1/4 inches, depth of 7/8 inches, and back Width of 2-9/16 inches minimum, hemmed edges.
- D. CEILING SUSPENSION: Provide 16 gauge galvanized channels, 3/4" x 1/2" and 11/2" or 2" x 17/32".

1. 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.
  - a. Basis of Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; MaxTrak or an equivalent product.

## 2.3 ACCESSORIES

- A. CORNER BEADS: 26 gauge galvanized beaded angle with 1-1/4" legs.
- B. Channel Bridging and Bracing: Steel, 0.0538-inch (1.37mm) minimum base metal thickness, with minimum 1/2 inch (13mm) wide flanges.
  - a. Basis of Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Spazzer 9200 Bridging and Spacing Bar, or an equivalent product.
  - b. Depth: As indicated on drawings, 7/8 inch by 7/8 inch by 50 inches.
  - c. Install at 48" o.c. horizontally.
2. Backing Plate: Proprietary fire-resistance treated blocking and bracing in width indicated.
  - a. Basis of Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Danback Fire-treated wood backing plate or an equivalent product.
- C. EDGE TRIM: 26 gauge galvanized steel "J" mould and angle with continuous bead. ClarkDietrich Building Systems 200.A and 200.B.
- D. WIRE: 9 gauge galvanized hanger wire and 16 gauge galvanized be wire.
- E. SCREWS: Bugel head Type "S" self tapping drywall screws in lengths recommended by wallboard manufacturer. USG "Super-Tite".
- F. CONTROL JOINTS: Roll formed zinc with 1/4" open joint, and perforated flanges. Provide with fireseal backing at rated systems. ClarkDietrich Building Systems No. 093.
- G. JOINT ADHESIVE: Premixed water based compound. USG taping joint compound.
- H. LAMINATING ADHESIVE: Durabond sheetrock setting-type for double-layer application and column fireproofing.
- I. JOINT REINFORCING: Center creased paper tape equal to "Perf-A-Tape".
- J. TROWELED FIRESTOPPING
  1. System Type: A combination of glass fiber or mineral wool insulation packing material with troweled-on application of sealing compound.
  2. Sealing Compound: Red tinted compound job mixed with water providing protection from heat (to temperatures of 1850 degrees F), smoke, toxic gas, fire and water. "Sta-Smooth FS 90 Fire-Shield Compound Fire and Smoke Stop" as manufactured by National Gypsum Co. or approved equivalent by Domtar Gypsum, Inc.
  3. Approvals:
    - a. Rated as noncombustible as defined by NFPA Standard 220 when tested in accordance with ASTM E 136 at Underwriters Laboratories.
    - b. Meet all requirements of ASTM E 814 and UL 1479: Fire tests of through penetration fire stops.

- K. CORNER GUARDS: Textured Vinyl Corner Guards 3" by WallProtex. 4' lengths, taped. Color as selected by Architect.

#### 2.4 WALLBOARD

- A. TYPICAL: 5/8" thick x 48" wide paper-faced gypsum panels, tapered long edges, lengths as required. U.L. listed and conforming to ASTM C-1396/C1396M-09a Standard Specification for Gypsum Board, Type X. USG fire code.
- B. WATER RESISTANT: 5/8" thick x 48" wide U.L. listed, Type X board with chemically treated face paper and water resistant gypsum core. Comply with ASTM C-1396/C1396M-09a Standard Specification for Gypsum Board.
- C. HIGH IMPACT: 5/8" thick x 48" wide, length as required. U.L. listed, "Fiberock Interior Panel Abuse Resistant" by USG or equal.

#### 2.5 TILE BACKER BOARD

- A. 5/8" thick cement board formed of aggregated Portland cement slurry with polymer-coated, glass-fiber mesh. "Durock" as manufactured by United States Gypsum Co or approved equivalent.

### PART 3 - EXECUTION

#### 3.1 PARTITION INSTALLATION

- A. STUD SYSTEM ERECTION: Attach metal runners at floor and to structural elements with suitable fasteners spaced maximum 24" o.c. Position studs vertically, engaging floor track and runner at ceiling or structure. Place studs in direct contact with all door frame jambs, abutting partitions, partition corners and existing construction elements.
- B. Anchor all studs adjacent to door and window frames, partition intersections, and corners to ceiling and floor runner flanges. Securely anchor studs to jamb and head anchor clips of door or side-light frames by screw attachment. Over door and side-light frames, install horizontal runner with a web-flange bend at each end, and secure with one positive attachment per flange.
- C. Install diagonal stud bracing above ceiling at strike side of door jambs and at other locations as indicated in the drawings. Secure to structure.
- D. Follow stud manufacturer's recommendations for all framing construction and fastening.

#### 3.2 WALL PANEL ERECTION

- A. Apply gypsum panels vertically or horizontally. Position all edges over studs for vertical application; all ends over studs for horizontal application. Use maximum practical lengths to eliminate end joints. Fit ends and edges closely together. Stagger joints on opposite side of partition.
- B. For single-layer vertical application of gypsum panels, space screws 12" o.c. in field of panels and 8" o.c. staggered along vertical abutting edges. For horizontal panel application, space screws 12" o.c. in field and along abutting end joints.

- C. For double-layer screw attachment, space screws 16" o.c. for both layers. Apply both layers of gypsum panels vertically with joints in face layer offset from base layer joints. For 5/8" panels, use 1" screws for base layer and 1-5/8" screws for face layers. For 1/2" panels, use 7/8" screws for base layer and 1-5/16" screws for face layer.

### 3.3 CHASE WALL ERECTION

- A. Align two parallel rows of floor and ceiling runners spaced as indicated in the drawings. Attach to concrete slabs with powder actuated anchors 24" o.c. and to suspended ceiling tees or structure with suitable fasteners 24" o.c.
- B. Position metal studs vertically in runners, 16" o.c., with flanges in the same direction and with studs on opposite sides of chase directly across from each other. Anchor all studs to floor and ceiling runner flanges with U.S.G. Metal Lock Fastener tool.
- C. Cut gypsum panel bracing to be placed between rows of studs, 12" high by chase wall width. Space braces 48" o.c. vertically and attach to stud webs with screw fasteners. 2-1/2" metal studs may be used in lieu of gypsum panels. Anchor web at each end of metal brace to stud web with two 3/8" pan head screws.

### 3.4 CEILING FRAMING

- A. GRILLAGE ERECTION: Space 8 gauge hanger wires 48" o.c. along carrying channels and within 6" of ends of carrying-channel runs. Wrap hanger around and through beams or joists. Install 1-1/2" carrying channels at 24" o.c. Position channels for proper ceiling height, level and secure with hanger wire saddle-bed along channel. Provide 1" clearance between runners and abutting walls and partitions. Secure furring to carrying channels with clips or saddle-tie to support. Overlap splices at least 8" and securely wire-tie each end with double-strand 16 gauge tie wire.
- B. Erect metal furring channels at right angles to 1-1/2" carrying channels or main support members Space furring (16") o.c. and within 6" of walls. Provide 1" clearance between furring ends and abutting walls and partitions. Secure furring to carrying channels with clips or saddle-tie to supports with double strand 16 gauge tie wire. Overlap splices at least 8" and securely wire-tie each end with double-strand 16 gauge tie wire.
- C. At light troffers or any openings that interrupt the carrying or furring channels, install additional cross reinforcing to restore lateral stability of grillage.
- D. At rated ceilings meet all requirements of selected U.L. Design No.
- E. METAL STUD CEILING FRAMING OPTION: Attach runners at ceiling height through gypsum panels to each partition stud with two screws. Insert metal studs in runners and attach each end with one 3/8" pan head screw. Install 1-5/8" stud cross-bracing over stud framing, space 48" o.c. and attach to each framing stud with two 3/8" pan head screws. At hangers, install 12" long stud section for box reinforcing or lap studs 12" and secure each end with two 3/8" pan head screws. At light troffers or any openings that interrupt the ceiling, install additional cross reinforcing to maintain structural integrity of framing.
- F. GYPSUM PANEL ERECTION: Apply gypsum panels of maximum practical length with long dimension at right angles to furring channels. Position end joints over channel web and stagger in adjacent rows. Fit ends and edges closely. Fasten panels to channels with 1", Type S screws, spaced 8" o.c. in field of panels and 8" along ends and edges.

3.5 EXTERIOR WALLS: Reference Section 05 41 00.

3.6 ACOUSTICAL BATTS

- A. Install unfaced full thickness acoustical fiberglass batts between studs at partitions as scheduled on the drawings. Fit batts tight to studs, tight to floor and head tracks and tight to one another. Batts shall run full height of partition unless indicated otherwise in the drawings.

3.7 ACOUSTICAL SEALANT

- A. Install continuous bead of sealant at bottom tracks at drywall partitions.
- B. Install vinyl foam double stick tape and sealant where head track terminates at ceiling.
- C. See drawings for additional locations.

3.8 ACCESSORY APPLICATION

- A. JOINT SYSTEM: Finish all face panel joints and corners with U.S.G. Joint System installed according to manufacturer's directions.
  - 1. Mix joint cement in strict accordance with manufacturers directions.
  - 2. Butter cement into joints filling them evenly and fully.
  - 3. Center tape and press down into cement leaving sufficient cement under tape for proper bond. Cover with thin coat of cement to fill recess between tape and board to bring material flush with surface.
  - 4. Face panels shall be cut fit around all wall outlets and switch boxes, utility lines, etc. All voids and cracks, occurring around all openings in board shall be taped and covered with joint cement.
- B. LAMINATING ADHESIVE: Spread to provide 1/2" adhesive beads 4-1/2" o.c. for full sheet lamination. For strip lamination, apply adhesive in vertical strips of four 1/2" beads, 1-1/2" to 2" o.c. Space strips 24" o.c.
- C. CORNER BEAD: Reinforce all vertical and horizontal exterior corners with corner bead fastened with 9/16" rosin-coated staples 9" o.c. on both flanges along entire length of bead.
- D. METAL TRIM: At exposed edges of board or where board terminates against other materials, apply metal trim over panel edge and fasten with screws.
- E. SCREWS: Power-drive at least 3/8" from edges or ends of panel to provide uniform dimple of 1/32" deep.
- F. CONTROL JOINTS: Cut panel at joint and back with double framing members. Attach control joint to face layer with 9/16" rosin-coated staples spaced 6" o.c. on both flanges along entire length of joint. At rated walls, provide fireseal behind joint. Provide joints at 25' maximum or as otherwise indicated in the drawings.
- G. CORNER GUARDS: Install as per manufacturer's recommendations. Double sided adhesive tape factory applied to corner guard.

3.9 TROWELED FIRESTOPPING:



- A. General: Install systems in complete accordance with manufacturers printed instructions and approved submittal for the required fire rating of the particular condition. Install firestopping systems at all penetrations and voids in all rated drywall ceilings and walls.
  - B. Through-penetrations. Ensure that pipe, conduit, duct, cables or other penetration element is rigidly supported by drywall framing on both sides of wall or ceiling assembly. Oversize opening in wall board to allow for required opening size and thickness of packing material in accordance with system and rating requirements. Install packing material in accordance with system requirements and compressed to allow for required thickness of sealing material. Trowel red-tint sealing material into void (same thickness as gypsum board) and smooth flush with both faces of drywall. Provide additional layer(s) of gypsum board around penetration where necessary to achieve required minimum thickness of sealing material.
  - C. Void-filling: For voids such as intersection of walls and smooth or corrugated deck, pack void with compressed packing material and trowel red-tint sealing material into void (same thickness as gypsum board) and smooth flush with both faces of drywall. Provide additional layer(s) of gypsum board around penetration where necessary to achieve required minimum thickness of sealing material.
- 3.10 **WOOD BLOCKING**: Coordinate with project carpenter to ensure installation of fire retardant wood blocking between studs for mounting casework, millwork, toilet partitions, drinking fountains and other equipment.
- 3.11 **FINISHING SCHEDULE**: Follow published "Recommended Specification: Levels of Gypsum Board Finish" as follows:
- A. **LEVEL 1 FINISH**: At concealed areas above ceiling.
  - B. **LEVEL 2 FINISH**: At gypsum backing board to be covered with file or panels thicker than 1/4".
  - C. **LEVEL 3 FINISH**: At mechanical rooms, storage rooms, custodial and maintenance rooms, electrical and telephone closets.
  - D. **LEVEL 4 FINISH**: All other drywall areas scheduled for paint, fabric or vinyl wall covering.

END SECTION

SECTION 09 30 00 — WALL AND FLOOR TILE

PART 1 - GENERAL

1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

- A. Provide and install all ceramic wall and floor tile and base as indicated in the drawings and specified herein.
- B. Provide and install all quarry tile flooring and base as indicated in the drawings and specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Cast-in-place concrete.
- B. Drywall systems.
- C. Masonry.
- D. Waterproofing and dampproofing.

1.4 SUBMITTALS

- A. Per SUPPLEMENTARY GENERAL CONDITIONS, submit samples, type of tile and color for Architect's approval. Mark with manufacturer's name and space where tile is to be installed.
- B. Submit manufacturer's printed literature describing products.
- C. Submit (2) boxes of tile chips showing full range of available colors.
- D. Submit (2) boxes of grout color samples.
- E. Submit 12" x 12" grouted sample board for each tile/grout combination selected.

- F. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

#### 1.5 WARRANTY

- A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.
- B. Warranted defects shall include but not necessarily be limited to cracking, crazing, staining, joint spalling or cracking, loosening of bond.

#### 1.6 QUALITY ASSURANCE

- A. Tile Contractor shall have a minimum of 3 years experience in tile installation for projects of similar size and scope as this project.
- B. Conform with all applicable requirements of the American Standards Association Specifications (A-108 Series) and the "Tile Handbook" of the Tile Council of America. Tile shall bear the seal of Tile Council of America, Inc., and be equal to or exceed Standard Grade.

#### 1.7 DELIVERY & STORAGE

- A. Deliver all manufactured materials in original, unbroken containers bearing name of manufacturer, brand and grade seal. Keep materials dry, clean and protected against deterioration in any form and at room temperature.
- B. Maintain room temperature between 70 and 80 degrees F. 24 hours prior, during and a minimum of 48 hours after installation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. CERAMIC TILE:
  - 1. American Olean
  - 2. Dal-Tile
  - 3. United States Ceramic Tile Co.
  
- B. QUARRY TILE: American Olean, United States Ceramic Tile Co.
  
- C. GROUT:
  - 1. American Olean
  - 2. Laticrete
  - 3. Tex Rite

## 2.2 MATERIALS

### A. GENERAL:

1. Floor Tile: Unglazed porcelain ceramic with cushioned edges and sheet backing.
  - a. Water absorption: Classified "Impervious" per A.S.T.M. C-373. Less than 1/2 of 1% absorption.
  - b. Size: Nominal 12" x 12" x 1/4" thick.
  - c. Base: 4" high base. Bottom tile with integral cove (provide bullnose plastic edge strip at top of all ceramic tile base).
  - d. Type: Porcelain Tile in **groups 4** as selected by the Architect from one of the specified manufacturers.
  - e. Color(s): Bidders shall assume a different color scheme for each room unless colors and patterns are indicated in the drawings.

### B. TOILET/SHOWER ROOMS:

1. Floor Tile: Unglazed porcelain ceramic with cushioned edges and sheet backing.
  - a. Water absorption: Classified "Impervious" per A.S.T.M. C-373. Less than 1/2 of 1% absorption.
  - b. Size: Nominal 2" x 2" x 1/4" thick.
  - c. Base: 4" high base. Bottom tile with integral cove.
  - d. Type: Ceramic Mosaic Tile in **groups 4** as selected by the Architect from one of the specified manufacturers.
  - e. Color(s): Bidders shall assume a different color scheme for each room unless colors and patterns are indicated in the drawings.
2. Wall Tile: Glazed ceramic with cushion edges.
  - a. Size: Nominal 4" x 4" x 1/4" thick.
  - b. Base: See floor base.
  - c. Type: **Groups 3 through 4** for field tile and for accent banding as selected by the Architect from one of the specified manufacturers.
  - d. Color(s): Bidders shall assume a different color scheme for each room unless colors and patterns are indicated in the drawings.
3. Trim: Terminate tile with bullnose edges and rounded outside corners. Provide square inside corners and at ceiling/wall joints.

C. **THINSET BOND COAT:** Latex/Portland Cement mortar mix meeting requirements of ANSI A118.4. Provide Portland cement and sand in a 1 to 1 mixture gauged with Laticrete 4237 latex additive. Use on dry cured mortar bed at slab recesses, where thinset on concrete slab, and where thinset on wall substrates.

D. **SEALANT:** One part silicone rubber meeting requirements of FS TT-S-001543, as manufactured by Dow Corning or General Electric.

### E. GROUT:

1. Walls: Portland Cement waterproof, dry set grout as manufactured by American Olean. Color(s) as selected by Architect.
2. Floor and base: Interior grout shall be epoxy type as manufactured by American Olean. Color(s) as selected by Architect.

F. **SEALANT:** One part silicone rubber meeting requirements of FS TT-S-001543, as manufactured by Dow Corning or General Electric.

### PART 3 - EXECUTION

#### 3.1 INSPECTION AND PREPARATION

- A. Examine surfaces to receive tile and do not start work until defects that will adversely affect tile work have been corrected.
- B. Inspect all surfaces to see that they are dry, clean, free of oily or waxy film, firm, level and plumb. Report any unsatisfactory conditions to the Architect. Starting installation shall be deemed as acceptance of surfaces.
- C. Do not start until work of other trades, which goes through or in the space behind tile has been completed. Do not proceed with installation until adjoining work is satisfactory protected. Close off spaces in which tile is being set to traffic and other work during installation and for at least 48 hours after completion of tile work.
- D. Do not apply mortar and adhesives to surfaces covered by frost. Maintain minimum temperature-for installation of tile above 50 Deg. F. Prevent rapid evaporation of moisture from mortar bed. Do not set tile on dry bed.
- E. Install specified mortar bed at slab depressions. Slope mortar bed uniformly to drain(s).

#### 3.2 INSTALLATION

- A. GENERAL: Tile shall be installed in accordance with current Tile Council of America's "Handbook for Ceramic Tile Installation", design numbers as indicated below.
- B. Center fields and patterns on applied areas so that no tile is less than half size. For heights stated in feet and inches, maintain full courses to nearest attainable height without cutting tile.
- C. Except where otherwise shown or specified, make joints in wall tile vertical and horizontal and joints in floor tile perpendicular and parallel to walls. Control joint widths of glazed tile by lugs on the sides of tile. Control joints widths between sheets of ceramic mosaic tile by supporting boards with metal spacing strips.
- D. Grind and fit tile carefully at intersections, against trim finish and at built-in fixtures and accessories. Fit tile closely around outlets, pipes, fixtures and fittings so that plates, escutcheons and collars will overlap cuts. Cut and drill tile and trim shapes accurately without damage. Rub all exposed cut edges smooth with abrasive stone.
- E. Coat trim with 1/32 to 1/16" pure coat paste. Set in same mortar mix as is recommended for setting flat tile on walls. Do not use pure coat as mortar to set trim and angles.
- F. FLOORS:
  - 1. Interior thinset on concrete floor slab:
    - a. Tile bonded with minimum 3/32" thick latex-Portland cement bond coat over cleavage membrane adhered to floor slab (**modified TCA F113**).

- b. Adhere cleavage membrane to slab in strict accordance with manufacturer's recommendations using specified latex-Portland cement bond coat. Increase typical curing time of bond coat by 50%.
2. Interior thin-set on recessed mortar bed (where required at existing kitchens): Tile bonded with minimum 3/32" thick Latex-Portland Cement bond coat to reinforced mortar bed over loose bond breaker membrane over floor slab (**TCA F111**).

G. WALLS:

1. Ceramic Tile at Drywall Toilets: Thinset to water resistant gypsum wallboard.
2. Ceramic Tile at Drywall Showers: Thinset to tile backer board.
3. Ceramic Tile at Masonry: Bonded to mortar bed at masonry. No. **W211**.
4. 12" x 12" Porcelain – Up to 3 ft. High Wainscot: Install with mastic over drywall.
5. 12" x 12" Porcelain – Over 3 ft. High Wainscot: Thinset over tile backer board.

H. EXPANSION JOINTS:

1. At floor tile provide 1/4" sealant expansion joints in accordance with TCA recommendations where tile abuts walls, curbs, columns and other restraining surfaces, where substrate material changes, at floor slab construction joints (cold joints), and each way in pattern approved by the Owner.
2. At walls install sealant expansion joints at inside corners, at maximum 30', and at other conditions subject to cracking or movement. Install specified sealant at expansion and control joints, at doorframe perimeters and similar conditions.

3.3 LAYOUT

- A. Layout all work so that no tiles less than half size occur. Align all joints vertically and horizontally.
- B. Cut and drill neatly without marring tile. Rub smooth any necessary cuts with a fine stone and set no cut edge against any fixture, cabinet, or other tile without a joint at least 1/16" wide.
- C. Maximum plane variation shall be 1/8" + or - in 10' when a straight edge is laid on the surface in any direction.

3.4 GROUTING AND SEALING:

- A. Follow grout manufacturer's recommendations for grouting procedures and precautions. Damp cure non-epoxy grout in accordance with manufacturer's recommendations.
- B. Grout Haze Removal:
  1. Unglazed Tile: For cement grout remove all grout haze following grout manufacturer's recommendations for use of acid and chemical cleaners. Rinse tilework thoroughly with clean water before and after chemical cleaners. Polish surface of tilework with soft cheesecloth.
  2. Glazed Tile: For cement grout remove all grout haze with cheesecloth rub.
  3. Take special care with epoxy grout to keep tiles clean as work progresses.

3.5 PROTECTION

- A. Protect tiled floors from foot and wheel traffic for at least 7 days after installation.
- B. Place plywood panels over traffic floors.

- C. In non-traffic areas, cover floors with heavy paper taped in place.
- D. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color, pattern, and type of tile installed.

END OF SECTION

## SECTION 09 51 00 - ACOUSTICAL TILE CEILINGS

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Provide and install all lay-in acoustical ceiling panels and suspended grid system in accordance with the drawings and as specified herein.
- B. Provide and install light fixture protection at all rated ceilings.
- C. Provide and install hold-down clips where required for rated system.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Steel joists (spacing)
- B. Mechanical (air devices)
- C. Electrical (lighting fixtures)

#### 1.4 DRAWING REFERENCES

- A. See drawings, finish schedule and Section 2.2 for ceiling types and ratings.

#### 1.5 SUBMITTALS

- A. Submit manufacturer's product data describing all materials, finishes, ratings and installation requirements.
- B. Submit physical samples for each type of acoustical tile proposed.
- C. Submit physical samples for each type of grid proposed.
- D. Submit tile manufacturer's certification for whether hold-down clips are required for the selected tile(s) and rated system(s).
- E. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.



1.6 WARRANTY

- A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.
- B. Warranted defects shall include but not necessarily be limited to rusting or deflection of grid, deterioration or deflection of acoustical tiles.

1.7 QUALITY ASSURANCE

- A. Suspended acoustical ceiling contractor shall have a minimum of 3 years experience in the installation of specified systems for projects of similar size and scope of this project.
- B. Installation of acoustical tile and panels shall not begin until residual moisture from plaster, drywall, concrete or terrazzo work is dissipated. Before installation, the building shall be enclosed and permanent heating and cooling equipment in operation.

1.8 DELIVERY AND STORAGE OF MATERIALS

- A. Do not deliver materials to jobsite until spaces are ready for ceiling installation.
- B. All materials shall be delivered in manufacturer's original packaging and stored in an enclosed shelter providing protection from damage and exposure to the elements.
- C. Damaged, rusted or deteriorated materials shall be removed from the premises.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. TYPICAL CEILING PANELS:
  - 1. Armstrong World Industries, Inc.
  - 2. USG Interiors, Inc.
- B. SPECIALTY CEILING PANELS
  - 1. Acoustical Resources, Inc.
  - 2. Wenger
  - 3. U.S.G.
- C. GRID SYSTEMS:
  - 1. Armstrong World Industries, Inc.
  - 2. USG Interiors, Inc.
  - 3. Chicago Metallic Corp.

2.2 MATERIALS:

- A. TYPICAL CEILING PANELS:
  - 1. 24" x 24" x 5/8" white **“Cortega Square Lay-in” No. 770**, square-edged as manufactured by Armstrong or equivalent (color, pattern, texture) by specified manufacturer. **Non-rated system.**

2. 24" x 24" x 5/8" white "**Cortega Square Lay-In" No. 824** square-edged as manufactured by Armstrong or equivalent (color, pattern, texture) by specified manufacturer. **Fire-rated system.**

B. SUSPENSION SYSTEM:

1. Components shall be formed from commercial quality cold-rolled steel, electro-galvanized, 2'x2' module.
2. The suspension system shall support the ceiling assembly with a maximum deflection of 1/360 of the span per A.S.T.M. C-635-69.
3. Main tee with double web design 1-1/2" high and rectangular bulb; 15/16" exposed flange with rolled cap; cross tee holes at 6" o.c.
4. Four foot cross tee 1-1/2" high with double web design. Rectangular bulb joining main runners at 2' on center.
5. Two foot cross tees perpendicular to 4' cross tees. Two foot cross tees minimum of 1-1/2" high, No. CMC 222-41 or equivalent by specified manufacturer.
6. Wall molding - hemmed edge, electro-galvanized cold rolled steel with equal leg width, finish to match grid.
7. Finish: Typical finish, factory white painted steel. At high humidity areas including kitchens, dressing rooms, toilet rooms provide factory white painted aluminum cap.
8. Rating: Provide U.L. listed grid for scheduled system rating.

PART 3 – EXECUTION

3.1 COORDINATION

- A. Verify that above ceiling work, including fire dampers, ductwork, piping, wiring and insulation is complete and approved prior to beginning ceiling work.

3.2 INSTALLATION

- A. Ceiling systems shall be suspended from structural members by 12 gauge annealed wire; spacing as recommended by manufacturer. Provide additional support for light fixtures and grilles at each corner. Provide secondary support framing ("Unistrut") where spacing of structural members exceeds suspension system manufacturer's recommendations.
- B. Acoustical lay-in panels shall be installed in strict accordance with the manufacturer's instructions. Tile shall be installed with fissures or pattern all in same direction.
- C. Provide additional hangers at ceiling suspended items including projection screens, speakers, exit lights, air supply and return grilles.
- D. Space main runner hangers a maximum of 6 inches from wall. Do not support systems from wall.
- E. Adjust hangers to ensure level ceiling in plane.

### 3.3 RATED CEILINGS

- A. Provide specified ceilings in fire rated assembly. Protect light fixture protection in accordance with approved U.L. Design to meet required assembly rating. Provide additional hangers to meet the requirements of the particular U.L. rating.
- B. Ceiling system manufacturers not listed in the required U.L. design number (reference drawings) shall be responsible for determining whether their rated system is acceptable to the particular local code authority.
- C. For ceiling tiles weighing 1 lb. per square foot or more, verify no requirement for hold-down clips at rated systems.

### 3.4 CLEANING AND REPLACEMENT

- A. At completion, replace file unit and grid systems that are damaged. Clean or replace tile and grid systems that cannot be cleaned.
- B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color, pattern, and type of ceiling tile installed.

END OF SECTION

SECTION 09 91 00 – PAINTING AND FINISHING

PART 1 - GENERAL

1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

- A. Provide all labor, materials, and equipment required for all painting, staining and finishing as indicated in the drawings, the approved submittals, and as specified herein. Painted or stained systems include but are not necessarily limited to the items listed below:
- B. EXTERIOR SYSTEMS:
  - 1. All visible wood unless noted otherwise.
  - 2. All ferrous metal. All galvanized metal unless noted otherwise. Touch-up on welds or damaged finishes.
  - 3. Exposed conduit, piping, etc., except for roof mounted piping not visible.
  - 4. Exposed roof mounted equipment visible from ground level or from upper floors of the building.
  - 5. All exposed concrete masonry units.
  - 6. All items normally painted in accordance with good construction practice.
- C. INTERIOR SYSTEMS:
  - 1. All visible wood or behind cabinet doors unless noted otherwise.
  - 2. All ferrous metal. All galvanized metal unless noted otherwise. Touch-up on welds or damaged finishes. Structural steel, steel joists and deck exposed to view except in mechanical rooms.
  - 3. Exposed conduit, piping, outlet boxes, raceways, and panel boxes except galvanized or aluminum piping located in mechanical or electrical rooms.
  - 4. All exposed concrete masonry units, gypsum board and plaster unless otherwise noted.
  - 5. All factory-primed hardware. Back-priming of all wood trim, millwork or finished carpentry prior to installation.
  - 6. All hollow metal doors and frames.
  - 7. All items normally painted in accordance with good construction practice.
  - 8. All unfinished louvers and grilles.

1.3 WORK TYPICALLY EXCLUDED

- A. Shop applied primer on structural steel and miscellaneous metals items.
  - B. Aluminum frames, doors, and windows.
  - C. Plastic clad casework, millwork, and wall panels.
  - D. Factory finished equipment unless noted otherwise (provide job touch-up).
- 1.4 DRAWING REFERENCE: Reference any paint or finish notes in the drawings for any pre-selected colors or other requirements.
- 1.5 SUBMITTALS
- A. Submit manufacturer's product data describing each proposed type of paint, sealer, stain, or coating and its recommended use. Include viscosity and percent solids information. Where not the specified base manufacturer, list the specified brand name and type and the proposed substitute. The Architect shall be the sole judge as to equivalency of systems.
  - B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.
- 1.6 WARRANTY
- A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of two years after the date of Substantial Completion of the project.
  - B. Warranted defects shall include but not necessarily be limited to peeling, crazing, cracking, blistering, mildewing, chalking or dusting, pin holes, color fade or loss of hardness or sheen.
- 1.7 QUALITY ASSURANCE
- A. Painting contractor shall have a minimum of 5 years experience in the application of the specified systems for projects of similar size and scope as this project.
  - B. If requested by the Architect, provide system manufacturer's certification of the proposed painting contractor as approved for application of the product.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Do not deliver painting materials to the jobsite until spaces and surfaces are ready for painting.
  - B. Deliver materials in manufacturer's original containers, unopened except for shop mixing of colors. Containers shall bear manufacturer's readable labels indicating brand and type of paint. Any additional containers with labels indicating products not approved shall be removed from the jobsite. Any applied material not previously approved by the Architect is subject to removal and reapplication with the appropriate approved product.
  - C. Store materials in environmentally controlled area. Interior products shall be acclimated to a temperature range of 50-80 degrees F. at least 24 hours prior to application.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **TYPICAL PAINTS:** Systems are based on the first listed manufacturer. Only equivalent systems provided by specified manufacturers in accordance with attached Product Comparison sheet and as approved by the Architect are approved for use.
1. Sherwin Williams, Inc.
  2. Pittsburgh Paints
  3. Pratt & Lambert
  4. Benjamin Moore Co.
- B. **SPECIALTY PAINTS:**
1. Epoxies: Sherwin Williams, PPG, Pratt & Lambert.
- C. **SUBSTITUTIONS:** In accordance with Section 01 25 00 Substitution Procedures.

### 2.2 INTERIOR SYSTEMS

- A. **SYSTEM TYPES FOR NEW WALLS** (Unless indicated otherwise on Finish Schedule or drawings):
1. Drywall in toilet rooms, storage rooms, and mechanical/electrical/toilet rooms/ classrooms: **Semi Gloss Enamel** at walls and ceilings.
  2. Drywall soffits: **Eggshell Enamel**.
  3. Typical masonry (CMU): **Gloss Enamel**.
  4. Masonry (CMU) in toilet rooms: **Gloss Epoxy**.
  5. Steel railings: **Gloss Aliphatic Urethane**.
  6. Suspended rigging over stage: **Dry Fog**.
- B. **SYSTEM DESCRIPTIONS** (Reference item 3.3 for modifications and preparation required for these systems when applied to existing walls already painted):
1. Primer on gypsum board: SW PrepRite High Build Primer B28W601 – one coat over light to medium texture (submit texture sample for approval)
  2. Eggshell Enamel on Drywall: SW Pro Mar 400 Latex Eg-Shel B20W4400 – one coat over specified primer.
  3. Semi-Gloss Enamel on Drywall: SW Pro Mar 400 Latex Semi Gloss B31W4400 - one coat over specified primer.
  4. Epoxy Paint on Drywall: One coat SW PrepRite 200 Latex Primer B28W200 over specified primer.
  5. Gloss Enamel on Drywall: Two coats SW Water Based Catalyzed Epoxy B70 Series gloss acrylic over specified primer.
  6. Semi-Gloss Enamel on shop-primed metals: SW Water Based Industrial Enamel B53-300 acrylic gloss Enamel – two coats.
  7. Natural Finish on Wood: SW Sherwood BAC Wiping Stain (one coat) + SW Wood Classics Sanding Sealer B26V3 (one coat) + SW Wood Classics Satin Varnish A66.
  8. Clear Finish on Wood: SW Wood Classics Polyurethane Varnish A67 (two coats). Sand lightly between all coats.
  9. Block Filler: SW Prep Rite Block Filler B25W25 (for areas not subject to moisture); SW Heavy Duty Block Filler (for areas subject to moisture). Provide 2 coats as specified under “Execution”.

10. Gloss Enamel on CMU or concrete: Two coats block filler plus two coats SW Water based Industrial Enamel gloss acrylic latex over specified primer.
11. Semi-Gloss Enamel on CMU or concrete: Two coats block filler plus two coats SW Water Based Industrial Enamel semi-gloss acrylic latex over specified primer.
12. Semi-Gloss Epoxy Paint on concrete: One coat SW Water Based Epoxy semi-gloss over cured concrete plus finish coat of SW Water Based Epoxy semi-gloss. Minimum paint thickness 3.0 dry mils.
13. Gloss Epoxy Paint on CMU: Two coats block filler (unless surface-bonded) plus finish coat of gloss. Minimum paint thickness 3.0 dry mils.
14. Gloss Epoxy Paint on concrete: One coat SW Water Based Epoxy gloss over cured concrete plus finish coat of SW Water Based Epoxy gloss. Minimum paint thickness 3.0 dry mils.
15. Semi-Gloss Enamel on utility piping and galvanized metals: SW Pro-Cryl Universal Metal Primer – one coat + SW DTM Acrylic Semi Gloss – two coats.
16. Semi-Gloss Epoxy Paint on CMU: Two coats block filler plus finish coat of SW Water Based Epoxy semi-gloss. Minimum paint thickness 3.0 dry mils.
17. Gloss Aliphatic Urethane Enamel on primed steel railings: Over epoxy shop primer apply two coats SW Hydrogloss Single Component Water Based Urethane B65-181 Urethane Gloss Enamel using airless spray equipment.
18. Dry Fall Acrylic (exposed deck, structure and rigging): One coat SW Super Save Lite Acrylic Dry Fall Eggshell Primer & Finish. Black color. Overspray dries to non-adhering dust in a ten foot fall.

## 2.3 EXTERIOR SYSTEMS

### A. SYSTEM TYPES:

1. Exterior Metals: **Gloss Enamel.**
2. Field welds: **Zinc-Rich Coating.**

### B. SYSTEM DESCRIPTION:

1. Gloss Enamel on Galvanized Metals: SW Pro-Cryl Universal Metal Primer B66W310 (one coat) + SW Sher-Cryl HPA B66-300 enamel – two coats.
2. Block Filler on CMU: SW Heavy Duty Block Filler B24W46, one coat.
3. Gloss Enamel on Shop-Primed Metals: SW Sher-Cryl HPA B66-300 gloss enamel-two coats.
4. Gloss Enamel on Aluminum: SW Pro-Cryl Universal Metal Primer B66W310 – (one coat) + SW Sher-Cryl HPA B66-300 gloss enamel – two coats.
5. Field Welds: “ZRC” cold-applied galvanizing.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. METALS: Remove grease, oil, and dirt. Touch-up any damaged primer with like material. Remove any welding tags and grind smooth before painting. Fill any open galvanizing ports.
- B. PLASTER, CMU, CONCRETE: Remove dusting and mortar residue. Remove any efflorescence and seal. Ensure that plaster, concrete and mortar joints are dry and fully cured.

### 3.2 APPLICATION

- A. GENERAL: All paint and finishes be brushed or sprayed in even, uniform coats without runs or sags. Allow each coat to dry completely before applying succeeding coats. All surfaces shall be dry and no painting shall be done in damp conditions or when the ambient temperature is below 50 degrees F.
- B. WOOD DOORS: Factory sealed tops, bottoms, and edges of plastic laminate surfaced doors left undisturbed require no additional finishing. Reseal any job cuts. Paint metal glazing stops.
- C. MECHANICAL/ELECTRICAL EQUIPMENT: Painting contractor shall examine the mechanical and electrical drawings to determine quantities and locations of exposed piping, louvers not shown in Architectural drawings, electrical and telephone panels in finished areas, exposed electrical conduit in finished areas.
- D. BLOCK FILLER AT CMU: Apply **first coat** of filler to ensure penetration into voids and work into block texture with bristle brush. Follow with a **minimum of one additional coat**. Provide uniform finish with no pinholes.
- E. DRYWALL: Paint finish, sheen and texture shall be uniform and match the samples submitted to and approved by the Architect.

### 3.3 PREPARATION OF EXISTING PAINTED SURFACES

- A. Maintenance painting will frequently not permit or require complete removal of all old coatings prior to repainting. However, all surface contamination such as oil, grease. Loose paint, mill scale dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers must be removed to assure sound bonding to the tightly adhering old paint. Glossy surfaces of old paint films must be clean and dull before repainting. Thoroughly washing with an abrasive cleanser will clean and dull in one operation, or, wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system. Check for compatibility by applying a test patch of the recommended coating system, covering at least 2 to 3 square feet. Allow to dry one week before testing adhesion per ASTM D3359. If the coating system is incompatible, complete removal is required.

## PART 4 – SCHEDULES

### 4.1 COLOR SELECTIONS

- A. SCHEDULE: Unless colors are pre-selected in the Bidding Documents, the Architect shall prepare color schedule for the project using colors selected from the approved paint manufacturer(s). Where colors are pre-selected, the painting contractor shall use the colors selected or submit a schedule of proposed exact color matches by one of the specified paint manufacturers. **Provide 12” x 12” samples of actual paint for each color** whether pre-selected color or proposed color match.
- B. DOCUMENTATION: Upon completion of the Project, painting contractor shall furnish to the Architect a complete schedule of paint brands, types, and colors actually used for each room and area.

### 4.2 EXTRA MATERIALS

- B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color (field and accent) of paint used.

END OF SECTION



## SECTION 10 14 00 — GRAPHICS AND SIGNAGE

### PART 1 - GENERAL

#### 1.1 COORDINATION:

- A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Material and installation for the Plastic Room Identification Plaques.
- B. Material and Installation for Exterior/Interior Building Identification Letters.
- C. Material and Installation For Building Dedication Plaque with logos (including but not limited to conversion of architectural drawings into useable vector line art format).

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Interior wall materials and finishes.
- B. Exterior wall materials and finishes.
- C. Typical handicapped site signage.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's product data describing materials, and mounting methods for Room Identification Plaques, Exterior/Interior Building Identification Letters, and Building Dedication Plaque.
- B. Submit color samples of actual material for color and finish selection by Architect.
- C. Submit finished sample of room identification plaque(s) with any required symbols other than text.
- D. Submit paper "rubbing" of final layout of Building Dedication Plaque for Architect's approval.
- E. Submit full size paper layout of Exterior Building Identification Letters for each line of text.
- F. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

## 1.5 WARRANTY

- A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.
- B. Warranted defects shall include but not necessarily be limited to color fading, delamination, failure of anchoring or fastening, cracking, breaking or tarnishing.
- C. Exterior signage or building letters contributing to streaking or staining of building shall be a defect to be corrected by the Contractor, with building materials cleaned or replaced as required.

## 1.6 QUALITY ASSURANCE

- A. Fabrication and installation company shall have a minimum of 3 years experience in the installation of similar systems for projects of similar size and scope.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver materials to the jobsite until surfaces are ready for installation of graphics.
- B. Store materials in covered, dry, temperature and humidity controlled space.

## 2 PART TWO – PRODUCTS

### 2.1 MANUFACTURERS

- A. ROOM IDENTIFICATION PLAQUES:
  - 1. South Texas Graphic Specialties, Inc.
  - 2. The Southwell Co.
  - 3. Cantrell Industries.
- B. EXTERIOR BUILDING IDENTIFICATION LETTERS:
  - 1. A.R.K. Ramos
  - 2. Gemini Inc.
  - 3. Matthews Bronze Div. – Architectural Products
  - 4. Metal Arts
- C. BUILDING DEDICATION PLAQUE:
  - 1. A.R.K. Ramos
  - 2. Matthews Bronze Div. – Architectural Products
  - 3. Metal Arts
  - 4. OMC Industries, Inc.

### 2.2 MATERIALS

- A. ROOM IDENTIFICATION PLAQUES:
  - 1. 6" X 9" X ¼" thick two tone series:
  - 2. Fabrication: Constructed of Wilson Art face laminate (as selected by the Architect from manufacturer's standard selections) laminated to a solid acrylic core. The raised 1/32" acrylic copy

shall be cut through the laminate face color and chemically welded to the acrylic core to assure permanent attachment, including the symbols. Any lower and secondary copy shall be 5/8" high Helvetica Medium (all caps) incised copy paint filled. Colors as selected by the Architect. Any secondary copy shall be 8-stroke computer engraved. Rounded corner letters will not be acceptable. The edge of the signs shall be finished to match the face laminate color-to-color as selected by the Architect.

3. At toilet rooms also provide with 2" high raised gender and wheelchair symbols when handicapped equipped noted on schedule. Symbols shall be chemically welded through the face laminate to the acrylic core. Edges painted a color as selected.
4. The raised copy shall be accompanied with grade 2 Braille by means of Visi Touch DuraDot Braille manufacturing system. The clear Glass DuraDot shall have a 0.059 surface diameter and raised 1/32" above the face laminate and shall be unitized to the acrylic core through the face laminate. The edges of the sign shall be finished to match the face laminate color-to-color as selected by the Architect. Any secondary copy shall be 8-stroke computer engraved. Rounded corner letters will not be acceptable.
5. Installed plaques shall comply with all state, local, and federal requirements for compliance.

#### B. EXTERIOR BUILDING IDENTIFICATION LETTERS

1. Scope: The project shall include a cast letters as described below, to be provided and installed by contractor. Letterstyle, finish and mounting to be selected by Architect.
2. Fabrication of Letters: Fabricate letters to comply with requirements indicated below and as indicated on drawings.

A. Cut letters : Form letters by cutting from solid sheet material of thickness specified. Produce characters with smooth flat faces, sharp corners, precisely formed lines and profiles, free from pits, scale, sand holes and other defects. Supply anchoring devices on reverse side of individual letters as required.

3. Characteristics:
  - A. Metal: Aluminum
  - B. Size: 12 inches and 4 inches unless noted otherwise on drawings.
  - C. Thickness: 1 1/2 inches.
  - D. Letterstyle: Times New Roman
  - E. Finish: As selected by Architect from manufacturer's finish options (submit samples).
  - F. Mounting: Concealed (refer to drawings for wall type).
  - G. Text: "TROPICAL"  
"TEXAS BEHAVIORAL HEALTH"  
"105"
4. Template: Provide full size paper mounting template showing hole placement and location of mounting holes.
5. Finishes: Colors and surface textures for exposed letters as selected by the architect from the manufacturer's standard and premium selections.

#### C. BUILDING IDENTIFICATION PLAQUE:

1. 18" wide X 24" high cast bronze alloy plaque. Borders and raised text shall have satin finish. Background shall receive a dark oxidized leatherette finish. Faces and edges to be chemically cleaned and sprayed with two coats of clear acrylic lacquer.
2. Provide threaded stainless steel or brass studs on back for concealed mounting with epoxy. Letter style "Helvetica Medium" per A.R. Ramos or equivalent by specified manufacturer.

3. Layout, logos and letter sizes to be provided by the Architect. General contractor shall perform all conversions of architectural drawings & logos into useable vector line art format or any other type of format as required in order to produce the building plaque layout as provided by the Architect.

### 3 PART THREE- EXECUTION

#### 3.1 INSPECTION AND PREPARATION

- A. Ensure that wall surfaces are completed and accepted by the Architect prior to installing wall-mounted items or painted wall graphics.
- B. Obtain approved location schedule for Room Identification Plaques prior to delivery of plaques to the jobsite.

#### 3.2 INSTALLATION

##### A. ROOM IDENTIFICATION PLAQUES:

1. Apply top and bottom strips of 1/8" thick double stick vinyl foam tape and backs of each plaque. Apply liberal amount of clear silicone rubber adhesive to a minimum of 50% coverage of back of plaque.
2. Plaques shall be mounted to the strike side of the door on the wall within 5' of the floor and 6" max. from the jamb; when location is on a glass side light or window, mount with a solid color back-up plate to cover reverse side of the glass. Attachment shall be with foam tape and silicone.

##### B. BUILDING DIRECTIONALS SIGNS:

1. Apply top and bottom strips 1/8" thick double stick vinyl foam tape on backs of each sign. Apply liberal amount of clear silicone rubber adhesive to a minimum of 50% coverage of back of sign.
2. Signs shall be mounted to the strike side of the door on the wall within 5' of the floor and 6" max. from the jamb; when location is a glass sidelight or window, mount with a solid color back-up plate to cover reverse side of the glass. Attachment shall be with foam tape and silicone.

##### C. EXTERIOR/INTERIOR BUILDING IDENTIFICATION LETTERS.

1. Pre-drill holes into masonry and insert threaded stud on back of letters into epoxy adhesive filled holes. Provide stainless steel spacers to set letters off wall 1/2" minimum 2 studs per letter. Refer to drawings for wall finish type.

##### D. BUILDING IDENTIFICATION PLAQUE:

1. Masonry Wall: Pre-drill holes into masonry walls and insert threaded studs on back of letters into epoxy adhesive filled holes. Mount plaque tight against wall.
2. Drywall: Mount plaque using a minimum of 4 moly type expansion screws and silicone adhesive. Mount plaque tight against wall.

END OF SECTION

## SECTION 10 14 53 — TRAFFIC STRIPING AND PARKING SIGNAGE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Provide traffic line, parking stripe and symbol painting on concrete/asphalt paving as indicated in the drawings.
- B. Provide and install pipe-mounted parking signs at handicapped parking spaces meeting requirements of ADA.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Reinforced concrete paving.

#### 1.4 SUBMITTALS

- A. PAINT: Submit manufacturer's product literature indicating Federal specification numbers and manufacturer's recommended use and application techniques.
- B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.
- C. Provide full size template for handicapped stall symbol.

#### 1.5 WARRANTY

- A. Provide written warranty against defects in material and workmanship for a period of one year after date of Substantial Completion.
- B. Warranted defects for paint striping shall include but not necessarily be limited to fading, bleed-thru, spalling, excessive wear or delamination.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. PAINT: "Traffic-Line" alkyd base marking paint meeting Federal Specifications TTP-85 and TTP-115 Type 1 as manufactured by Devco or equivalent.
  - 1. Width: Typically 4 inches unless indicated otherwise in the drawings.
  - 2. Colors:
    - a. White: Traffic lines, directional symbols, symbols for the handicapped.
    - b. Yellow: Striping for parking stalls.
- B. HANDICAPPED PARKING SIGNS:
  - 1. Provide sign size, colors and copy meeting state, local and federal requirements for handicapped parking signage.
  - 2. Sign blank shall be 1/8" aluminum sheet with Dupont "Emron" glass paint background, graphics and copy.
  - 3. Graphics and copy shall be photo silk screened.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Ensure that paving operations are complete and surfaces thoroughly dry, clean, and free of oil or grease stains or other contaminants.
- B. Clean with high pressure wash or brush if necessary for proper adhesion.

### 3.2 PAINT

- A. Spray apply two coats of marking paint in patterns indicated on the drawings after weathering of asphalt or concrete paving for a minimum of 30 days. Edges shall be sharply defined.
- B. Provide minimum dry thickness of 2.5 mils. Provide additional coats if required for complete hiding.

- 3.3 HANDICAPPED PARKING SIGNS: Set 2" galvanized pipe sign support in minimum 6" diameter x 24" deep concrete footing.

END OF SECTION

## SECTION 10 28 13 - TOILET & BATH ACCESSORIES

### PART 1 GENERAL

#### 1.00 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.01 SECTION INCLUDES

- A. Vertical or Horizontal Baby Changing Stations and Child Protection Seat for use in commercial men's and women's toilet and bath facilities.

#### 1.02 QUALITY ASSURANCE

- A. Regulatory, Requirements: Conform to ASTM F2285 (formerly ASTM PS125) Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use, ANSI A117.1 Accessible and Usable Buildings and Facilities, ANSI Z535.4 Product Safety Signs and Labels, German TUV Technical Inspection Association, or local code if more stringent installation requirements are applicable for barrier-free accessibility. FDA approved high-density polyethylene (HDPE) materials conform to ASTM G21 Antifungal, and ASTM G22 Antibacterial Standards.

#### 1.03 WARRANTY

- A. Submit manufacturer's 5-year limited warranty on materials and workmanship and 5-year replacement warranty against vandalism agreeing to repair or replace unit that fails to perform as intended from date of substantial completion.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Koala Kare Products, a Division of Bobrick, Englewood, CO, 877-284-3906

## 2.02 ACCEPTABLE PRODUCTS

### A. Baby Changing Stations

1. Horizontal Design with molded Braille instructions (Model KB100-00)
2. Vertical Design with molded Braille instructions (Model KB101-00)
3. Stainless Steel Recessed Mounted Horizontal Design (Model KB110-SSRE)
4. Stainless Steel Surface Mounted Horizontal Design (Model KB110-SSWM)

### B. Sanitary Liner Refills. Liners are for use with all Koala Baby Changing Station designs (Model KB150-99).

### C. Child Protection Seat: Koala Child Protection Seat (Model KB102-00)

## 2.03 MATERIALS

### A. Materials/finishes: {[Molded FDA approved high density polyethylene HDPE, cream color] (Models KB100-00, KB101-00, KB102-00)} {[18 gauge, type 304 satin stainless steel exterior finish with grey polyethylene interior (Models KB110-SSRE, KB110-SSWM)]}.

### B. Hinges: reinforced, full-length steel-on-steel.

### C. Mounting supports: multiple, 11-gauge steel.

### D. Operation: hidden pneumatic gas spring mechanism for safe open/close motions.

## 2.04 ACCESSORIES

### A. Integral, built-in Liner Dispenser for use with 3-ply chemical-free biodegradable 13" x 19" sanitary liners.

### B. Replaceable snap-lock protective holding straps.

### C. Molded graphic instructions and safety messages in 6 languages and Braille. Identifying door plaque.

### D. Optional antimicrobial polyethylene.

### E. Optional lock supplied with 2 keys (not available for stainless steel exterior finish models).

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Provide templates and rough-in measurements as required.

### 3.02 INSTALLATION

#### A. Install in accordance with manufacturer's hardware and instructions.

#### B. Locate products to eliminate interference with door swings or use of fixtures in compliance with ADA regulations



END OF SECTION

## SECTION 10 44 00 - FIRE EXTINGUISHERS AND CABINETS

### PART 1 GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

#### 1.02 RELATED SECTIONS

- A. Section 04 22 00 – Concrete Masonry Units; CMU walls to receive bracket mounted fire extinguisher.
- B. Section 06 10 00 – Rough Carpentry: Wood blocking and framing to receive semi-recessed fire extinguisher cabinets.
- C. Section 09 21 16 – Gypsum Drywall Assemblies: Finished openings in walls for semi-recessed fire extinguisher cabinets.

#### 1.03 REFERENCES

- A. NFPA 10 – Standard for Portable Fire Extinguishers; National Fire Protection Association; 2002.
- B. UL (FPED) – Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10.
- B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

## 1.05 SUBMITTALS

- A. See Section 01 33 00 – Submittals, procedures and requirements for shop drawings, product data and submittal requirements.
- B. Shop Drawings: Indicate cabinet physical dimensions.
- C. Product Data: Provide extinguisher operational features.
- D. Manufacturer’s Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer’s Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

## 1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Fire Extinguishers, Cabinets and Accessories:
  - 1. JL Industries, Inc; Product 1037B20 with Extinguisher: [www.jlindustries.com](http://www.jlindustries.com).
  - 2. Larsen’s Manufacturing Co: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 3. Potter-Roemer: [www.potterroemer.com](http://www.potterroemer.com).
  - 4. Substitutions: See Section 01 25 00 – Product Requirements.

### 2.02 FIRE EXTINGUISHERS

- A. Basis of Design: JL Industries, “Cosmic 10E”.
- B. Type: Multipurpose dry chemical.
- C. Rating: Sized for project requirements.
- D. Mounting: Refer to floor plans for locations, annotated FEC for cabinets and FE extinguishers alone.
- E. Dry Chemical Type: Stainless steel tank, with pressure gage.
  - 1. Class A:B:C.
  - 2. Size 10.
  - 3. Finish: Baked enamel, Red color.
- G. ALL fire extinguishers shall be inspected and certified by the local authority having jurisdiction that they are charged and ready for use and shall be “tagged” identifying such.

### 2.03 FIRE EXTINGUISHER CABINETS

- A. Basis of Design:
  - 1. JL Industries, “Cosmopolitan – 1035B20 ADAC with Saf-T-Loc, TAS compliant.
  - 2. Designations: Refer to the floor plans, FEC for Extinguishers in cabinets and FE for surface mounted extinguishers secured to walls.

- B. Surface Mounted (Non-Cabinet, FE Type) – Bracket and Extinguisher (non-cabinet):  
Manufacturer’s standard stainless steel strap with enamel finished bracket with locking band retainer.
  - 1. Bracket shall match the extinguisher type.
- C. Metal for Cabinets: Formed stainless steel sheet; 0.036 inch thick base metal; #4 finish stainless steel.
- D. Cabinet Configuration: Recessed type.
  - 1. Sized to accommodate accessories.
  - 2. Exterior nominal dimensions of 13 7/8 inch wide x 27 3/8 inch high x 6 inch deep.
  - 3. Trim: Returned to wall surface, with 3 inch projection, 1 1/2 inch wide face.
  - 4. Form cabinet enclosure with right angle inside corners and seams. Form perimeters trim and door stiles.
- E. Door: 0.036 inch thick, reinforced for flatness and rigidity; lock with full glass access. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.
- F. Door Glazing: Glass, clear, 1/8 inch thick float. Set in resilient channel gasket glazing.
- G. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
- H. Weld, fill, and grind components smooth.
- I. Finish of Cabinet Interior: Enamel, color to select from manufacturer’s full color line.

#### 2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Cabinet Signage: FIRE EXTINGUISHER, vertical up face of cabinet to one side.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer’s instructions.
- B. Install cabinets plumb and level in wall openings, 30 inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

END OF SECTION

## SECTION 10 75 00 - FLAGPOLES

### PART 1 GENERAL

#### 1.0 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 specification section, apply to work of this section.

#### 1.2 SESSION INCLUDES:

- 1.3 Aluminum flagpoles, ground mounted.

#### 1.4 REFERENCES

- A. AASHTO M246/M246M Standard Specification for steel sheet, metallic-coated and polymer pre-coated for corrugated steel pipes.
- B. ASTM A53/A53M-02 Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- C. ASTM A123/A123M-02 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A790/A790M-02 Standard Specification for Seamless and Welded Ferrite/Austenitic Stainless Steel Pipe
- E. ASTM B221-02 Aluminum Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- F. ASTM B241/B241M-02 Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
- G. CDA (Copper Development Association) - Handbook.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. The General Contractor shall furnish and install a tapered aluminum flagpole, complete with a 50-star U.S. Flag, a State of Texas flag and a Mexico Flag, and all fittings, top ornament, lighting, ground spike with plate, foundation, grounding facilities, and all appurtenant work, all in accordance with the requirements of the Contract Documents.

#### 1.6 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements and imposed loads.

- C. Product Data: Provide product data on pole, accessories and configurations.

#### 1.7 OPERATION AND MAINTENANCE DATA

- A. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

#### 1.8 QUALIFICATIONS

- A. Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Texas. Provide calculations.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
- B. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- C. Protect flagpole and accessories on site from damage or moisture.

### PART 2 PRODUCTS

#### 2.1 POLE MATERIALS

- A. Aluminum: ASTM B241; 6063 alloy, T6 temper.

#### 2.2 POLE CONFIGURATION

- A. Nominal Height: 25 ft measured from nominal ground elevation.
- B. Flagpole: Ground mounted type.
- C. Flagpole Design: Cone tapered, seamless.
- D. Halyard: External type.

#### 2.3 COMPONENTS AND ACCESSORIES

- A. Finial Ball: 6" diameter, spun aluminum.
- B. Truck Assembly: Cast aluminum; revolving, stainless steel ball-bearings, non-fouling.
- C. Flags: (1) U.S.A. design, 8 x 5 feet size, nylon fabric, brass grommets, hemmed edges.  
(1) Texas design, 8 x 5 feet size, nylon fabric, brass grommets, hemmed edges.  
(1) Mexico design, 8 x 5 feet size, nylon fabric, brass grommets, hemmed edges.
- D. Cleats: Aluminum with stainless steel fastenings, two per halyard.
- E. Cleat Box: Aluminum with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.
- F. Halyard: 3/8" diameter polypropylene, braided, white.

#### 2.4 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M-246, corrugated 16-gage steel, galvanized.
- B. Pole Base Attachment: Flush, aluminum base with base cover.
- C. Lightning Ground Rod: Copper rod, 3/4" diameter; design length.

#### 2.5 FINISHES

- A. Metal Surfaces in Contact with Concrete: Asphaltic paint.

- B. Concealed Steel Surfaces: Galvanized to ASTM A123 1.25 oz/sq ft.
- C. Aluminum: Anodized to color as selected.
- D. Finial: Spun and Lacquered.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 03 90.
- B. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

### 3.2 PREPARATION

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

### 3.3 INSTALLATION

- A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.
- B. Electrically ground flagpole installation.
- C. Fill foundation tube sleeve with sand specified in Section 02 22 30 and compact.
- D. Install foundation plate and centering wedges, welded base assembly for flagpoles base set on concrete base and fasten.

### 3.4 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: One inch

### 3.5 ADJUSTING

- A. Adjust work under provisions of Section 01 70 00.
- B. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

**SECTION 11 40 00  
FOODSERVICE EQUIPMENT**

**PART 1- GENERAL**

**1.01** **CONDITIONS OF CONTRACT** and DIVISION 1, as indexed, apply to this section.

**1.02** **SCOPE:** All Foodservice Equipment as shown on the drawing and as specified herein.

**1.03** **RELATED WORK SPECIFIED ELSEWHERE**

- |  |             |
|--|-------------|
| A. Heating, Ventilation and Air Conditioning | Division 15 |
| B. Plumbing                                  | Division 15 |
| C. Electrical                                | Division 16 |

**1.04** **RELATED WORK BY OTHERS**

A. The rough-in service and the actual connection between kitchen equipment shall be furnished under Electrical, Plumbing and Mechanical Contractors unless specifically called for in the Item Specifications. The actual hardware connections and required labor to connect equipment to rough-ins shall be the entire responsibility of the prospective Contractor.

B. The Plumbing Contractor shall furnish and install all tailpieces, "P" traps, line strainers, grease traps, indirect copper drain lines, check valves, backflow preventors, fittings and stops for a complete system. All connections shall be made in accordance with local codes, except where plans and specifications exceed code requirements. Exhaust fans, ducts, gas flues and/or vents shall be furnished by the Mechanical Contractor. Final connection to kitchen equipment shall be by Plumbing Contractor. All faucet and prerinse assemblies for foodservice equipment are to be furnished by Kitchen Equipment Contractor and installed by Plumbing Contractor unless noted otherwise in item specifications.

C. All exhaust ducts, fans shall be furnished and installed by the Mechanical Contractor. Exhaust ducts to have water and grease tight connections and be constructed of rust resistant metal with continuous welded joints.

D. The Electrical Contractor shall furnish and install disconnect switches, safety shut-offs, control panels, fuse boxes, fan starters and other electrical controls to complete the project. Starting switches for the kitchen equipment are to be furnished by the Kitchen Contractor. Labor for connections shall be by the Electrical Contractor.

E. Sleeves and P.V.C. tubing for syrup lines and refrigeration lines shall be furnished and installed by the Plumbing Contractor.

F. The Kitchen Contractor shall be responsible to furnish and install all related refrigeration work. Final plumbing and electrical connections shall be made by other related Contractors.

G. All Masonry bases, depressions, and built up recessed walk-in floors shall be the responsibility of the General Contractor. The General Contractor shall be responsible for providing all wall blocking for overshelves, pot racks, rack shelves, etc. as mention herein. Kitchen Contractor shall submit all special provisions required for foodservice equipment.

**1.05** **APPROVED KITCHEN EQUIPMENT CONTRACTORS**

A. Subcontractors providing the foodservice equipment, foodservice equipment fabrication and



foodservice equipment installation for this project shall meet the following criteria:

1. Subcontractor shall have successfully completed three projects of similar size and scope to this project within a three year period prior to bidding this project.
2. Subcontractor shall be an authorized Dealer for all equipment as specified in this section.
3. Stainless steel fabrication contractor shall be an N.S.F. Certified fabricator.

#### **1.06 QUALITY ASSURANCE**

A. Workmanship and Employees: Workmanship shall be of the highest grade throughout and in accordance with best standards as practiced for heavy-duty kitchen equipment. The Contractor shall enforce at all times strict discipline and good order among his employees, and shall not employ any unfit person.

#### **1.07 STANDARDS**

A. All food service equipment shall be fabricated in accordance with the National Sanitation Foundation (NSF) and post the seal of approval. Where Contract Documents exceed NSF requirements, the Contract Documents govern. If the Architect is not satisfied with the sanitary construction casework details, the Contractor shall call in the area NSF representative for an onsite inspection and evaluation at no cost to the Owner.

B. All plumbing pipes and fixtures listed herein shall conform to the Safe Drinking Water Act (SDWA) and its LEAD FREE standards. If for any reason the fixtures do not pass the standards as set forth by the SDWA, it is the Contractors responsibility to replace those fixtures with an approved equal, which does comply.

#### **1.08 MECHANICAL**

A. All gas burners, valves, fittings, etc. shall be installed in accordance with local codes and the American Gas Association. All buy-out gas equipment shall bear the seal of A.G.A. All hot and cold water service stops at the point of equipment to be furnished by others.

#### **1.09 ELECTRICAL**

A. All fabricated equipment electrical work shall be installed in accordance with local codes Uniform Building and National Electrical Codes, except where plans exceed codes and specifications. All buy-out equipment to be listed and/or recognized by Underwriters Laboratories, Inc. All vertical service mounted controls to be recessed.

B. Electrical fittings and components: furnished under this Section area as follows.

Components provided loose under this Section for field installation and connection under Division 16 are indicated by asterisk \* or as indicated on detail. Coordinate foodservice equipment voltage and phase with building system.

\*1. Walk-in Cooler/Freezer ceiling lights, to be pre-wired with pigtails and mounting hardware consisting of F.S. junction box with cover and plastic nipple to fasten to walk-in box ceiling panels. Division 16 contractor is to provide and install all loop wire between light fixtures to electrical rough-in junction box above

walk-in boxes door panel and seal all holes in panels. All wiring to be above ceiling panels in code acceptance conduits.

2. Division 16 to provide and connect all control wiring for walk-in box evaporators from remote compressor panel to walk-in box evaporators and provide disconnect switch on evaporator, all wiring and rigid metal conduit to code requirements. Kitchen Equipment Contractor to supply remote outdoor refrigeration racks, pre-wired to master control panel with outdoor type NEMA 4 power disconnect. Division 16 to connect power lines from rough-in points to master control panel.

3. Contractor is to verify all electrical requirements for existing and owner supplied equipment.

Notify Electrical Engineer and/or Foodservice Consultant immediately if any discrepancies are discovered.

### **1.10 SUBMITTALS**

A. The Contractor shall submit six sets for the Consultant's approval such as assembly drawings, electrical and mechanical rough-in connection plans, details for plumbing, electrical, air conditioning and ventilation services for all kitchens equipment and brochures, catalog cut-sheets, specifications and operating characteristics for buy-out equipment. This submittal set shall be submitted within 35 days of notification of bid award. Submittals shall be submitted in the following format:

1. Submittal shall be submitted with front and rear hard protective covers with labeled project name.
2. Front sheet indicating the name and address of the project, Architect, Foodservice Consultant and Kitchen Equipment Supplier.
3. A separate divider sheet for each component/item of equipment indicating: item number, name, quantity, manufacturer, optional equipment, modifications and utility requirements.
4. Clearly indicate any deviations from contract Documents, such as arrangement of piping, connections, wiring method of fabrication, manner of structural conditions, standard shop practices, or other reasons, as noted in letter of transmittal accompanying submittals.
5. Drawing of fabricated equipment shall not be less than 3/4" equal on foot scale. Rough-in drawings shall not be less than 1/4" equal one foot scale.
6. Under no circumstances shall any work be undertaken or material shipped prior to the written approval of the Consultant. Approval of such plans and brochures by the Consultant shall not relieve the Kitchen Contractor of any obligation to furnish all materials and labor required for the completion of the project. The Consultant's approval shall not relieve the Kitchen Contractor of any responsibility with regard to the final successful operation of the Equipment nor shall it under any circumstances relieve the Kitchen Contractor from fulfilling any or all guarantees made in the agreement.
7. The Contractor shall, after all revisions are complete, furnish for the Consultant three (3) sets of final drawings and specifications.

### **1.11 FIELD MEASUREMENTS**

A. All measurements required to facilitate the installation and connection of all kitchen equipment shall be the responsibility of the Kitchen Contractor. Drawing dimensions are approximate locations for all plumbing, electrical and ventilation connections. Any conflicting

dimensions and/or obstacles performed by others that prevent the installation of specified equipment shall be reported to the Consultant before proceeding with installation.

## **PART 2 – EQUIPMENT SUBSTITUTIONS:**

### **2.01 SUBSTITUTIONS**

A. Wherever a specific equipment item is specified, it is not the intention of the Owner or Consultant to discriminate against another manufacturer. It is rather the intention to set a definite standard as to the class of material itself. Under no circumstances, however, shall any substitution be made without

the written approval of the Consultant. In making his proposal, each prospective Contractor is expected to include in his proposed sum the cost of the materials, which are specified.

B. Request for permission to make substitutions will be considered by the Consultant only for a period of

(14) fourteen days prior to bid opening date.

C. In all instances such request shall be accompanied by complete descriptive literature and complete operation and performance data. The Consultant will investigate such request for substitutions, consult the Owner when necessary and render final decision as promptly as possible.

D. If a substitution granted proves unsatisfactory for the service for which it was intended within the guarantee period, the Contractor shall make the Project conform to the specifications at his own expense.

E. If substituted equipment requires more of different electrical, plumbing or mechanical connections, the Kitchen Contractor shall pay for said additions to respective Electrical or Mechanical Contractor. INSPECTION, TESTING AND BALANCING.

### **2.02 CONDEMNATION**

A. Final approval of equipment and installation shall be made by the Consultant and/or Owner's Agent.

A review of the installed equipment shall be made with the Contractor at which time the Contractor shall demonstrate the operation procedures of each item. Three hard bound sets of operation procedures and repair part lists shall be presented to the Owner at the time of inspection.

B. Should any equipment item be rejected by the Consultant or Architect as not meeting Contract Documents requirements, the Contractor shall remove the equipment item within a twenty-four hour period.

C. All-tests of individual equipment components and steel gauge shall be conducted without cost to Owner.

## **PART 3 - EQUIPMENT**

### **3.01 KITCHEN EQUIPMENT**

A. Fabricated Equipment: All fabricated equipment such as food servicing units, tables, sinks, etc. described in the item specifications, other than by name and catalog number shall

be manufactured in the successful bidder's manufacturing plant having personnel with expertise and facilities to manufacture high quality kitchen equipment. If the bidder does not maintain and operate a fabrication plant he shall submit the name and address of the factory that is fabricating the proposed equipment.

B. Buy-Out Equipment: The successful bidder shall be an authorized distributor of the buy out equipment specified in the item specifications. He shall be responsible to furnish any replacement part promptly when required.

C. Guarantee: The Kitchen Contractor shall guarantee all equipment, materials and workmanship incorporated in the Project for a period of one year after the date of the final acceptance of the Project. Faults discovered by the Owner within the guarantee period shall be corrected by the Kitchen Contractor.

D. Any equipment that requires removal to repair shall be replaced with an equal to or better piece of equipment on a loan basis.

### **3.02 MATERIALS:**

A. General: All material installed as a permanent part of the fabricated equipment shall be new and unused and of the quality specified. The material on the job shall be maintained in an undamaged condition. All items of buy-out equipment shall be of the latest model at the time of bidding.

B. Stainless steel used in the construction of the fabricated kitchen equipment to be Type 304, having a standard analysis type of 188-8. Exposed stainless steel shall be polished to a No. 4 finish. Sheet colors throughout with a uniform finish and appearance.

C. Galvanized metal shall be copper bearing galvanized steel sheets or ingot galvanized iron steel sheets equal to Armco or Toncon, re-rolled for smoothness and used in the largest possible size to facilitate as few welded joints as necessary.

D. Structural Shapes: Galvanized 1 1/2" x 1 1/2" x 1/8" steel angle as required for structural support of fabricated equipment.

E. Bolts, Screws and Rivets: All working surfaces shall be free of bolts, screws and rivet heads. When fasteners are required on working and/or exposed surfaces they shall be approved concealed type. All fasteners shall be of the same composition as metal to be fastened.

F. Tubing shall be seamless 1 5/8" outside diameter, 16-gauge stainless steel.

G. Sealant shall be CLEAR silicone by General Electric Co. or equal and approved by USDA for incidental food contact.

### **3.03 FABRICATION:**

A. Welding: All welds of stainless steel shall be heli-arc welded. Welds to be free of pits and flaws and ground smooth and uniform to the grain and finish of the original sheet. Where grinding and polishing have destroyed the grain, restore and blend the joints such that all traces of the weld are removed.

All welds are to be backgrounded. Acetylene welding or silver solder shall not be used.

All galvanized welding shall be arc-welded. Welds shall be free of pits and flaws and peened to remove flux and other impurities, and ground smooth.

- B. Finishing: All exposed edges shall be deburred such that a rounded smooth edge is produced. All stainless steel shall have a No. 4 finish except for leading edges that will be highlighted to a No. 7 finish.
- C. Painting: All tables, cabinets and sinks under carriages, except for stainless steel, shall be painted with black semi-gloss acrylic enamel. A baked enamel finish, according to paint manufacturer's recommendations, is required for all exposed surface.
- D. Laminated Plastic: Wherever laminated plastic is specified for cabinet work it shall be Formica, Wilson Art or equal. Plastic to be bonded with a Urea based cement, waterproof and heatproof. All edges to be mitered. Plastic shall be applied directly over 1/2" thick close grain plywood.
- E. Sound Deadening: A plastic mastic sound deadening material shall be applied to underside of all counter tops, sinks and worktables to a minimum of 1/8" thickness. Excess mastic on visible part shall be cleaned. An NSF approved material shall be used. A tar base material is not acceptable.
- F. Field Joints: Field joints shall be limited only to facilitate installation and transportation. All field joints to be continuously welded, grounded and finished smooth without buckling.
- G. Equipment Refrigeration: All refrigeration equipment for a complete system shall be furnished by the

Kitchen Contractor. All refrigeration systems rated over 1/3 hp shall have a sight glass, thermal expansion valve, high and low pressure controls and defrost cycle. All refrigeration lines to have Armaflex covering except for conduit runs.

1. All compressors to have a five (5) year warranty. Completed systems to have a one (1) year  
Warranty from date of substantial completion or acceptance.
  2. All-thermostatic capillary tubes to be adequately protected from user damage.
  3. All refrigeration systems less than 1 hp that use a capillary expansion line shall be properly charged such that ice balling does not occur at the frost line.
- H. Plumbing Trim: Kitchen Contractor shall furnish all trim as specified within or in the Item Specifications.
1. Faucets, Splash Mount with adequate nozzle length as manufactured by T&S Brass or Fisher  
Faucets.
  2. Faucets, Deck Mount with adequate nozzle length as manufactured by T&S Brass or Fisher  
Faucets.
  3. Faucet, Pantry Type as manufactured by T&S Brass or Fisher Faucets.
  4. Pre-Rinse Unit as manufactured by T&S Brass or Fisher Faucets.
  5. Hose Reel as manufactured by T&S Brass or Fisher Faucets.
  6. Kettle Filler as manufactured by T&S Brass or Fisher Faucets.
  7. Drain-Klein 4591C with twist handle with no overflow assembly.
  8. All foodservice related faucet assemblies, pot fillers, piping, fittings, etc. shall comply with the

Federal Safe Drinking Water Act

Requirements. I. Hardware-Fabricated

Equipment:

1. Casters--Klein 222-58-SR adjustable stainless steel bullet feet.
2. Counter Legs--Klein 222-60-S.
3. Leg Sockets--Klein 481-58 stainless steel.
4. Door Hinge--Klein 499A continuous stainless steel piano hinge.
5. Pull--Klein 12270 bevel edge recessed pull.
6. Hinged Door Catch--Klein 242 or 9475.
7. Refrigerator Door Handle and Lock--Klein 13000-C with walnut vinyl insert and keyed alike.
8. Sliding Door Track Assembly--Klein 550 track, NT-551 and NT-552 sheave, and Klein 1096 stainless steel guide pins.
9. Drawer Slide--Klein SSA-9100-HD.

J. Metal-Table and Counter Tops:

1. Working tops, unless otherwise specified, shall be 14-gauge stainless steel. All seams, corners, and end splashes shall be welded closed and finished. All edges not adjacent to walls shall be turned down 1 1/2" at 90 degrees and tight hemmed. Where tops are adjacent to other fixtures they shall be flanged straight down two (2") inches or turned up two (2") inches. Tabletops shall overhang cabinet base section on working side not less than two (2") inches.
2. Counter top adjacent to walls shall overhang the base by 1", such that the cabinet can be adjusted to an irregular wall line. Return all body ends to wall. Top to be affixed to cabinet body by concealed welded studs. All backsplashes to be curved on 3/4" radius.

Q. Sinks:

1. All sinks to be constructed of 14 gauge stainless steel to the size specified, with a continuous sheet forming the back, bottom and front. All horizontal and vertical corners including ends and partitions shall have a 3/4" radius. Sink partitions to be double thickness with a 1 1/2" diameter top edge. All welds to be ground smooth with no pits. Solder is not acceptable. The front and side including drainboards shall have a 1 1/2" diameter 180 degree rolldown. Faucet holes will be punched on 8" centers over center line of single compartment sinks and over partitions of multiple sinks. Sink assembly to be mounted at a 3" distance from rear of backsplash to wall.
2. All vats to be pitched toward a center drain. Drain to be a 3 1/2" Klein #4591-C twist handle drain with overflow heads or as specified in the Item Specifications. Lever to have sanitary bracket support.

R. Sink Inserts:

1. Where sinks are to be welded into table tops they shall be fully coved, deep drawn 16 gauge stainless steel. All welding to be continuous and ground and finished smooth. See Item Specifications for center

drain

requirements. S.

Drainboards and

Dish Tables:

1. Drainboards to be constructed of 14-gauge stainless steel welded continuously to the sink body. All drainboards shall have a 2 1/2" high rim with integral 180 degree rolled edges to match sink body. All corners to be on 3/4" radius. Drainboards to be pitched a minimum of 1/8" per foot to sink or dishwasher.

T. Hoods:

1. Hoods shall be 18 gauge all welded 304 stainless steel closure with stainless steel angle frame as required for support. Hood shall be hung with all thread rod. All welded brackets required for hanging of the hood shall be included. Unless specified, hood shall be supplied with 20" x 20" stainless steel baffle type filters.
2. All Type I hoods or portions thereof penetrating a ceiling, wall or furred space shall be enclosed in a fire rated enclosure as per local and jurisdictional code requirements. Enclosure and/or approved fire blanketing to be provided and installed by General Contractor.
3. Trim: Stainless steel trim shall be fabricated and installed in any location where an opening of 3/8" or greater exists between fabricated equipment and wall or adjacent equipment.

U. Fire Suppression System:

1. The fire suppression system shall be plenum fire protection system, U.L. listed, Wet chemical, fire suppression system to be Ansul R-102. Equipment and installation shall be according to NFPA standards 17, 17A and 96; UL 300 standards and all applicable local code requirements. System to be complete including remote fire pull station, mechanical gas shut-off valve (were applicable), shunt trip and duct and hood protection devices.
2. Wet Chemical Agents: The fire extinguisher agent shall be potassium carbonate, potassium acetate base formulation designed for fire knockdown and securement of grease related fires. The agent shall be available in plastic container labeled with handling instructions.
3. Agent Tank: The agent tank shall be installed in the exhaust hood enclosure. The tank shall be constructed of stainless steel. The tank size shall be determined by the Contractor to meet the requirements of the specific application. Tanks shall have 100 psi working pressure, 300 psi tank pressure and 600 psi minimum burst pressure.
4. Tank Adapter: Tank adapter assembly shall be chrome plate steel with a 1/4" NPT female inlet and a 3/8" NPT male outlet.

5. Regulate Release Mechanism: Spring loaded, mechanical/pneumatic type capable of providing expellant gas supply to all agent tanks. It shall contain a factory installed regulator deadset at 100 psi.
6. Regulated Actuator Assembly: Provide expellant gas for additional tanks in systems requiring three or more tanks. It shall contain a factory-installed deadset at 100 psi.
7. Discharge Nozzles: Tested and listed for the specific application and stamped with the flow designation. Each nozzle shall be equipped with a protective cap to keep the nozzle tip orifice free of cooking grease build-up.
8. Equipment and materials
  - a. Distribution Piping: Schedule 400 black steel pipe and fittings sized as per manufacture's recommendations. All piping shall be sealed with pipe tape.
  - b. Actuation and Expellant piping: Schedule 40 black iron pipe and fittings sized per Manufacture's recommendations. All piping shall be sealed with pipe tape.
  - c. All pipes exposed in food service are to be sleeved with chrome plated sleeves with no exposed threads. All hangers and support brackets to be chrome plated.
  - d. Fire suppression Contractor is to coordinate with all respective Contractors for all requirements and final location.
  - e. Kitchen Contractor is to provide the kitchen and mechanical consultants a testing report on hood systems mentioned herein at the time of the completion of all exhaust and make-up supply fan installations.

V. Item Specifications:

1. General: The following basic category minimum features are listed followed by the specific item specifications. The quantity of items are to be as per plans and specifications. If there are any discrepancies or differences in the quantities shown on plans and specifications, the Contractor is to assume the larger quantity in their bid and contract.
1. Cooking Equipment shall have the following minimum features unless noted otherwise:
  - a. Pressure regulators
  - b. Stainless steel adjustable leg kits
  - c. Stainless steel fronts
  - d. Cords and caps for all electrical equipment.
  - e. All mobile cooking equipment to have T&S or Dormont quick disconnects of 36" minimum length.
2. Ventilation Equipment shall have the following minimum features:
  - a. Underwriters' Laboratory approval
  - b. Stainless steel grease extractors
  - c. Vapor proof bullet type fixtures at 4' on center. Pre-wire to junction box.
  - d. Cooking line Vent hood shall have Ansul R.102 Ansulex liquid fire Suppressant system or equal; complete with hand extinguish, manual operation mode, and gas solenoid valve for incoming gas line to equipment under the hood.



### 3.04 DELIVERY AND INSTALLATION

- A. Kitchen Contractor is not to install any kitchen equipment until all floors, ceilings and walls have been completed and cleaned as required. Damage to the equipment due to premature installation shall be the responsibility of the General Contractor and must be replaced with new.
- B. SUPERVISION: Provide a competent foreman or supervisor who shall remain on the job during the entire installation.
- C. DELIVERY: Foodservice equipment excluding exhaust hoods, trench liners and walk-in coolers are not to be delivered and/or set in place until the following construction has been completed: kitchen floors prepped and cleaned, wall painted, ceiling installed and wiring pulled to junction boxes.  
(Note 1. acid floor washes are not to be used on or near stainless steel or aluminum surfaces.  
2. Walk-in cooler/freezer doors are to remain open during concrete cure).
1. Assemble, square, level and make ready items for final utility connections.
  2. Scribing: cut neatly around obstructions to provide sanitary conditions. Where gaps occur between equipment, apply CLEAR General Electric silicon construction sealant Series SE-1200 mastic or stainless steel trim molding of proper shape with concealed attachment. Use epoxy cement and/or "zee" clips wherever possible to secure trim.
  3. At the discretion of Pharr-San Juan-Alamo I.S.D., new equipment may either be stored offsite in a bonded warehouse or on-site in a locked trailer unit, after delivery and prior to installation. These facilities shall be accessible to Pharr-San Juan- Alamo .S.D. and their agents for inspection purposes. Cost of storage is the responsibility of the Kitchen Equipment Contractor.

### 3.05 CLEAN AND ADJUST

- A. Clean up and remove from the job site, all debris resulting from the work as the installation progresses.
- B. Thoroughly clean and polish all foodservice equipment, in and out, ready for the Owner's use prior to demonstration and final inspection.
- C. Lubricate and adjust drawer slides, hinges  
and casters.
- D. Clean and replace faucet aerators and  
water strainers.
- E. Touch-up damage to painted finishes.
- F. Start-up and check all refrigeration systems for at least 72 hours prior to acceptance.

### 3.06 EQUIPMENT START-UP AND DEMONSTRATION

- A. Prior to final inspection, provide an authorized service agent to carefully test, adjust and regulate all equipment in accordance with the manufacturer's instructions and certify in

writing to the Owner that the installation, adjustments and performance are in full compliance.

B. Provide Owner with a list of equipment, equipment representatives and their telephone numbers to allow the Owner to schedule demonstrations on the equipment at their own convenience.

C. Kitchen Contractor shall coordinate schedule and be present at an equipment operating demonstration and personnel training with the kitchen manager and staff at the completion of the project, prior to the week before school begins.

D. Kitchen Equipment Contractor shall include preventative maintenance for one full year and a warranty for parts and labor for a minimum of one year on all Contractor supplied equipment. Warranty begins the date of approved construction substantial completion.

E. Contractor is to issue all equipment keys with transmittal to the Owner at the time of equipment demonstrations.

### **3.07 FINAL INSPECTION**

A. Final inspection will be made when the contractor will certify that they have completed their work; made through review of the installation/operation of each item in the contract and found it to be in compliance with the construction documents.

B. The Foodservice Consultant's repetitive final inspection and all costs associated thereto, incurred due to the Contractor's failure to comply with the requirements of this Article, will be invoiced to this Contractor.

### **3.08 EXISTING AND OWNER SUPPLIED EQUIPMENT:**

A. Contractor shall be responsible for the installation of all items listed below as Owner supplied and provide all accessories as listed in the Item specification.

B. Contractor is to verify all electrical requirements for existing/owner supplied equipment and notify Electrical Engineer and/or Foodservice Consultant immediately if any discrepancies are discovered.

## **PART 4 – FOODSERVICE EQUIPMENT ITEMS**

A. Referenced attached products and installation.

### **Item No. 01: Sink**

One (1) 3-compartment sink NSF approved.

- 5-Year Warranty Standard.

### **Item No. 02: Refrigerator**

Two (1) True T-49 Two Door Reach in Refrigerator 675-002

- 2-Year Warranty Standard.

**Item No. 03: Gas Range**

One (1) American Range AR6

- Heavy duty 6-in. stainless steel landing ledge
- 32,000 BTU lift off top burners making deep cleaning easier
- Interior porcelain finish on oven for easy cleaning
- 6-in. chrome plated steel legs
- 100% gas shut off prevents gas build up for added safety
- Welded frame construction adds durability
- Oven steel burner produces 35,000 BTUs
- Natural gas fuel allows for instant temperature adjustment and faster food preparation
- Overall Dimensions: 36-in W x 28.5-in D x 56-in H
- NSF listed; CGA Design, CSA Gas, and AGA Certified
- 1-Year Parts and Labor Warranty

## SECTION 12 36 40

### STONE COUNTERTOP

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Granite Countertops
  - 2. Granite Splashes
  - 3. Granite Wall Claddings

##### 1.2 REFERENCES

- A. ASTM: American Society for Testing and Materials International
- B. AWI: Architectural Woodwork Institute
- C. AWMAC: Architectural Woodwork Manufacturers' Association of Canada.
- D. MIA: Marble Institute of America
- E. NBGQA: National Building Granite Quarries Association, Inc.
- F. WI: Woodwork Institute (Formerly: WIC - Woodwork Institute of California)

##### 1.3 SUBMITTALS

- A. Product Data: Provide data on stone units.
- B. Shop Drawings:
  - 1. Indicate facing layout and sizes.
  - 2. Indicate counter top dimensions and installation methods.
- C. Samples for Initial Selection:
  - 1. Stone Samples: Submit two stone samples **6 by 6 inch (15.0 by 15.0 cm)** in size, illustrating color range and texture, markings, and surface finish for each stone product and color required.
  - 2. Sealant Samples: Manufacturer's color chart indicating full range of standard sealant colors.
- D. Samples for Verification: Submit two stone samples **6 by 6 inch (15.0 by 15.0 cm)** in size, illustrating color range and texture, markings, and surface finish for each stone product [**and each color of sealant**] required. **Apply one, 6 inches (15.0 cm) long by 1/8 inch (0.30 cm) wide bead of sealant between stone samples for each color of sealant and each color of stone required**.
  - 1. Provide an electronic digital image of slab in sufficient resolution and detail to evaluate color and quality of stone.

- E. Qualification Statements:
  - 1. Fabricator's qualification statement.
  - 2. Installer's qualification statement.
- F. Operation and Maintenance Data: Indicate list of approved cleaning materials and procedures required; list of substances that are harmful to the component materials.
- G. Maintenance Materials: Sealer, **2 gallon (8.0 litre)**.

#### 1.4 QUALITY ASSURANCE

- A. Mockup: Construct mockup as indicated on drawings [ **and coordinate with mockup requirements of Section**] [06 20 00 Finish Carpentry] [06 22 00 Millwork] [06 40 00 Architectural Woodwork] [06 41 00 Architectural Wood Casework].

### PART 2 PRODUCTS

#### 2.1 STONE SOURCE

- A. C.H. Briggs Company
  - 1. Address: P.O. Box 15188, Reading, PA - 19612-5188
  - 2. Phone: (800) 355-1000
  - 3. Fax:: (800) 355-3131.
  - 4. Web Site: <http://www.chbriggs.com>.
- B. Substitutions to be submitted.

#### 2.2 APPROVED FABRICATORS

- A. Cava
  - 1. Address: 200 Washington Avenue, Philadelphia, PA 19146
  - 2. Phone: 215-732-7800
- B. DeSavino
  - 1. Address: Midvalley Industrial Park, 1003 Underwood Road, Olyphant, PA 18447
  - 2. Phone: 570-383-3988
- C. Down East
  - 1. Address: 215 Salem Church Road, Mechanicsburg, PA 17050
  - 2. Phone: 717-790-6040
- D. Henry Ross
  - 1. Address: 121 Koser Road, Litiz, PA 17543
  - 2. Phone: 717-626-6268
- E. MacLaren Fabrication

1. Address: 1135 Phoenixville Pike, West Chester, PA 19380
  2. Phone: 610-436-5436
- F. McGrory
1. Address: 576 Rosedale Road, PO Box 999, Kennett Square, PA 19348
  2. Phone: 610-444-4512
  3. Web Site: www.mcgroryinc.com
- G. Solid Image
1. Address: 212 Laureltown Road, Laurel, DE 19956
  2. Phone: 302-877-0901.
- H. Solidsurface Designs Inc
1. Address: PO Box 5356, Delanco, NJ 08075
  2. Phone: 856-910-7720
- I. Stone Crafters
1. Address: 6084 Reega Avenue, Egg Harbor TWP, NJ. 08234
  2. Phone: 609-646-0406

## 2.3 STONE MATERIALS

- A. Granite: ASTM C615; type, color, and surface texture as **approved by architect**
1. Species: Selected by Owner
  2. Grade: Architectural

## 2.4 COMPONENTS

- A. Granite Countertops:
1. Dimensions: **As indicated on drawings.**
    - a. Thickness: **3/4 inch (2.0 cm)**
    - b. Width: **24 inches (60.0 cm)**
  2. Standard Edge Detail:
    - a. **Full bullnose**
- B. Granite **Backsplashes and End Splashes:**
1. Dimensions: **As indicated on drawings.**
    - a. Thickness: **3/8 inch (1.0 cm)**
    - b. Height: **4 inches (10.0 cm)**

## 2.5 FABRICATION

- A. General:
1. Comply with the requirements of the following reference standards:
    - a. NBGQA's "Standard Specifications for Architectural Granite."

- b. Marble Institute of America's "Dimension Stone Design Manual."
  2. Cut edges, corners, intersections, openings square, true, and straight unless otherwise indicated.
- B. Layout:
1. Field verify dimension before fabricating components.
  2. Layout work to minimize the number of seams.
  3. Align seams with joints in **cabinets and casework**.
  4. Do not locate seams at large openings, such as sinks.
- C. Counter:
1. Sink Mount: **Top-mount**.
  2. Cutouts: Coordinate size and location with other trades and comply with sink manufacturer's product specifications.
    - a. Accurately locate and size cutouts.
    - b. Polish edges of cutouts.
  3. Corners Condition: **Mitered seam through bullnose edge detail**
- D. Splashes:
1. Provide separate from countertops for field installation.
  2. Corners Condition: **Mitered**
- E. Wall Claddings:
- F. Seams:
1. Bonded Seams: **Epoxy Resin**.
  2. Sealant Filled Seams: **As specified in Division 07 Section titled, "Joint Sealants."**
- G. Edge Condition: **Routed** Edges:
1. Hand grind to create a sharp line of reprise.
- H. Finish:
1. **Polished finish**.

## 2.6 MISCELLANEOUS MATERIALS

- A. Adhesive: DuPont™ Silicone Adhesive.
- B. Sealant: Manufacturer's recommended sealant.
  1. Color: **As required to match Architect's approved sample**

## 2.7 ACCESSORIES

- A. Attachments: Stainless steel.

- B. Fixture Mountings: Stainless steel, suitable for **top** mounting and countertop construction.

## **PART 3 EXECUTION**

### 3.1 INSTALLATION

#### A. General:

1. Install items specified in this section according to countertop manufacturer's instructions and in compliance with the installation requirements of the following referenced standards:
  - a. MIA's "Dimension Stone Design Manual" Chapters 13 & 17.
  - b. NBGQA's "Standard Specifications for Architectural Granite"
  - c. Architectural Woodwork Standards, Section 11, Subparagraph 6.2.5 for installation of epoxy resin, natural/manufactured stone as published by AWI, WI, and AWMAC.
2. Do not field cut stone unless otherwise indicated.
3. "Dry assemble" pieces to verify fit before applying adhesives.
4. Shim pieces as required to produce surfaces that are plumb, level, flush, aligned, and true.
5. Apply adhesives only after final adjustments and corrections to fit have been made.
6. **Apply adhesive to seams and draw panels tight**

#### B. Loose Splashes.

1. Mask seams to prevent adhesive from smearing.
2. Install splash units to countertop and wall surface with adhesive.
3. Align seams between splash units and countertop panels.
4. Join splash units in same fashion as countertop panels.

#### C. Sealant: Apply sealant **around fixtures and appliances set into panels and seams between granite units.**

### 3.2 CLEANING

#### A. Clean according to manufacturer's instructions, but not less than the following:.

1. Wash with clean, water suitable for drinking and neutral (pH 7), soapless cleaner approved by countertop manufacturer.
2. Leave no streaks, smears, or stains.

### 3.3 PROTECTION

#### A. Repair scratches and scars according to manufacturer's instructions.

#### B. Provide protection according to countertop manufacturer's instructions, but not less than the following:

1. Sealer: Apply according to sealer manufacturers instructions.
2. Protective Covering: Cover granite surfaces with nonstaining kraft paper, clean fabric tarp, or 6 mil plastic film.



- a. Remove protective covering at **Substantial** Completion.

**END OF SECTION**

## SECTION 13 34 19 — PRE-ENGINEERED METAL BUILDINGS

### PART 1 - GENERAL

#### 1.00 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.01 SCOPE:

- A. Provide all pre-engineered metal buildings, complete, as shown on the Drawings, specified herein, or needed for a complete and proper installation and not specifically called for under other Sections of these specifications.
- B. The requirements of Division 0 – “Bidding and Contract Requirements” and Division 1 – “General Requirements” of this Project Manual apply to all work required for this section.

### PART 2 - PRE-ENGINEERED METAL BUILDING SYSTEM:

#### 2.01 GENERAL:

- A. The intent of these specifications and drawings is to establish a quality and performance level for structural design, material, durability, and workmanship.
- B. All bidders must conform strictly to these specifications in their bid.
- C. The building shall be the design of a manufacturer who is regularly engaged in the fabrication of pre-engineered structures. All materials shall be new, unused, free from defects and of American manufacture.
- D. The following standards and criteria (of most recent issue) shall be used where applicable in the structural design of the building covered by this specification:

“MANUAL OF STEEL CONSTRUCTION” - American Institute of Steel Construction  
“COLD FORMED STEEL DESIGN MANUAL” - American Iron and Steel Institute  
“ALUMINUM CONSTRUCTION MANUAL” - The Aluminum Association  
“CODE FOR WELDING IN BUILDING CONSTRUCTION” - American Welding Society

The following criteria shall also be applicable in other phases of design: latest edition of the INTERNATIONAL BUILDING CODE.

E. Listing by:

*Underwriters' Laboratories Inc.  
Factory Mutual System or other recognized testing laboratories*

2.02 DESIGN LOADS:

A. GENERAL:

1. The basic design loads shall include live and wind, in addition to dead load. All other design loads, whether they be of static or dynamic nature, shall be considered as auxiliary loads.

B. VERTICAL LIVE LOAD:

1. Roof covering shall be designed for either 50 psf uniformly distributed or a 200-pound concentrated (point) load (over a 1' x 1' area) located at center of maximum roof (panel) span. The most severe conditions shall govern.
2. Purlins shall be designed for 20 psf uniformly distributed over the roof area which they support.
3. Primary framing (frames) shall be designed for 20 psf uniformly distributed over the roof area which it supports.
4. All the above loads to be in addition to the applicable dead loads and shall be applied to the horizontal projection of the roof.

C. WIND LOADS:

1. The wind load on the structure shall be proportioned and applied as horizontal and uplift forces according to and as recommended by the latest edition of the INTERNATIONAL BUILDING CODE.
2. The roof construction shall carry a U.L. Construction (Uplift) Listing of not less than Class 90.
3. Wind load may be proportioned as allowed by the latest edition of the INTERNATIONAL BUILDING CODE. However, such proportioning shall not compromise the UL-Class 90 listing.

D. AUXILIARY (ADDITIONAL COLLATERAL) LOADS:

1. Other superimposed dynamic and/or static loads shall be considered as part of the design requirements and combined with normal design (live and/or wind) loads as prescribed hereafter:

*DYNAMIC LOADS:VARIOUS HVAC EQUIPMENT (REFER TO DRAWINGS FOR LOCATIONS).*

*STATIC LOADS:THE ROOF FRAMING AT 1:12 PITCH SHALL BE DESIGNED FOR AN AUXILIAR LOAD OF 5 PSI.*

E. COMBINATION OF LOADS:

1. The combining of normal loads and auxiliary loads for design purposes shall be as prescribed and recommended by the latest edition of the INTERNATIONAL BUILDING CODE.

F. CERTIFICATION:

1. After the awarding of the Contract, complete structural analysis shall be submitted by the Metal Building Manufacturer to the Architect. Structural design must be sealed by a Texas Registered Professional Structural Engineer.

2.03 DESCRIPTION:

- A. The pre-engineered metal buildings covered in this specification are to be rigid frame structure of steel (frames) rafter beams.
- B. The roof slope shall be not less than 1"; 12" as indicated on the drawings.
- C. Column spacing shall be as indicated on the drawings.
- D. Nominal eave height shall be as indicated on the drawings.

2.04 ROOF COVERING AND SUPPORTS:

A. ROOF PANELS – ***“Standing Seam Metal Roof” Panel:*** At 1:12 ROOFS:

1. The exposed metal roof covering shall be 24-gauge (minimum) “Standing Seam Metal Roof” Panel as manufactured by Berridge Manufacturing Co. or equal. Roof panels shall be of “Standing Seam Metal Roof” panel design and secured to the purlins with a concealed structural fastening system (mechanically seamed panel). The concealed system shall provide minimal through penetration of the exposed roofing surface and allow the roof covering to move independently of any differential thermal movement by the structural framing system. Except at the concealed fastener, there shall be no thermal contact of the roof panels with the supporting purlin. Roof panels with lap-type side (longitudinal) joints and exposed structural fasteners shall not be considered acceptable.
2. Roof panels shall be fastened to the purlins or secondary support members with a concealed clip or backing device of steel having a protective metallic coating. Through penetration of the roofing surface by exposed fasteners shall occur only at terminal locations of the roof panels. Such fasteners shall be stainless steel or aluminum screws, bolts, or rivets, with weather-seals washers. Carbon steel shank-fasteners with vinyl or stainless steel-capped heads shall be acceptable also.
3. Deflection of the roof panel shall not exceed  $L/180$  of its span when supporting the applicable vertical live loads previously described.
4. Roof Panels to be “Standing Seam Metal Roof” Panels with overall panel width to be 38-1/4", with 36" net coverage.

B. WARRANTY:

1. Durability of the roof panels due to rupture, structural failure, perforation, or noticeable discoloration or fading shall be warranted for a period of twenty (20) years by the Roofing Manufacturer and the General Contractor.

C. PURLINS (ROOF COVER SUPPORT MEMBERS):

1. The configuration, thickness and spacing of the purlins shall be the Building Manufacturer’s standard. The allowance design capacity of cold-formed purlin members shall be calculated in accordance with the provisions of the AISI Specification for the Design of Cold-Formed Steel Structural Members.

2. The deflection of the purlin or secondary member shall not exceed  $L/180$  of its span when supporting the applicable vertical live loads previously prescribed and any collateral loads required.
3. The standing seam roof does not provide a diaphragm or purlin bracing function. Brace purlins as required to conform with A.I.S.C. and A.I.S.I. specifications.

D. ROOF JACKS AND CURBS:

1. At roof penetrations for plumbing vents, install roof jacks (rubber) DEKTITE type where standing seam roofing is installed.
2. At roof penetrations for mechanical equipment skylights requires curbs; provide custom fabricated roof curbs as manufactured by CUSTOM CURB, INC., LCM INC.

2.05 RAKE, TRIM, GUTTERS, ROOF DOWNSPOUTS, TRIMS AND SOFFIT LINERS:

- A. The closures, flashings, fascias, gutters, and trim shall be the Building Manufacturer's standard, compatible with the material furnished as roof panels.
- B. Buildings shall have continuous gutters with downspouts where shown on the drawings.
- C. Gutters, downspouts, rake trim, ridge panels, and trim associated with standing seam roof panels shall be a color to be selected by Architect from manufacturer's KYNAR 500 custom and to be part of base bid colors.

D. WARRANTY:

1. The exterior color finish for the metal panels shall be warranted by the Material Manufacturer and General Contractor for twenty (20) years against blistering, peeling, cracking, flaking, checking, and chipping. Excessive color change and chalking shall be warranted for twenty (20) years. Color change shall not exceed 5 N.B.S. units (per ASTM D-2244.64T) and chalking shall not be less than a rating of 8 per ASTM D-659.

E. GIRTS:

1. The girt's configuration and thickness shall be the Building Manufacturer's standard provided all design criteria, including deflection and girt spacing is met.
2. Based on a simple span, the deflection of the girts (supporting the wall covering) shall be proportioned with due regard to that produced by the previously prescribed design (wind) load.

2.06 STRUCTURAL STEEL PRIMER:

- A. All uncoated structural steel shall be given one (1) coat of rust inhibitive (primer) paint which meets or exceeds Federal Specifications TT-P-664, or certification shall be submitted that it conforms to a recognized authoritative specification, such as from a Federal or Military authority or the Structural Steel Painting Council.
- B. Exposed pre-engineered metal building must be painted with at least one (1) coat of primer and two (2) coats of finish paint.

2.07 INSULATION AND INTERIOR FINISH:

A. ROOF

1. The upper layer of insulation system shall be applied under the metal roofing panels. The insulation, R-19 batt, should be over the roof support member. The vapor membrane shall always be placed nearest the interior of the building, whether it be exposed or non-exposed. All joints shall be lapped, taped, or folded and stapled in accordance with the Building Manufacturer's standard. The vapor membrane shall have a perm rating of not more than 0.02. The second layer insulation shall be polypropylene scrim-foil; R-10 suspended between the purlins. Both layers to provide R-20. At exposed locations insulation shall be changed to **Black** plastic faced.
2. All exposed roof insulation shall be supported by **Black** plastic mesh.
3. With blanket-type insulation, a thermal spacer (break) shall separate the roof support member from the roof panel, except at each concealed structural fastener. The spacer shall be of material having a density of not less than 2 pcf and, if of a combustible material, shall be classified (ASTM E-84) as having a flame spread rating no greater than 25.
4. Roof insulation shall be flexible, non-combustible fiberglass blankets with a vapor resistant membrane. The vapor resistant membrane shall be laminated to the insulation as a composite unit. The insulation and vapor membrane shall carry an Underwriters' Laboratories Inc. (U.L. Label) fire hazard classification indicating a flame spread rating of 25 or less and a smoke developed rating of 450 or less, as a tested assembly.

### PART 3 - EXECUTION

#### 3.01 ERECTION:

- A. Erection of metal building, accessories, and insulation shall be performed by one of the following:
  1. Authorized systems contractors or builders of the manufacturer.
  2. Building manufacturer's crews.
  3. Other erectors authorized by the manufacturer as trained and qualified to erect that manufacturer's product. In this case, the manufacturer shall inspect the work and certify its correctness.

END OF SECTION

## SECTION 21 22 00- CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 APPLICABLE STANDARDS AND PUBLICATIONS

- A. The design, installation, testing and maintenance of the Clean Agent Extinguishing System shall be in accordance with the applicable requirements set forth in the latest edition of the following codes, standards, and third party approval agencies:
  1. NFPA 2001: Standard on Clean Agent Fire Extinguishing Systems
  2. NFPA 70: National Electrical Code
  3. NFPA 72: National Fire Alarm and Signaling Code
  4. Factory Mutual (FM)
  5. Underwriters Laboratories (UL)
  6. Requirements of the local Authority Having Jurisdiction (AHJ)

#### 1.3 SUMMARY

- A. Section Includes:
  1. Piping and piping specialties.
  2. Extinguishing-agent containers.
  3. Extinguishing agent.
  4. Detection and alarm devices.
  5. Releasing control panel.
  6. Accessories.
  7. Connection devices for and wiring between system components.
  8. Connection devices for power and integration into building's fire-alarm system.
- B. Section Excludes:
  1. Power supply (120/240 VAC) to system control panel.
  2. Interface (conduit and wiring) to HVAC units, dampers, electric power supplies, relays, or shunt-trip breakers.
  3. Interface (conduit and wiring) to local/remote fire alarm system
  4. Connection to listed central station fire alarm system.
  5. Room sealing, other than penetrations made by the suppression system contractor during system installation. Suppression system contractor shall coordinate room sealing requirements with project's General contractor and all sub-contractors.

#### 1.4 DEFINITIONS

- A. AHJ: Authority Having Jurisdiction.
- B. ATS: Acceptance Testing Specifications.
- C. EPO: Emergency Power Off.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  1. Prepared by persons with the following qualifications:
    - a. Trained and certified by the manufacturer of the Clean Agent Suppression system.
    - b. NICET certified Fire-Alarm Technician, Level III minimum.
  2. Comply with recommendations in the "Working Plans" Section of the "System Design" Chapter in NFPA 2001.
  3. Comply with the recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
  4. Include plans, elevations, sections, details, and attachments to other work.
  5. Include design calculations: Enclosure volume, agent quantity, backup battery, voltage drop, detector spacing, etc.
  6. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  7. Specifier Note: Retain subparagraph below for projects where routing of cable and conduit is critical.
  8. Include plans to indicate mounting location of field devices, including size and routing of cable and conduits.
  9. Specifier Note: Retain subparagraph below if submittals are required to be sealed by a PE.

10. Submittals shall be signed and sealed by a qualified professional engineer prior to submitting them to the Authority Having Jurisdiction.

11. Specifier Note: Retain subparagraph below if a construction permit is required prior to commencing the Work of this Section.

12. Submittals shall be approved by the Authority Having Jurisdiction prior to submitting them to Architect.

C. Delegated-Design Submittal: For clean-agent fire-extinguishing system signed and sealed by the qualified professional engineer.

1. Indicate compliance with performance requirements and design criteria, including analysis data.

2. Include design calculations for selecting the spacing and sensitivity of detection devices, complying with NFPA 72.

3. Include design calculations for weight, volume, and concentration of extinguishing agent required for each hazard area.

4. Include design calculations for enclosure pressure relief/venting as required to avoid structural damage to the hazard enclosure, equipment, or building.

5. Indicate the Following on Reflected Ceiling Plans:

a. Ceiling penetrations and ceiling-mounted items.

b. Extinguishing-agent containers if mounted above floor, piping and discharge nozzles, detectors, and accessories.

c. Method of attaching hangers to building structure.

d. Other ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.

6. Indicate the Following on Occupied Work Area Plans:

a. Controls and alarms.

b. Extinguishing-agent containers, piping and discharge nozzles if mounted in space, detectors, and accessories.

c. Equipment and furnishings.

7. Indicate the Following on Access Floor Space Plans:

a. Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.

b. Method of supporting piping.

8. Indicate the Following on Ceiling Plans:

a. Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.

b. Method of supporting piping.

c. Other equipment located in the ceiling space that is being protected including sprinkler piping, HVAC equipment, raceways, or conduit.

#### 1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Domestic water piping.

2. Items Penetrating Finished Ceiling Include the Following:

a. Lighting fixtures.

b. Air outlets and inlets.

B. Permit Approved Drawings: Working plans, prepared according to NFPA 2001, that have been approved by authorities having jurisdiction. Include design calculations.

C. Seismic Qualification Certificates: For extinguishing-agent containers and control panels from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control reports.

E. Installer Qualifications:

1. Authorized distributor of the system manufacturer. Shall maintain an inventory of replacement parts.

2. Trained by the system manufacturer to design, install, test, and maintain the clean agent extinguishing system.

3. Provide proof of emergency service available on a twenty-four hour, seven-days-a-week basis.

4. Maintain or have access to a recharging station capable of recharging the largest suppression system within 72 hours after a discharge.

5. Minimum five (5) years' experience in the design, installation, and testing of clean-agent fire extinguishing systems. A list of systems of similar nature and scope shall be provided upon request.

6. Shall employ a NICET Level IV certified special hazard designer, who will be responsible for this project.



### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For special agent system to include in emergency, operation, and maintenance manuals.
- B. Deliver copies to Authorities Having Jurisdiction and include the following:
  - 1. Comply with the "Records" Section of the "Inspections, Testing and Maintenance" Chapter of NFPA 72.
  - 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
  - 3. Record copy of site-specific software.
  - 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
    - a. Frequency of testing of installed components.
    - b. Frequency of inspection of installed components.
    - c. Requirements and recommendations related to results of maintenance.
    - d. Manufacturer's user training manuals.
  - 5. Manufacturer's required maintenance related to system warranty requirements.
  - 6. Abbreviated operating instructions for mounting at the control panel.
  - 7. Specifier Note: Retain subparagraph below when project contain water-based sprinkler systems.
  - 8. Copy of NFPA 25.
- C. As-built Drawings: Indicate actual installation configuration at time of project completion including all equipment locations, pipe routing, conduit routing, room configurations, etc.

### 1.8 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. Deliver extra materials to Owner.
  - 1. Detection Devices: Not less than 20 percent of amount of each type installed.
  - 2. Container Valves: Not less than 10 percent of amount of each size and type installed.
  - 3. Nozzles: Not less than 20 percent of amount of each type installed.
  - 4. Extinguishing Agent: Not less than 100 percent of amount installed in largest hazard area. Include pressure-rated containers with valves.

### 1.9 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. Specifier Note: Retain "FM Global Compliance" Paragraph below if FM-Approved components are required.
- C. FM Global Compliance: Provide components that are FM Approved and that are listed in FM Global's "Approval Guide."
- D. UL Compliance: Provide equipment listed in UL's "Fire Protection Equipment Directory."
- E. All devices, components, and equipment shall be new, standard products of the manufacturer's latest design and suitable to perform the functions intended. The name of the manufacturer, part number, and serial number shall appear on all major components.
- F. Locks for all cabinets shall be keyed alike.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide a HFC-227ea or FM200 or comparable product by one of the following manufacturers:
  - 1. Chemetron Fire Systems; a UTC Fire & Security company.
  - 2. Ansul.
  - 3. Pem All Fire Extinguisher Corporation; a division of Pem Systems Inc.
  - 4. Siemens Building Technologies, Inc.; Fire Safety Division.
  - 5. DuPont.

### 2.2 Description: Clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard of LAN/TELCO room GAF-13 as shown on plans.

- A. Delegated Design: Design clean-agent fire-extinguishing system and obtain approval from authorities having jurisdiction. Design system for Class A and C fires as appropriate for areas being protected, and include safety factor. Use clean agent indicated and in concentration suitable for normally occupied areas.
- B. Specifier Note: Retain one of three "Performance Requirements" paragraphs below. Verify agent concentration, holding time, and other requirements with authorities having jurisdiction.
- C. Performance Requirements: (HFC-227ea per NFPA 2001).
  - 1. Minimum design concentration: 10% by volume in all areas and/or protected spaces at the minimum anticipated temperature within the protected area.

2. Per NFPA 2001, the system design shall not exceed a maximum exposure limit concentration level of 10.5% by volume, unless provisions for room evacuation before agent release are provided. All personnel should be able to leave the protected space prior to the discharge or at least within 5 minutes of the commencement of discharge.
  - D. Verified Detection: Devices located in single zone. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating second-detection device.
  - E. Single Detector Release: Devices located in a single zone. Sound alarm on activating single-detection device, and discharge extinguishing agent.
- 2.3 SYSTEM OPERATING SEQUENCE
- A. Cross-Zone or Verified Detection:
    1. Actuating First Detector (Alarm):
      - a. Visual and audible indication on control panel.
      - b. Visual indication on optional annunciator panel.
      - c. Energize audible and visual alarms inside the protected hazard area (unique pattern).
      - d. Transfer relays to shut down air-conditioning and ventilating systems serving protected area, close doors in protected area, and send signal to fire-alarm system.
    2. Actuating Second Detector (Pre-discharge):
      - a. Visual and audible indication on control panel.
      - b. Visual indication on optional annunciator panel.
      - c. Energize audible and visual alarms inside the protected hazard area (unique pattern).
      - d. Transfer relays to shut down power to protected equipment.
      - e. Start time delay for extinguishing-agent discharge for [30] seconds.
      - f. Initiate system abort sequence.
    3. Extinguishing-agent discharge (Release): Pre-discharge time delay expires or manual release switch is operated.
      - a. Visual and audible indication on control panel.
      - b. Visual indication on optional annunciator panel.
      - c. Energize audible and visual alarms inside and outside the protected area (unique pattern).
      - d. Release clean agent suppression system agent.
      - e. Specifier Note: Include actuation of sprinkler systems only if coordinated with Section 211313 "Wet-Pipe Sprinkler Systems" and Section 211316 "Dry-Pipe Sprinkler Systems."
      - f. Release pre-action valve to allow water to fill sprinkler system.
  - B. System Operating Sequence: Single Detector Release.
    1. Actuating First Detector (Pre-discharge):
      - a. Visual and audible indication on control panel.
      - b. Visual indication on optional annunciator panel.
      - c. Energize audible and visual alarms inside the protected hazard area (unique pattern).
      - d. Transfer relays to shut down air-conditioning and ventilating systems serving protected area, close doors in protected area, and send signal to fire-alarm system.
      - e. Transfer relays to shut down power to protected equipment.
      - f. Start time delay for extinguishing-agent discharge for [30] seconds.
        - g. Initiate system abort sequence.
    2. Extinguishing-agent discharge (Release):
      - a. Visual and audible indication on control panel.
      - b. Visual indication on optional annunciator panel.
      - c. Energize audible and visual alarms inside and outside the protected area (unique pattern).
      - d. Discharge extinguishing agent upon expiration of the discharge time delay.
      - e. Specifier Noe: Include actuation of sprinkler systems only if coordinated with Section 211313 "Wet-Pipe Sprinkler Systems" and Section 211316 "Dry-Pipe Sprinkler Systems."
      - f. Release pre-action valve to allow water to fill sprinkler system.
  - C. Supervisory signal initiation shall be by one or more of the following devices and systems:
    1. Clean agent container low pressure switch.
  - D. Trouble signal initiation shall be by one or more of the following devices and actions:
    1. Open circuits, shorts, and grounds in designated circuits.
    2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
    3. Loss of primary power at fire-alarm control unit.
    4. Ground or a single break in fire-alarm control unit internal circuits.
    5. Abnormal AC voltage at fire-alarm control unit.
    6. Break in standby battery circuitry.
    7. Failure of battery charging.
    8. Abnormal position of any switch at fire-alarm control unit or annunciator.

- E. System Supervisory and Trouble Signal Actions:
    - 1. Visual and audible indication on control panel.
    - 2. Visual indication on optional annunciator panel.
    - 3. Transfer relays to send signal to fire-alarm system.
  - F. Operating manual release switches will cause the immediate discharge of the extinguishing agent, overriding the system's discharge time delay and abort functions. Panel operation shall duplicate the extinguishing-agent discharge sequence described in the previous paragraphs.
    - 1. Electric manual release switches shall be located at each hazard exit.
    - 2. Push button actuators shall be located on extinguishing agent container solenoid actuator. Requires a discharge pressure switch to be mounted on the discharge piping. Switch shall be wired to the control panel to indicate system activation when actuator is pressed.
  - G. Operating abort switches will delay extinguishing-agent discharge while being activated. Release of hand pressure on the switch will cause agent discharge if the discharge time delay has expired.
  - H. Specifier Note: Retain paragraph below only if emergency power off is applicable to project.
  - I. EPO: Will terminate power to protected equipment immediately on actuation.
  - J. Low-Agent Pressure Switch: Initiate trouble alarm if sensing less than set pressure.
- 2.4 PIPING MATERIALS
- A. See "Writing Guide" Article in the Evaluations for a discussion on the Section Text's organization and the most efficient way to revise the Section Text. See "Manufacturer's Installation Manual" Article for applications of pipe, tube, fitting, and joining materials.
  - B. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section 4.2 "Distribution," for charging pressure of system.
- 2.5 PIPE AND FITTINGS
- A. Steel Pipe: ASTM A-106, Seamless, [Grade A] ; ASTM A-106, Seamless, Grade C; ASTM A-53, ERW, [Grade A]; Schedule 40.
    - 1. Threaded Fittings:
      - a. Malleable-Iron Fittings: ASME B16.3, Class 300.
      - b. Flanges and Flanged Fittings: ASME B16.5, Class 300.
      - c. Specifier Note: HFC-227ea systems are usually 360-psig (2482-kPa) charging-pressure systems. Verify system charging pressure.
      - d. Fittings Working Pressure: **416 psig (2868 kPa)** minimum.
      - e. Threaded malleable or ductile iron: Class 300
      - f. Flanged Joints: Class 300 minimum.
    - 2. Steel, Grooved-End Fittings: FM Approved and NRTL listed, ASTM A 47/A 47M malleable iron or ASTM A 536 ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.
  - B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
    - 1. ASME B16.21, nonmetallic, flat, asbestos-free, **1/8-inch (3.2-mm)** maximum thickness unless thickness or specific material is indicated.
  - C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
  - D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
  - E. Steel, Keyed Couplings: UL 213, AWWA C606, approved or listed for clean-agent service, and matching steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gasket, and steel bolts and nuts.
- 2.6 VALVES
- A. General Valve Requirements:
    - 1. UL listed or FM Approved for use in fire-protection systems.
    - 2. Compatible with type of clean agent used.
    - 3. Automatic excessive pressure relief provision.
    - 4. Low pressure gauge.
  - B. Container Valves: With fast acting rupture disc with solenoid actuator and manual-release lever, capable of immediate and total agent discharge and suitable for intended flow capacity.
  - C. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid, or install valve and separate pressure relief device.
  - D. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.

## 2.7 EXTINGUISHING-AGENT CONTAINERS

- A. Description: High strength alloy steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.
  - 1. Specifier Note: Retain one of two options in first subparagraph below.
  - 2. Finish: Manufacturer's standard color, enamel or epoxy paint.
  - 3. Specifier Note: Retain one of two "Manifold" subparagraphs below or delete as required for arrangement.
  - 4. Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.
  - 5. Manifold: Fabricate with valves, pressure switches, selector switch, and connections for main- and reserve-supply banks of multiple storage containers.
  - 6. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.
- B. Location: Located within hazard area, or as near as possible to reduce the required amount of pipe and fittings.

## 2.8 FIRE-EXTINGUISHING CLEAN AGENT

- A. HFC-227ea Clean Agent: Heptafluoropropane.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Fike®; HFC-227ea or comparable product by one of the following:
    - a. DuPont.
    - b. Great Lakes Chemical Corporation; a Chemtura company.

## 2.9 DISCHARGE NOZZLES

- A. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, size, discharge pattern, and capacity required for application.

## 2.10 MANIFOLD AND ORIFICE UNIONS

- A. Description: NRTL-listed device with minimum 2175-psig (15-MPa) pressure rating, to control flow and reduce pressure of IG-55 gas in piping.
  - 1. NPS 2 (DN 50) and Smaller: Piping assembly with orifice, sized for system design requirements.
  - 2. NPS 2-1/2 (DN 65) and Larger: Piping assembly with nipple, sized for system design requirements.

## 2.11 CONTROL PANELS

- A. Description: FM Approved or NRTL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system. Listed and approved for releasing service, and suitable for deluge/pre-action sprinkler service.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Fike®; SHP-PRO® or comparable product by one of the following:
- B. Power Requirements: [120] V ac; with electrical contacts for connection to system components and fire-alarm system, and transformer or rectifier as needed to produce power at voltage required for initiating devices, notification appliances, trouble signals, supervisory signals, digital alarm communicator transmitter, and auxiliary power.
  - 1. Alarm current draw of the entire clean agent suppression system shall not exceed 80 percent of the control panel's power supply rating.
- C. Enclosure: NEMA ICS 6, Type 1, steel cabinet.
  - 1. Mounting: Surface.
  - 2. Finish: [Red]baked on enamel finish
- D. Supervised Circuits: Wired NFPA 72, [Class A]
  - 1. Two detection circuits; capable of cross zone; sequential; single detector release actuation methods.
  - 2. Three initiating device circuits; capable of monitoring contact closure devices.
  - 3. Three notification appliance circuits.
  - 4. Agent release circuit capable of actuating suppression system.
  - 5. Solenoid release circuit capable of actuating suppression system or sprinkler solenoids.
  - 6. Auxiliary power circuit (resettable/non-resettable) for field devices.
  - 7. Three Form-C relay contacts for auxiliary control functions.
  - 8. Eight additional Form-C relay contacts with addition of supplemental relay cards.
- E. Control-Panel Features:
  - 1. Specifier Note: Verify availability and applicability of control-panel features.
  - 2. Microprocessor controlled.
  - 3. Ten LED indicators to provide positive indication of system status.
  - 4. Diagnostic LED indicator to display system and trouble events.
  - 5. Configurable via dip-switches.
  - 6. Automatic switchover to standby power at loss of primary power.
  - 7. Storage container, low-pressure indicator.

8. Service disconnect to interrupt system operation for maintenance with visual status indication on the panel.
  9. Silence and reset switch.
  10. 120 VAC or 240 VAC power input.
  11. Five optional abort types.
  12. Simultaneous monitoring and release of clean agent and sprinkler suppression systems.
- F. Annunciator Panel: Graphic type showing protected, hazard-area plans, as well as locations of detectors and abort, EPO, and manual stations. Include lamps to indicate device-initiating alarm, electrical contacts for connection to control panel, and stainless-steel or aluminum enclosure.
- G. Standby Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Batteries: Sealed lead calcium, sized to operate system for [24] hours and alarm for minimum of [15] minutes.
- H. Optional Cards: Cards mount directly to and receive their operational power from the SHP PRO® control board.
1. Class A Input Module: Converts all five initiating devices circuits to NFPA 72, Class A wiring.
  2. Class A Output Module: Converts all three notification appliance and releasing circuits to NFPA 72, Class A wiring.
  3. Relay Module: Provides four additional Form-C relay contacts for auxiliary control functions.
- ## 2.12 SYSTEM SMOKE DETECTORS
- A. General Requirements:
1. Comply with NFPA 2001, NFPA 72, and UL 268.
  2. 24-V dc, nominal.
  3. Two-wire type.
  4. Self-restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  5. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
- B. Ionization Detectors: Dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
- C. Photoelectric Detectors: LED light source and silicon photodiode receiving element.
- D. Base Mounting: Detector shall be mounted on a twist-lock, fixed base.
1. Select according to operational characteristics: Verified detection, Cross-zone detection, and Single-detector release.
  2. Base provides terminals for connection to control unit.
- E. Signals to the Central Fire Alarm Control Panel: Any type of local system Alarm, Trouble, or Supervisory event is reported to the central fire alarm control panel as a composite signal for each event type.
- ## 2.13 HEAT DETECTORS
- A. General Requirements:
1. Comply with NFPA 2001, NFPA 72, and UL 521.
  2. 24-V dc nominal.
  3. Two-wire type.
  4. Self-restoring: Detectors do not require resetting after actuation to restore them to normal operation.
  5. Integral Visual-Indicating Light: LED type, indicating detector has operated and power on status.
- B. Fixed Temperature Type: Actuated by a temperature that exceeds a fixed temperature of 190 deg F.
- C. Combination Type: Actuated by either a fixed temperature of 190 deg. F or a rate of rise that exceeds 12 deg F (11 deg C) per minute unless otherwise indicated.
- D. Base Mounting: Detector shall be mounted on a twist-lock, fixed base.
1. Select according to operational characteristics: Verified detection, Cross-zone detection, and Single-detector release.
  2. Base provides terminals for connection to control unit.
- ## 2.14 LINEAR HEAT DETECTION
- A. General Requirements:
1. Comply with NFPA 2001, NFPA 72, and UL 521.
  2. Temperature Rating: Actuated by a temperature that exceeds a fixed temperature of 155 deg F ‘
- B. Connects to the control panels detection and input circuits; providing a contact closure input.
- ## 2.15 SWITCHES
- A. General Description: [Surface] FM Approved or NRTL listed, low voltage, includes contacts for connection to control panel.
- B. Manual Release Switch: Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
1. Stainless steel faceplate.
  2. Dual-action requiring two distinct operations to initiate suppression system release.
  3. Red plastic release button, keyed reset.
  4. "MANUAL RELEASE" caption.

- C. Abort Switch: Unit can manually prevent the release of the suppression system while pressed.
  - 1. Stainless steel faceplate.
  - 2. Red plastic abort button, momentary contact (dead-man type).
  - 3. Available with key-operated switch.
  - 4. "SYSTEM ABORT" caption.
- D. Main-Reserve Switch: Unit allows transfer of release circuit signal from main supply to reserve supply.
  - 1. Stainless steel faceplate.
  - 2. Black plastic selector button (main/reserve)
  - 3. "CONTAINER SELECT" caption.
- E. EPO Switch: "EPO" caption, with yellow finish.
- F. Low-Agent Pressure Switches: Installed on extinguishing agent container; pneumatic operation.
- G. Suppression Disconnect Switches: Unit enables releasing circuit (i.e., clean agent or sprinkler) to be disconnected from the control panel.
  - 1. Stainless steel faceplate.
  - 2. Key operated selector switch (armed/disarmed).
  - 3. LEDs to provide indication of switch status (armed/disarmed).
  - 4. "SUPPRESSION DISCONNECT" caption.
- H. Discharge Pressure Switches: Installed on suppression piping to provide indication of manual actuation of the clean agent suppression system back to the control panel.

#### 2.16 ALARM DEVICES

- A. General Requirements: Listed and labeled by an NRTL or FM Approved, low voltage, and surface mounting.
- B. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly. Connected to notification appliance signal circuits, equipped for mounting as indicated and with screw terminals for system connections.
- C. Bells, comply with UL 464: High dBa output; 120-V ac; vibrating type; minimum **6-inch (150-mm)** diameter. Bells shall produce a sound-pressure level of 90 dBa minimum, measured 10 feet (3 m) from horn.
- D. Horns, comply with UL 464: Electric-vibrating-polarized type, 24-V dc. Horns shall produce a sound-pressure level of 90 dBa minimum, measured 10 feet (3 m) from horn.
- E. Visible Notification Appliances, comply with UL 1971: Xenon strobe lights with translucent lens, with "FIRE" or similar caption.
  - 1. Rated Light Output:
    - a. Indicated on drawings.
    - b. 15/30/75/110 cd, selectable in the field.
  - 2. Mounting: Indicated on Drawings.
  - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  - 4. Flashing shall be in a temporal pattern, synchronized with other units.
  - 5. Strobe Leads: Factory connected to screw terminals.
  - 6. Mounting Faceplate: Factory finish, red.

#### 2.17 INFORMATIONAL SIGNAGE

- A. Provide informational signs as required to comply with NFPA 2001 for the specific agent.

#### 2.18 ANNUNCIATOR PANEL

- A. Description: Annunciator shall provide a graphic display of the protected area, and shall provide LEDs to indicate the location of system detectors.
  - 1. Mounting: Steel enclosure; black finish; flush or surface mounted.

#### 2.19 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Features:
  - 1. 100 event history buffer.
  - 2. Communication Protocols: Modem IIIa<sup>2</sup>, SIA, and 4/2
  - 3. LEDs for heartbeat, system trouble, and telephone line trouble (one per line).
  - 4. Dual telephone line interface.
  - 5. Self-Test: Conducted automatically every 10 minutes with report transmitted to central station.
  - 6. Communication failure indication.
  - 7. Operating Power: 24-V dc continuous power from control panel.
- C. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from the control panel and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with the central station, signals shall be transmitted. If service on either line is interrupted for longer than 36 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the

remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

- D. Mounting: Digital alarm communicator transmitter must be mounted adjacent to the control panel within 20 feet (6.1 m) with interface wiring in conduit.
- E. Secondary Power: Auxiliary power supply with integral rechargeable battery and automatic charger; UL listed for Fire Protective Signaling System service.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with hazard-area leakage requirements, installation tolerances, and other conditions affecting work performance.
  - 1. The general contractor shall be responsible for sealing and securing the protected enclosure against agent loss and/or leakage during the required agent "hold" period.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PIPING APPLICATIONS

- A. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
- B. **NPS 2 (DN 50)** and Smaller: Schedule 40, steel pipe; malleable-iron threaded fittings; and threaded joints.
- C. **NPS 2-1/2 (DN 65)** and Larger: Schedule 40, steel pipe;

#### 3.3 PIPING APPLICATIONS

- A. Piping between Storage Containers and Orifice Union: Schedule [80] , steel pipe;
- B. Piping Downstream from Orifice Union: Schedule [40]

#### 3.4 CLEAN-AGENT PIPING INSTALLATION

- A. Install clean-agent extinguishing piping and other components level and plumb, according to manufacturers' written instructions.
- B. Each pipe section shall be cleaned internally after preparation and before assembly by means of swabbing, using a suitable nonflammable cleaner. Pipe network shall be free of particulate matter and oil residue before installing nozzles or discharge devices.
- C. Grooved Piping Joints: Groove pipe ends according to AWWA C606 dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.
- D. Install extinguishing-agent containers anchored to substrate.
- E. All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male threads only.
- F. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001, Section 4.2 "Distribution."
  - 1. Install valves designed to prevent entrapment of liquid, or install pressure relief devices in valved sections of piping systems.
  - 2. Support piping using supports and methods according to NFPA 13.
  - 3. Install seismic restraints for extinguishing-agent containers and piping systems.

#### 3.5 DETECTION, ACTUATION, ALARM, AND CONTROL SYSTEMS INSTALLATION

- A. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 72 and NFPA 2001, Section "Detection, Actuation, and Control Systems," as required for supervised system application.
- B. Smoke or Heat Detector Spacing:
  - 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke detector spacing.
  - 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat detector spacing.
  - 3. Specifier Note: Retain first subparagraph below to indicate how Contractor shall determine detector spacing.
  - 4. Smoke ceiling spacing shall not exceed 30 feet (9 m).
  - 5. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
  - 6. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
  - 7. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
- C. Audible Alarm-Indicating Devices: Wall mounted with tops above the finished floor not less than 90 inches (2.29 m), and below the ceiling not less than 6 in. (150 mm). Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

- D. Visible Alarm-Indicating Devices: Wall mounted with entire lens not less than 80 in. (2.03 m) and not greater than 96 in. (2.44 m) above the finished floor. Where ceiling height does not permit mounting at minimum height, mount within 6 inches (150 mm) of the ceiling.
- E. Combination Audible-Visual Devices: Where combination audible and visual devices are used, mount devices according to Visual Alarm-Initiating Device requirements.
- F. Control Unit: [Surface] [Flush] mount, with top of cabinet not more than 72 inches (1830 mm) above the finished floor.
- G. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to equipment, allow space for service and maintenance.
- C. Connect electrical devices to control panel and to building's fire-alarm system.

### 3.7 IDENTIFICATION

- A. Identify system components, equipment, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001.
- C. Install signs at entry doors for protected areas to warn occupants that they are entering a room protected with a clean-agent fire-extinguishing system.
- D. Specifier Note: Revise paragraph below to include warning devices that are to be installed.
- E. Install signs at entry doors to advise persons outside the room the meaning of the horn(s), bell(s), and strobe light(s) outside the protected space.
- F. Install framed operating instructions in a location visible from control unit.

### 3.8 SYSTEM WIRING

- A. Wiring shall be installed by qualified individuals, in a neat and workmanlike manner in accordance with the National Electrical Code (NEC), Article 725 and 760, except as otherwise permitted for limited energy circuits as described in NFPA 72. Installation shall meet all local, state, province and/or country codes.
- B. All wiring shall be installed in electrical metallic tubing (EMT) or conduit, and must be kept separate from all other building wiring. Runs of conduit shall be straight, neatly arranged, properly supported and installed parallel and perpendicular to walls and partitions.
- C. Conductors shall be sized according to the design documents and color coded to allow easy circuit identification.
- D. All wires shall be tagged at all junction boxes.
- E. All wires shall be tested for the presence of opens, shorts and grounds prior to connection to control panel. Final wire terminations to control panel shall be made under the direct supervision of a factory trained representative.
- F. All system components shall be securely supported independent of the wiring.
- G. Ground control panel and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to control panel.

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Specifier Note: Retain first paragraph below to require a factory-authorized service representative to perform inspections, tests, and adjustments.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- D. 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.
- E. Submit test plan for review and approval by the owner or owner's designated representative prior to performing tests.
- F. Detection, Actuation, Alarm, and Control Systems Tests:
  - 1. Visual Inspection: Conduct the visual inspection prior to testing.
    - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamental of Fire Alarm Systems" Chapter.
    - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  - 2. Operational Test: After electrical circuitry has been energized, apply power to control panel and confirm proper unit operation. Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing, and Maintenance" Chapter in NFPA 72.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- G. Clean-Agent Fire Extinguishing Systems Test:



1. Flow Test: Using nitrogen or other inert gas, perform a flow test on the piping network to verify that flow is continuous and unobstructed through piping and nozzles.
2. Pressure/Leak Test: pneumatically test the piping in a closed circuit for a period of 10 minutes at 40 psi (276 kPa). At the end of 10 minutes, the pressure drop shall not exceed 20 percent of the test pressure. Repair leaks and retest until no leaks exist.
3. Room Pressurization Test: After all construction work is complete, conduct a room pressurization test in accordance with NFPA 2001 in each clean agent suppression system hazard area. Test shall confirm enclosures ability to retain the agent concentration level for the required hold time. If the test fails, the suppression system contractor shall coordinate room sealing with the general contractor. Additional tests shall be conducted until successful test results are achieved. Include final test results in project 'Closeout Submittals'.

H. System will be considered defective if it does not pass tests and inspections.

- I. Prepare test and inspection reports: Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

### 3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the clean-agent fire-extinguishing systems.

### 3.11 SERVICE CONTRACT

- A. Suppression system installing contractor shall provide two (2) inspections of the systems installed under this contract, during the manufacturer's one-year warranty period. The first inspection shall be at the six month interval, and the second shall be at the twelve month interval after system acceptance.
- B. Inspections shall be conducted in accordance with the equipment manufacturer's guidelines and the recommendations of NFPA 72 and NFPA 2001. Use forms provided in NFPA 72 for initial tests and inspections.
- C. Prepare and submit test and inspection reports.

### 3.12 WARRANTY

- A. Clean Agent System manufacturer shall guarantee all components furnished under this contract against defects in design, materials, and workmanship for no less than one (1) year from the date of system acceptance.

END OF SECTION

## SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Includes But Not Limited To:
1. Furnish and install complete wet-pipe fire sprinkler system as specified in Contract Documents.
  2. Furnish and install Firestop Penetration Systems for fire sprinkler system penetrations as described in Contract Documents.

#### 1.2 REFERENCES

- A. Association Publications:
1. Underwriters Laboratories, Inc.:
    - a. UL Directory B, 'Fire Protection Equipment Directory' (2011).
- B. Reference Standards:
1. American National Standards Institute / American Society of Mechanical Engineers:
    - a. ANSI/ASME B1.20.1-1983(R2006), 'Pipe Threads, General Purpose (Inch)'.
    - b. ANSI/ASME B16.1-2010, 'Cast Iron Pipe Flanges and Flanged Fittings'.
    - c. ANSI/ASME B16.3-2011, 'Malleable Iron Threaded Fittings: Classes 150 and 300'.
    - d. ANSI/ASME B16.4-2011, 'Gray Iron Threaded Fittings, Classes 125 and 250'.
    - e. ANSI/ASME B16.5-2009, 'Pipe Flanges and Flanged Fittings'.
  2. American National Standards Institute / American Water Works Association:
    - a. ANSI/AWWA C606-11, 'Grooved and Shouldered Joints'.
  3. American National Standards Institute / American Welding Society:
    - a. ANSI/AWA B2.1/B2.1M-2009, 'Specification for Welding Procedure and Performance Qualification'.
  4. ASTM International:
    - a. ASTM A53/A53M-12, 'Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless'.
    - b. ASTM A135/A135M-09, 'Standard Specification for Electric-Resistance-Welded Steel Pipe'.
    - c. ASTM A234/A234M-11a, 'Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service'.
    - d. ASTM A395/A395M-99(2009), 'Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures'.
    - e. ASTM A536-84(2009), 'Standard Specification for Ductile Iron Castings'.
    - f. ASTM A795/A795M-08, 'Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use'.
  5. National Fire Protection Association / American National Standards Institute:
    - a. NFPA 13: 'Standard for the Installation of Sprinkler Systems', (2010 Edition).
    - b. NFPA 24: 'Installation of Private Fire Service Mains and their Appurtenances', (2010 Edition).
    - c. NFPA 25: 'Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems', (2011 Edition).
    - d. NFPA 101: 'Life Safety Code', (2012 Edition).

#### 1.3 SUBMITTALS

- A. Action Submittals:
1. Shop Drawings:
    - a. Size sprinkler system by one of following methods:

- 1) Hydraulic calculation design method based on water supply evaluation performed at building site.
  - b. On submittals, refer to sprinkler heads by sprinkler identification or model number published in appropriate agency listing or approval. Trade names and other abbreviated designations are not acceptable.
  - c. Submittal Procedure:
    - 1) After award of Contract and before purchase of equipment, submit seven sets of shop drawings with specifications and hydraulic calculations to Architect and two sets to local jurisdiction having authority for fire prevention for review.
    - 2) After integrating Architect's and AHJ's comments into drawings, licensed certified fire protection engineer of record who designed fire protection system shall stamp, sign, and date each sheet of shop drawings and first page of specifications and calculations.
    - 3) Submit stamped documents to Owner and to AHJ for fire prevention for final approval.
    - 4) After final approval, submit four copies of approved stamped documents to Architect.
    - 5) Failure of system to meet requirements of authority having jurisdiction and/or approved stamped construction documents shall be corrected at no additional cost to Owner.
- B. Informational Submittals:
1. Qualification Statement:
    - a. Licensed fire protection engineers or fire protection system designer:
      - 1) Licensed for area of Project.
      - 2) Certified by NICET to level three minimum.
      - 3) Provide Qualification documentation if requested by Architect or Owner.
    - b. Installer:
      - 1) Provide Qualification documentation if requested by Architect or Owner.
- C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Operations and Maintenance Data:
      - 1) Maintenance and instructions.
        - a) List of system components used to indicate name and model of each item.
        - b) Manufacturer's maintenance instructions for each component installed in Project.
        - c) Instructions shall include installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
    - b. Warranty Documentation:
      - 1) Include copies of required warranties.
    - c. Record Documentation:
      - 1) Include copies of approved shop drawings.
      - 2) Provide master index showing items included.
      - 3) Provide name, address, and phone number of Architect, Architect's Fire Sprinkler Consultant, General Contractor, and Fire Protection subcontractor.
      - 4) Provide operating instructions to include:
        - a) General description of fire protection system.
        - b) Step by step procedure to follow for shutting down system or putting system into operation.
      - 5) Provide copy of system's above ground and below ground hydrostatic tests. Provide separate copies for Architect and Owner.
      - 6) Provide copy of 'Contractor's Material and Testing Certificate for Above Ground Piping' NFPA 13, Figure 24.1 (2010 edition).
  2. Inspection:
    - a. Provide Owner with latest version of NFPA 25.
- D. Maintenance Material Submittals;
1. Extra Stock Materials:
    - a. Spare sprinkler heads in the quantity recommended by NFPA 13 selected in representative proportion to quantity used in Project and in accordance with NFPA 13 (Six (6) spare sprinkler heads minimum).
    - b. Provide spare heads in cabinet with sprinkler head wrench for each type of head used. After approval of cabinet and contents, mount cabinet in convenient location in Riser Room.

## 1.4 QUALITY ASSURANCE

### A. Requirements of Regulatory Agencies:

1. Unless noted otherwise, system shall conform to:
  - a. NFPA 13, 'Light & Ordinary Hazard Occupancies'.
  - b. NFPA 24, 'Service Mains and Their Appurtenances, Private'.
  - c. NFPA 25, 'Inspection, Testing, and Maintenance.
  - d. NFPA 101, 'Life Safety Code'.
  - e. Requirements of local water department and local authority having jurisdiction for fire protection.
  - f. Underwriters Laboratories Publication, UL Directory B, 'Fire Protection Equipment Directory', current edition at time of Pre-Bid Meeting.
  - g. Comply with backflow prevention requirements and, if required, include device in hydraulic calculations.
  - h. Applicable rules, regulations, laws, and ordinances.

### B. Qualifications:

1. Licensed fire protection engineer or fire protection system designer certified by NICET to level three minimum and engaged in design of fire protection systems. Engineer / designer shall:
  - a. Licensed for area of Project.
  - b. Minimum five (5) years experience in fire protection system installations.
  - c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
  - d. Be responsible for overseeing preparation of shop drawings, hydraulic calculations where applicable, and system installation.
  - e. Make complete inspection of installation.
  - f. Provide corrected record drawings to Owner with letter of acceptance.
  - g. Certify that installation is in accordance with Contract Documents.
  - h. Upon request, submit documentation.
2. Installer:
  - a. Licensed for area of Project.
  - b. Minimum five (5) years experience in fire protection system installations.
  - c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
  - d. Upon request, submit documentation.

## PART 2 - PRODUCTS

### 2.1 SYSTEM

#### A. Manufacturers:

1. Manufacturer Contact List:
  - a. Croker Corp, Elmsford, NY [www.croker.com](http://www.croker.com).
  - b. Gruvlock by Anvil International, Portsmouth, NH [www.anvilintl.com](http://www.anvilintl.com).
  - c. HO Trerice Company, Oak Park, MI [www.hotco.com](http://www.hotco.com).
  - d. Kennedy Valve, Elmira, NY [www.kennedyvalve.com](http://www.kennedyvalve.com).
  - e. Milwaukee Valve Co, New Berlin, WI [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - f. Mueller Company, Decatur, IL [www.muellerflo.com](http://www.muellerflo.com).
  - g. Nibco Inc, Elkhart, IN [www.nibco.com](http://www.nibco.com).

#### B. Description:

1. Automatic wet-pipe fire sprinkler system starting at flange in Fire Riser Room and extending throughout heated portions of building.
2. Dry sprinkler heads preferred over and into Vestibules.

#### C. Performance:

1. Design Criteria:

- a. Area of Application and Corresponding Design Density:
    - 1) Serving Area and Mechanical, Electrical, and Janitorial Areas:
      - a) Ordinary Hazard Group 1.
      - b) Design density = 0.15 gpm per sq ft over 1,500 sq ft (140 sq m).
    - 2) Storage Areas:
      - a) Ordinary Hazard Group 2.
      - b) Design density = 0.20 gpm per sq ft over 1,500 sq ft (140 sq m).
    - 3) All Other Areas:
      - a) Light Hazard.
      - b) Design density = 0.10 gpm per sq ft over 1,500 sq ft (140 sq m).
    - 4) Increase remote areas by 30 percent where ceiling / roof is sloped more than 2 inches (50 mm) per ft.
    - 5) Remote areas may be reduced within parameters indicated in NFPA 13 for use of quick response sprinklers throughout.
  - b. Maximum Coverage per Sprinkler Head:
    - 1) Ordinary Hazard Areas: 130 sq ft (12.1 sq meters).
    - 2) Attic Areas: 120 sq ft (11.2 sq meters).
    - 3) Light Hazard Areas: 225 sq ft (20.1 sq meters).
  - c. Design Area shall be hydraulically most remote area in accordance with NFPA 13.
    - 1) Provide a 10 PSI safety allowance under adjusted water flow supply curve.
  - d. Maximum velocity of water flow within piping: 20 feet (6.1 m) per sec.
- D. Components:
1. General: Use only domestically manufactured cast iron pipe fittings, valves, sprinkler heads, and other components.
    - a. Pipe of foreign manufacture that meets ASTM Standards is acceptable.
    - b. Ductile iron fittings of foreign manufacture are acceptable.
  2. Pipe:
    - a. Schedule 40 Welded Steel:
      - 1) Exterior, Above Ground: Schedule 40 hot-dip galvanized welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
      - 2) Interior, Above Ground: Schedule 40 black welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
      - 3) Connections:
        - a) 2 inches (50 mm) And Smaller: Screwed, flanged, or roll grooved coupling system.
        - b) 2-1/2 inches (64 mm) And Larger: Flanged or roll grooved coupling system.
  3. Fittings:
    - a. Usage:
      - 1) 2 inches (50 mm) And Smaller: Welded, screwed, flanged, or roll grooved coupling system. For use with schedule 40 carbon steel pipe.
      - 2) 2-1/2 inches (64 mm) And Larger: Welded, flanged, or roll grooved coupling system.
    - b. Types And Quality:
      - 1) Screwed:
        - a) Cast iron meeting requirements of ANSI B16.4 or ductile iron meeting requirements of ANSI B16.3 and ASTM A536, Grade 65-45-12.
        - b) Threaded fittings and pipe shall have threads cut to ANSI B1.20.1.
        - c) Do not extend pipe into fittings to reduce waterway.
        - d) Ream pipe after cutting to remove burrs and fins.
      - 2) Flanged: Steel meeting requirements of ANSI B16.5.
      - 3) Welded:
        - a) Carbon steel meeting requirements of ASTM A234/A234M.
        - b) Weld pipe using methods complying with AWS B2.1, level AR-3. Welding procedures and performance of welders shall comply with AWS B2.1, level AR3.
      - 4) Roll Grooved Pipe Coupling System:
        - a) Ductile iron meeting requirements of ASTM A395/A395M and ASTM A536, and UL listed.
        - b) Grooved products used on Project shall be from same manufacturer. Grooving tools shall be as recommended by manufacturer of grooved products.
        - c) Category Four Approved Products: See Section 01 6200 for definition of Categories:

	Gruvlok	Tyco (Grinnell)	Victaulic
Rigid Couplings	7401	772	Style 005
Flexible Couplings <sup>1</sup>	7000	705	Style 75
Flange Adaptors <sup>2</sup>	7012	71	Style 744
Grooved Coupling Gaskets <sup>3</sup>	'E' EPDM	Grade 'E' EPDM	'E' EPDM <sup>4</sup>

<sup>1</sup> Use in locations where vibration attenuation, stress relief, thermal expansion, or seismic design is required / needed.

<sup>2</sup> Class 125 or 150.

<sup>3</sup> Temperature rated **30 to 150 deg F (minus one to plus 65 deg C)**. NSF-61 certified.

<sup>4</sup>Grade 'A'.

- c. Use of saddle or hole cut type mechanical tees is NOT APPROVED.
4. Valves:
- a. Butterfly Valves:
- 1) Design Criteria:
    - a) UL / CASA approved.
    - b) Indicating type.
  - 2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
    - a) Milwaukee:
      - (1) Model BB-SCS02 threaded ends with tamper switch **one inch (25 mm) to 2 inches (50 mm)**.
      - (2) Model BBVSCS02 Grooved ends with tamper switch **2 inches (50 mm) to 2-1/2 inch (64 mm)**.
    - b) Nibco:
      - (1) Model WD3510-8 Wafer type with valve tamper switch.
      - (2) Model GD4765-8N Grooved type with valve tamper switch, **2-1/2 inches (64 mm) to 8 inches (200 mm)**.
    - c) Tyco (Grinnell):
      - (1) Model BFV-N wafer.
      - (2) Model BFV-N grooved.
    - d) Victaulic: Series 705W Grooved end type with internal supv. switches.
    - e) Kennedy:
      - (1) Model 01W wafer.
      - (2) Model G300 grooved.
- b. Gate Valves:
- 1) Design Criteria:
    - a) UL / CASA approved.
    - b) Outside Screw and Yoke Type (O.S.&Y).
    - c) Class 150 psi.
  - 2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
    - a) Nibco:
      - (1) T-104-0 with Threaded Ends **1/2 inch (12.7 mm) to 2 inches (50 mm)**.
      - (2) F-637-31 Flanged Ends.
    - b) Mueller: R-2360-6 Flanged Ends.
    - c) Victaulic: Series 771 Grooved Ends
- c. Ball Valves:
- 1) Design Criteria:
    - a) UL / CASA approved.
    - b) Valve tamper switch.
  - 2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
    - a) Milwaukee: BB-SCS02 with threaded ends.
    - b) Nibco: KT-505 with threaded ends.
    - c) Nibco: KG-505 with grooved ends.
    - d) Victaulic: Series 728 with grooved or threaded ends.
- d. Swing Check Valves:
- 1) **1/2 to 3 inch (13 to 75 mm)** horizontal check.
    - a) Design Criteria:
      - (1) Regrinding type.

- (2) Renewable disk.
        - (3) Bronze Class 125 with threaded ends.
      - b) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
        - (1) Nibco: KT-403-W.
        - (2) Victaulic: Series 712.
        - (3) Viking: G-1 Grooved ends.
    - 2) **2 to 4 inch (50 to 100 mm)** Horizontal check:
      - a) Design Criteria:
        - (1) Grooved ends.
        - (2) Ductile iron body.
        - (3) Rated **300 psi (2.07 MPa)**.
      - b) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
        - (1) Tyco (Grinnell): CV-1F Grooved ends.
        - (2) Victaulic: Series 712.
        - (3) Viking: G-1 Grooved ends.
    - 3) **3 to 12 inch (76 to 300 mm)** Horizontal check:
      - a) Design Criteria:
        - (1) Bolted bonnet.
        - (2) Raised face flanges.
        - (3) Bronze mounted with ductile iron body.
        - (4) **125 lb (56.7 kg)** Class A.
      - b) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
        - (1) Nibco: F-938-31.
        - (2) Mueller: A-2120-6.
        - (3) Viking: F-1 grooved and flanged.
  - e. Wafer Type Check Valves:
    - 1) Design Criteria:
      - a) **4 to 8 inch (100 to 300 mm)** cast iron body.
      - b) **175 psi (1.21 MPa)** minimum working pressure.
      - c) Rubber Seat.
    - 2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      - a) Nibco: KW-900-W.
      - b) Mueller: A-2102.
      - c) Kennedy: Fig.706.
  - f. Grooved-End Check Valves:
    - 1) Design Criteria:
      - a) UL / CASA listed and approved to **250 psi (1.72 MPa)** maximum operating pressure.
      - b) **2-1/2 to 12 inch (64 to 300 mm)** ductile iron body.
      - c) Disc And Seat:
        - (1) **2-1/2 And 3 Inch (64 to 75 mm)**: Aluminum bronze disc with mounted elastomer seal and PPS (polyphenylene sulfide) coated seat.
        - (2) **4 Inch (100 mm)** And Larger: Elastomer encapsulated ductile iron disc with welded in nickel seat.
        - (3) Viking: Model VK462.
    - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Nibco: KG-900-W grooved ends.
      - b) Victaulic: Series 717.
      - c) Kennedy: Fig.426.
  - g. Alarm Check Valves:
    - 1) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      - a) Reliable: E with gauges and drain.
      - b) Tyco (Grinnell): Model AV-1-300.
      - c) Victaulic: Series 751 with gauges and drain.
      - d) Viking: J-1 with gauges and drain.
  - h. Backflow Preventer: Make and model shown on Drawings or as required by local codes.
  - i. Retard Chamber:
    - 1) Design Criteria:
      - a) Self-draining.
    - 2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:

- a) Reliable: E-1.
  - b) Victaulic: Series 752.
  - c) Viking: C-1.
  - j. Inspector's Test Valve:
    - 1) Design Criteria:
      - a) Bronze body with threaded or grooved ends.
      - b) Combination sight glass / orifice.
    - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Tyco (Grinnell): Model F350.
      - b) Victaulic: Testmaster Alarm Test Module Style 720.
5. Sprinkler Heads:
- a. Concealed Pendant:
    - 1) Design Criteria:
      - a) Adjustable cover.
      - b) UL / CASA listed and approved.
      - c) Coordinate concealed cover finish with Architect.
    - 2) Type One Acceptable Products:
      - a) Wet Pendant, Flat Profile:
        - (1) Reliable: F4FR.
        - (2) Victaulic: Model 3802.
        - (3) Viking: Model VK462.
        - (4) Tyco (Grinnell): Model RF11.
        - (5) Equal as approved by Architect before bidding. See Section 01 6200.
      - b) Dry Pendant:
        - (1) Flat Profile:
          - (a) Tyco (Grinnell): DS-C.
          - (b) Victaulic: V3618.
        - (2) Equal as approved by Architect before bidding. See Section 01 6200.
  - b. Horizontal Sidewall Sprinkler:
    - 1) Design Criteria:
      - a) UL / CASA listed and approved.
      - b) Recess adjustable.
      - c) Where guards are required, use chrome plated sprinkler guards that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.
    - 2) Type One Acceptable Products:
      - a) Wet System:
        - (1) Reliable: F1FR.
        - (2) Tyco (Grinnell): Model TY-FRB.
        - (3) Victaulic: Model V2710.
        - (4) Viking: VK305.
        - (5) Equal as approved by Architect before bidding. See Section 01 6200.
      - b) Dry System:
        - (1) Reliable: F3QR.
        - (2) Tyco (Grinnell): DS-1.
        - (3) Victaulic: Model V3610.
        - (4) Viking: VK162.
        - (5) Equal as approved by Architect before bidding. See Section 01 6200.
  - c. Attic Sprinklers, Upright:
    - 1) Design Criteria:
      - a) UL / CASA listed and approved.
      - b) Approved for use in roof structures, combustible and non-combustible, with ceiling below.
    - 2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      - a) Tyco: BB, SD, or HIP.
  - d. Pendant Sprinklers:
    - 1) Design Criteria:
      - a) UL / CASA listed and approved.



- b) Where guards or escutcheons are required, use chrome plated sprinkler guards and escutcheons that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.
- 2) Type One Acceptable Products:
  - a) Reliable: F1FR.
  - b) Tyco: TY-FRB.
  - c) Victaulic: Model V2704.
  - d) Viking: VK302.
  - e) Equal as approved by Architect before bidding. See Section 01 6200.
- e. Upright Sprinklers:
  - 1) Design Criteria:
    - a) UL / CASA listed and approved.
  - 2) Type One Acceptable Products:
    - a) Reliable: F1FR.
    - b) Tyco: TY-FRB.
    - c) Victaulic: Models V2704.
    - d) Viking: VK300.
    - e) Equal as approved by Architect before bidding. See Section 01 6200.
- 6. Water Flow Alarm:
  - a. Electric Flow Alarm:
    - 1) Design Criteria:
      - a) UL / CASA listed and approved.
    - 2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      - a) Potter Electric: Horn Strobe, SASH-120, 120VAC.
      - b) System Sensor: Horn Strobe, P2RHK-120, 120 VAC.
- 7. Waterflow Detectors:
  - a. Electrical Water Flow Switch:
    - 1) Design Criteria:
      - a) UL / CASA listed.
      - b) Switch activates with flow of 10 gpm (37.85 lpm) or more.
      - c) Two single pole double throw switches.
      - d) Automatic reset.
    - 2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      - a) Potter-Roemer: Model 6201 thru 6208.
      - b) System Sensor: WFD20 thru WFD80.
      - c) Viking: VSR-F.
- 8. Tamper Switch
  - a. Weather and Tamper Resistant Switch.
    - 1) Design Criteria:
      - a) UL / CASA listed.
      - b) Mount to monitor valve and not interfere with operation.
      - c) Shall operate in horizontal and vertical position.
    - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Control Valves, Butterfly Valves, Post Indicator Valves:
        - (1) Potter Electric: Model PCVS.
        - (2) Notifier: Model PIBV2.
        - (3) System Sensor: Model PIBV2.
      - b) O.S. & Y Valves:
        - (1) Potter Electric: Model OSYSU.
        - (2) System sensor: Model OSY2.
- 9. Automatic Drain Device:
  - a. Design Criteria:
    - 1) Straight Design, 3/4 inch: (19 mm).
  - b. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
    - 1) Nibco: Ball-Drip.
    - 2) Potter-Roemer: Figure 5982.
    - 3) Viking: B-1.
- 10. Fire Department Connection:
  - a. One Way Inlet with 5" Stortzguard Cap:

- 1) Class One Quality Standards: See Section 01 6200:
  - a) Round 'AUTO SPKR' identification plate, red enamel finish aluminum plate:
    - (1) Croker: Fig 6766.
    - (2) Potter-Roemer Fig. 5966.
  - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Rough chrome plated:
      - (1) Croker: 6405-RC.
      - (2) Potter-Roemer: Fig. 5710-C.
    - b) Caps and Chains:
      - (1) Croker: 6747 RC.
      - (2) Potter-Roemer: 4625.
11. Indicating Post Valve:
  - a. Design Criteria:
    - 1) As specified in Section 33 1119: 'Fire Suppression Water Distribution Piping'.
    - 2) Prefer exposed parts non-brass, for theft protection.
    - 3) Supervisory switch.
  - b. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
    - 1) As required by Authority Having Jurisdiction (AHJ).
12. Riser Manifold Assembly:
  - a. Design Criteria:
    - 1) Groove x Groove Manifold Body.
    - 2) Water Flow Alarm Switch, VSC with Vane, UL / CASA listed and approved.
    - 3) **300 psi (2.07 MPa)** Water Pressure Gauge.
    - 4) Test and Drain Valve with Manifold Drain Trim and **1/2 inch (12.7 mm)** diameter test Orifice.
    - 5) Pressure Relief Valve, **175 psi (1.21 MPa)**, non adjustable, pipe discharge to test Drain Valve.
  - b. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
    - 1) Tyco: Model 513.
    - 2) Victaulic: Style 747P.

## 2.2 ACCESSORIES

### A. Manufacturers:

1. Manufacturer Contact List:
  - a. Anvil International, Portsmouth, NH [www.anvilintl.com](http://www.anvilintl.com).
  - b. Cooper B-Line, Highland, IL [www.b-line.com](http://www.b-line.com).

### B. Hangers, Rods, And Clamps:

1. Design Criteria:
  - a. Galvanized, unless specified otherwise, and UL / CASA approved for service intended.
2. Class One Quality Standard:
  - a. Hangers and accessories shall be Anvil numbers specified or equals by Cooper B-Line.
  - b. Pipe Ring Hangers: Equal to Anvil Fig 69.
  - c. Riser Clamps: Equal to Anvil Fig. 261.

### C. Posted System Diagram:

1. Provide single, color-coded floor plan diagram showing total system. Color antifreeze pipe system elements BLUE and wet pipe system elements RED. Indicate locations of antifreeze system drains and sample test station.
2. Include following information on diagram sheet:
  - a. Explanation of how to test an antifreeze system.
  - b. Step by step shut down procedure.
  - c. Step by step system drainage procedure.
  - d. Step by step start-up procedure.
  - e. Step by step procedure for protection of system from freezing.
3. Laminate diagram with plastic and mat or frame suitable for hanging near riser.

### D. Steel Deck Bracket:

1. Class Two Quality Standard: See Section 01 6200.

- a. Unistrut P1000 with clamp nut, minimum 6 inch (150 mm) length.

### PART 3 - EXECUTION

#### 3.1 INSTALLERS

- A. Acceptable Installers. See Section 01 4301:
  1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

#### 3.2 EXAMINATION

- A. Drawings:
  1. Fire Protection Drawings show general arrangement of piping. Follow as closely as actual building construction and work of other trades will permit. Install system so it drains.
  2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These Drawings take precedence over Fire Protection Drawings.
  3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions and to enable system to drain.

#### 3.3 INSTALLATION

- A. Interface With Other Work: Provide inserts for attaching hangers in concrete floor construction at time floors are placed.
- B. Connect system to flange provided under Section 33 1119. After installation of riser, fill annular space between pipe and slab with flexible mastic.
- C. Install sprinkler systems in accordance with requirements of latest editions of NFPA 13 and as specified below:
  1. Provide maintenance access to equipment
  2. Conceal sprinkler lines installed in occupied areas. In Mezzanine areas, route pipe to side or underneath Mezzanine walkway. Do not impede egress from Attic.
  3. Install to enable drainage of system.
    - a. Install main drain from riser according to NFPA 13, paragraph 8.17.4.
  4. Install piping system, except for dry heads, so it will not be exposed to freezing temperatures.
  5. Do not use dropped, damaged, or used sprinkler heads.
  6. Install tamper switches and flow detectors where located by Architect.
  7. Except for Siamese connection, install automatic ball drip device in lowest point of piping to fire department connection and drain to floor drain or to exterior of building.
  8. Brace and support system to meet seismic zone requirements for building site.
  9. Inspector's Test and Drain to be placed in a location approved by the architect.
- D. Flush system at full design flow rate for minimum five minutes. Route water to outside of building. Protect landscaping and other exterior elements from damage during flow tests.

#### 3.4 FIELD QUALITY CONTROL

- A. Field Tests:
  1. Pressure Test:

- a. Hydrostatically test system to **200 psi (1.38 MPa)** minimum for 2 hours as required by 'Contractor's Material And Testing certificate for Above Ground Piping' NFPA-13, Figure Figure 24.1 (2010 Edition).
- b. If system or part of system is to have a glycol solution, hydrostatic test is to be performed using approved glycol solution. Do not hydrostatically test any section of system that is to be filled with a glycol solution with plain water.
2. Water Flow Test:
  - a. Test to determine static and residual pressures and corresponding flow rate at point of connection to utility water main.
  - b. Adjust water flow test data for seasonal fluctuations and future growth as recommended by Water Utility and AHJ.
  - c. At point of connection to utility water main, combine inside and outside hose stream allowances.
3. Check piping in relation to insulation envelope to be certain piping and auxiliary drains are properly enclosed inside building insulation envelope. Report unsatisfactory conditions to Architect.
4. Tests shall be witnessed by Architect and representative of local jurisdiction over fire prevention.

### 3.5 CLOSE-OUT ACTIVITIES

#### A. Instruction of Owner:

##### 1. Instruction Sessions:

- a. Instruct Owner's personnel in operation and maintenance of system utilizing 'Operation And Maintenance Manual' when so doing. Minimum instruction period shall be four (4) hours.
  - 1) Include antifreeze system requirement to be tested at least once a year.
- b. Instruction sessions shall occur after Substantial Completion inspection when system is properly working and before final payment is made.
- c. Provide Owner with latest version of NFPA 25.

#### B. Training:

1. Installer required to provide FM Training from latest version of NFPA 25 with checklist and brief explanation of following inspections:
  - a. Weekly Inspection.
  - b. Monthly Inspection.
  - c. Quarterly Inspection.
  - d. Semi-Annual Inspection.
  - e. Annual Inspection.

END OF SECTION

## SECTION 22 00 00 - SUMMARY OF PLUMBING WORK

### PART 1 - GENERAL

#### 1.1 WORK COVERED BY CONTRACT DOCUMENTS

- A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
- B. Plumbing Contract Documents were prepared for the Project by:

Trinity MEP Engineering, LLC  
3533 Moreland Dr. Ste. A  
Weslaco, Texas 78596  
Phone Number: (956) 973-0500  
Contact Person: Leonardo Munoz, P.E.

#### C. General Scope of Work:

1. Install systems and equipment as shown on the contract documents. Refer to drawings for schedule of equipment that will be installed. After installing equipment, connect all water, sewer, and/or power to fixtures.
2. Provide all materials and labor associated with a complete operational installation of new systems including, but not limited to:
  - Fixtures for facility
  - Piping for Sanitary Sewer and Vent Systems
  - Piping for Domestic water and Hot Water Systems.

#### 1.2 COORDINATION

- A. All plumbing work shall be done under sub-contract to a General Contractor. Plumbing Contractor shall coordinate all work through General Contractor, even in areas where only plumbing work is to take place.
- B. Coordination between all trades shall take place on a regular basis to avoid conflicts between disciplines and equipment clearances.
- C. Work shall take place with minimal disruption to Owner's operations in areas surrounding the new building.
- D. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.
- E. Fully coordinate with electrical contractor for providing power to plumbing equipment.

#### 1.3 UTILITIES

1. Coordinate with power, water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

#### 1.4 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
  1. Owner Occupancy: Allow for Owner occupancy and use by the public.
  2. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
  1. Temporary fencing around construction areas.
  2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.

3. Temporary fencing around equipment while site work is in progress.

1.5 SUBMITTALS

1. All equipment and fixtures shall be provided with a submittal.
2. To expedite the submittal process more efficiently, DO NOT piece-meal the submittals. Submit entire plumbing or in a bound enclosure. This will eliminate delays in the submittal process.

END OF SECTION

## SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Includes But Not Limited To:

1. Common requirements and procedures for plumbing systems.
2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
3. Furnish and install sealants relating to installation of systems installed under this Division.
4. Furnish and install Firestop Penetration Systems for plumbing systems penetrations as described in Contract Documents.

##### B. Products Furnished But Not Installed Under This Section:

1. Sleeves, inserts, supports, and equipment for plumbing systems installed under other Sections.

#### 1.2 SUBMITTALS

##### A. Action Submittals:

###### 1. Product Data:

- a. Manufacturer's catalog data for each manufactured item.
  - 1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
  - 2) Include name, address, and phone number of each supplier.

##### B. Informational Submittals:

###### 1. Qualification Statement:

- a. Plumbing Subcontractor:
  - 1) Provide Qualification documentation if requested by Architect or Owner.
- b. Installer:
  - 1) Provide Qualification documentation if requested by Architect or Owner.

##### C. Closeout Submittals:

###### 1. Include following in Operations And Maintenance Manual specified in Section 01 7800:

- a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):
  - 1) At beginning of PLUMBING section of Operations And Maintenance Manual, provide master index showing items included:
    - a) Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and Plumbing subcontractor.
    - b) Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
      - (1) List of plumbing equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.
      - (2) Manufacturer's maintenance instructions for each piece of plumbing equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance instructions.
    - c) Provide operating instructions to include:
      - (1) General description of fire protection system.
      - (2) Step by step procedure to follow for shutting down system or putting system into operation.
  - b. Warranty Documentation:
    - 1) Include copies of warranties required in individual Sections of Division 22.

### 1.3 QUALITY ASSURANCE

#### A. Regulatory Agency Sustainability Approvals:

1. Perform work in accordance with applicable provisions of Plumbing Codes applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
3. Identification:
  - a. Motor and equipment name plates as well as applicable UL / ULC and AGA / CGA labels shall be in place when Project is turned over to Owner.

#### B. Qualifications.

1. Plumbing Subcontractor:
  - a. Company specializing in performing work of this section.
    - 1) Minimum five (5) years experience in plumbing installations.
    - 2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
  - b. Upon request, submit documentation.
2. Installer:
  - a. Licensed for area of Project.
  - b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
  - c. Upon request, submit documentation.

### 1.4 DELIVERY, STORAGE, AND HANDLING

#### A. Delivery And Acceptance Requirements:

1. Accept valves on site in shipping containers with labeling in place.
2. Provide temporary protective coating on cast iron and steel valves.
3. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

#### B. Storage And Handling Requirements:

1. In addition to requirements specified within, stored material shall be readily accessible for inspection by Architect/engineer until installed.
2. Store items subject to moisture damage in dry, heated spaces.

### 1.5 WARRANTY

#### A. Manufacturer Warranty:

1. Provide certificates of warranty for each piece of equipment made out in favor of Owner.

#### B. Special Warranty:

1. Guarantee plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
2. If plumbing sub-contractor with offices located more than 150 miles (240 km) from Project site is used, provide service / warranty work agreement for warranty period with local plumbing sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

## PART 2 - PRODUCTS

### 2.1 COMPONENTS

- A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.
- B. Pipe And Pipe Fittings:
  1. Weld-O-Let and Screw-O-Let fittings are acceptable.
  2. Use domestic made pipe and pipe fittings on Project, except non-domestic made cast iron pipe and fittings by MATCO-NORCA are acceptable.
- C. Sleeves:
  1. General:
    - a. Two sizes larger than bare pipe or insulation on insulated pipe.



2. In Concrete And Masonry:
    - a. Sleeves through outside walls, interior shear walls, and footings shall be schedule 80 black steel pipe with welded plate.
  3. In Framing And Suspended Floor Slabs:
    - a. Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 ga (2 mm) galvanized sheet metal.
- D. Valves:
1. Valves of same type shall be of same manufacturer.

### PART 3 - EXECUTION

#### 3.1 INSTALLERS

- A. Acceptable Installers:

3.2 Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

#### 3.3 EXAMINATION

- A. Drawings:

1. Plumbing Drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing Drawings.
3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

- B. Verification Of Conditions:

1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which plumbing work is dependent for efficiency and report work that requires correction.
2. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
3. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.

3.4 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

#### 3.5 PREPARATION

- A. Demolition Requirements:

- B. Changes Due To Equipment Selection:

1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings showing proposed installations.
2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
3. Provide additional motors, valves, controllers, fittings, and other equipment required for proper operation of systems resulting from selection of equipment.
4. Be responsible for proper location of rough-in and connections provided under other Divisions.

#### 3.6 INSTALLATION

- A. Interface With Other Work:

1. Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
2. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and confirm that they are properly installed.

3. Furnish inserts for attaching hangers that are to be cast in concrete floor construction at time floors are poured.
- B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.
- C. Locating Equipment:
  1. Arrange pipes and equipment to permit ready access to valves, cocks, unions, traps, and to clear openings of doors and access panels.
  2. Adjust locations of pipes, equipment, and fixtures to accommodate work to interferences anticipated and encountered.
  3. Install plumbing work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
  4. Determine exact route and location of each pipe before fabrication.
    - a. Right-Of-Way:
      - 1) Lines that pitch shall have right-of-way over those that do not pitch. For example, plumbing drains shall normally have right-of-way.
      - 2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
    - b. Offsets, Transitions, and Changes in Direction:
      - 1) Make offsets, transitions, and changes in direction in pipes as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
      - 2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.
- D. Penetration Firestops:
  1. Install Penetration Firestop System appropriate for penetration at plumbing systems penetrations through walls, ceilings, roofs, and top plates of walls.
- E. Sealants:
  1. Seal openings through building exterior caused by penetrations of elements of plumbing systems.
  2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.
- F. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus:
  1. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper installation of plumbing systems.
  2. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings:
    - a. Arrange so as to facilitate removal of tube bundles.
    - b. Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
      - 1) Make connections of dissimilar metals with di-electric unions.
      - 2) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
    - c. Do not use reducing bushings, bull head tees, close nipples, or running couplings. Street elbows are allowed only on potable water pipe **3/4 inch (19 mm)** in diameter and smaller.
    - d. Install piping systems so they may be easily drained
    - e. Install piping to insure noiseless circulation.
    - f. Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
  3. Do not install piping in shear walls.
  4. Cut piping accurately to measurements established at site. Remove burr and cutting slag from pipes.
  5. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
  6. Make changes in direction with proper fittings.

7. Expansion of Thermoplastic Pipe:
    - a. Provide for expansion in every 30 feet of straight run.
    - b. Provide 12 inch offset below roof line in each vent line penetrating roof.
  8. Expansion of PEX Pipe: Allow for expansion and contraction of PEX pipe as recommended by Pipe Manufacturer.
- G. Sleeves:
1. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete slabs on grade (unless noted on plans).
  2. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Seal sleeves with specified sealants. Follow Pipe Manufacturer's recommendations for PEX pipe (if used) penetrations through studs and floor slabs.
  3. Sleeves through floors shall extend 1/4 inch above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
  4. Sleeves through floors and foundation walls shall be watertight.
- H. Escutcheons:
1. Provide spring clamp plates where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.
- 3.7 REPAIR / RESTORATION
- A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it:
    1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
    2. Surface finishes shall exactly match existing finishes of same materials.
- 3.8 FIELD QUALITY CONTROL
- A. Field Tests:
    1. Perform tests on plumbing piping systems. Furnish devices required for testing purposes.
  - B. Non-Conforming Work:
    1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
    2. Repeat tests on new material, if requested.
- 3.9 CLEANING
- A. Remove dirt, grease, and other foreign matter from each length of piping before installation:
    1. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
    2. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
    3. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.
  - B. Clean exposed piping, equipment, and fixtures. Remove stickers from fixtures and adjust flush valves.
- 3.10 CLOSEOUT ACTIVITIES
- A. Instruction of Owner:
    1. Instruct building maintenance personnel in operation and maintenance of plumbing systems utilizing Operation And Maintenance Manual when so doing.
    2. Conduct instruction period after Substantial Completion inspection when systems are properly working and before final payment is made.
- 3.11 PROTECTION
- A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

END OF SECTION

## SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Includes But Not Limited To:
  - 1. Common hanger and support requirements and procedures for plumbing systems.
- B. Products Installed But Not Furnished Under This Section:
  - 1. Paint identification for gas piping used in HVAC equipment.

#### 1.2 SUBMITTALS

- A. Action Submittals:
  - 1. Product Data:
    - a. Manufacturer's catalog data for each manufactured item.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLIES

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Anvil International,
    - b. Cooper B-Line,
    - c. Unistrut, Wayne,
- B. Materials:
  - 1. Hangers, Rods, And Inserts
    - a. Galvanized and UL approved for service intended.
    - b. Support horizontal piping from hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on Drawings. Hangers shall have double nuts.
      - 1) Support insulated pipes **2 inches** in diameter and smaller with adjustable swivel ring hanger with insulation protection shield. Gauge and length of shield shall be in accordance with Anvil design data.
      - 2) Type Two Acceptable Products:
        - (1) Swivel Ring Hanger: Anvil Fig. 69.
        - (2) Insulation Protection Shield: Anvil Fig. 167.
        - (3) Equals by Cooper B-Line.
      - 3) Support insulated pipes **2-1/2 inches** in diameter and larger with clevis hanger or roller assembly with an insulation protection shield. Gauge and length of shield shall be according to Anvil design data.
        - a) Type Two Acceptable Products:
          - (1) Clevis Hanger: Anvil Fig. 260.
          - (2) Roller Assembly: Anvil Fig. 171.
          - (3) Insulation Protection Shield: Anvil Fig. 167.
          - (4) Equals by Cooper B-Line.
        - 4) Support uninsulated copper pipe **2 inches** in diameter and smaller from swivel ring hanger, copper plated and otherwise fully suitable for use with copper tubing. Support non-copper uninsulated pipes from swivel ring hanger.
          - a) Type Two Acceptable Products:
            - (1) Swivel Ring Hanger For Copper Pipe: Anvil Fig. CT-69.
            - (2) Swivel Ring Hanger For Other Pipe: Anvil Fig. 69.
            - (3) Equals by Cooper B-Line.
          - 5) Support uninsulated copper pipe **2-1/2 inches** in diameter and larger from clevis hanger, copper plated hangers and otherwise fully suitable for use with copper tubing. Support non-copper uninsulated pipes from clevis hanger.
            - a) Type Two Acceptable Products:
              - (1) Clevis Hanger For Copper Pipe: Anvil Fig. CT-65.
              - (2) Clevis Hanger For Other Pipe: Anvil Fig. 260.
              - (3) Equals by Cooper B-Line.

c. Support rods for single pipe shall be in accordance with following table:

Rod Diameter	Pipe Size
3/8 inch	2 inches and smaller
1/2 inch	2-1/2 to 3-1/2 inches
5/8 inch	4 to 5 inches
3/4 inch	6 inches
7/8 inch	8 to 12 inches

d. Support rods for multiple pipe supported on steel angle trapeze hangers shall be in accordance with following table:

Rods		Number of Pipes per Hanger for Each Pipe Size						
Number	Diameter	2 Inch	2.5 Inch	3 Inch	4 Inch	5 Inch	6 Inch	8 Inch
2	3/8 Inch	Two	0	0	0	0	0	0
2	1/2 Inch	Three	Three	Two	0	0	0	0
2	5/8 Inch	Six	Four	Three	Two	0	0	0
2	5/8 Inch	Nine	Seven	Five	Three	Two	Two	0
2	5/8 Inch	Twelve	Nine	Seven	Five	Three	Two	Two

1) Size trapeze angles so bending stress is less than 10,000 psi

e. Riser Clamps For Vertical Piping:

1) Type Two Acceptable Products:

- a) Anvil Fig. 261.
- b) Equals by Cooper B-Line.

f. Concrete Inserts:

1) Individual Inserts:

- a) Suitable for special nuts size 3/8 inch through 7/8 inch with yoke to receive concrete reinforcing rods, and with malleable iron lugs for attaching to forms.
- b) Type Two Acceptable Products:
  - (1) Anvil Fig. 282.
  - (2) Equals by Cooper B-Line.

2) Continuous Inserts:

- a) Class Two Quality Standard: Equal to Unistrut P-3200 series.

g. Steel Deck Bracket:

- 1) Class Two Quality Standard: Equal to Unistrut P1000 with clamp nut, minimum 6 inch length.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work: If project contains concrete structural system.

- 1. Furnish inserts for attaching hangers that are to be cast in concrete floor construction at time floors are poured.

B. Piping:

1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.

- a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.

b. Supports For Horizontal Piping:

- 1) Support metal piping at 96 inches on center maximum for pipe 1-1/4 inches or larger and 72 inches on center maximum for pipe 1-1/8 inch or less.
- 2) Support thermoplastic pipe at 48 inches on center maximum.
- 3) Support PEX pipe at 32 inches minimum on center.

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- 4) Provide support at each elbow. Install additional support as required.
  - c. Supports for Vertical Piping:
    - 1) Place riser clamps at each floor or ceiling level.
    - 2) Securely support clamps by structural members, which in turn are supported directly from building structure.
    - 3) Provide clamps as necessary to brace pipe to wall.
  - d. If Structural concrete systems are used: Install supports from inserts cast into concrete floor system, including concrete joists and floor slabs. Where inserts cannot be used, provide expansion shields and support hangers from angles held in place by expansion bolts, never directly from expansion bolt itself. Provide calculations necessary to determine number of expansion bolts required to equal capacity of cast-in-place insert.
  - e. Attach Unistrut to structural steel roof supporting structure. Spacing and support as described above.
  - f. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.
2. Gas piping Identification:
    - a. Apply paint identification for gas piping used with HVAC equipment as specified in Section 23 0553.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install identification of plumbing piping and equipment as described in Contract Documents.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Materials:

1. Labels:

a. Equipment Identification:

- 1) Black formica, with white reveal when engraved.
- 2) Lettering to be **3/16 inch** high minimum.

2. Paint:

a. One Coat Primer:

- 1) 6-2 Quick Drying Latex Primer Sealer over fabric covers.
- 2) 6-205 Metal Primer under dark color paint.
- 3) 6-6 Metal Primer under light color paint.

b. Finish Coats: Two coats 53 Line Acrylic Enamel.

c. Type Two Acceptable Products.

- 1) Paint of equal quality from following Manufacturers may be submitted for Architect's approval before use.  
Maintain specified colors, shades, and contrasts.

- a) Benjamin Moore,
- b) ICI Dulux,
- c) Sherwin Williams,

PART 3 - EXECUTION

3.1 APPLICATION

A. Labels:

1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
2. Water Heaters.
3. Engrave following data from Equipment Schedules on Drawings onto labels:
  - a. Equipment mark.
  - b. Room(s) served.
  - c. Panel and breaker from which unit is powered.

B. Painting:

1. Only painted legends, directional arrows, and color bands are acceptable.
2. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
  - a. Adjacent to each item of equipment.
  - b. At point of entry and exit where piping goes through wall.
  - c. On each riser and junction.
  - d. Every **25 feet** on long continuous lines.
  - e. Stenciled symbols shall be one inch high and black.

3.2 ATTACHMENTS

A. Schedules:

1. Pipe Identification Schedule:

a. Apply stenciled symbols as follows:

Pipe Use	Abbreviation
Domestic Cold Water	CW
Domestic Hot Water	HW

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART1- GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
  - 1. Furnish and install insulation on hot and cold water lines, fittings, valves, and accessories as described in Contract Documents.
  - 2. Furnish and install insulation on roof drain piping as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 22 1116: 'Domestic Water Piping'.
  - 2. Section 22 1400: 'Facility Storm Drainage'.(if provided on plans)

1.2 SUBMITTALS

- A. Informational Submittals:
  - 1. Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, 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.

1.4 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.

Service Water Temperature	Pipe Sizes		
	Up to 1-1/4 In	1-1/2 to 2 In	Over 2 In
170 - 180 Deg F	One In	1-1/2 In	2 In
140 - 160 Deg F	1/2 In	One In	1-1/2 In
45 - 130 Deg F	1/2 In	1/2 In	One In

1.5 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for insulation application.
- C. Coordinate installation and testing of steam or electric heat tracing.

1.6 SCHEDULING

- A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 COMPONENTS

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Armacell, Mebane, NC [www.armacell.com](http://www.armacell.com).
    - b. Childers Products Co, Eastlake, OH [www.fosterproducts.com](http://www.fosterproducts.com).
    - c. IMCOA, Youngsville, NC [www.nomacokflex.com](http://www.nomacokflex.com).
    - d. Johns-Manville, Denver, CO [www.jm.com](http://www.jm.com).
    - e. Knauf, Shelbyville, IN [www.knauffiberglass.com](http://www.knauffiberglass.com).
    - f. Manson, Brossard, PQ, Canada [www.isolationmanson.com](http://www.isolationmanson.com).
    - g. Nomaco Inc, Yopungville, NC [www.nomacokflex.com](http://www.nomacokflex.com).



- h. Owens-Corning, Toledo, OH [www.owenscorning.com](http://www.owenscorning.com).
- i. Speedline Corp, Solon, OH [www.speedlinepvc.com](http://www.speedlinepvc.com).
- j. CertainTeed Manson.
- k. Knauf FiberGlass GmbH.
- l. Owens-Corning Fiberglas Corp.
- m. Schuller International, Inc.
- n. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- o. Armstrong World Industries, Inc.
- p. Rubatex Corp.

B. Materials:

1. Above Grade Metal Piping:

a. Insulation For Piping:

- 1) Snap-on glass fiber or melamine foam pipe insulation, or heavy density pipe insulation with factory vapor jacket.
- 2) Insulation Thickness:
- 3) Performance Standards: Fiberglas ASJ by Owens-Corning.
- 4) Type One Acceptable Manufacturers:
  - a) Childers Products.
  - b) Knauf.
  - c) Manson.
  - d) Owens-Corning.
  - e) Johns-Manville.
  - f) Equal as approved by Architect before bidding. See Section 01 6200.

b. Fitting, Valve, And Accessory Covers:

- 1) PVC.
- 2) Performance Standard: Zeston by Johns-Manville.
- 3) Type One Acceptable Manufacturers:
  - a) Knauf.
  - b) Speedline.
  - c) Johns-Manville.
  - d) Equal as approved by Architect before bidding. See Section 01 6200.

2. Below Grade Metal Piping:

a. Insulation:

- 1) **1/2 inch (13 mm)** thick.
- 2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
  - a) SS Tubolit by Armacell.
  - b) ImcoLock by Imcoa.
  - c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:

- 1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
  - a) Armacell 520.
  - b) Nomaco K-Flex R-373.

3. Pex Piping, Above And Below Grade:

a. Insulation:

- 1) **1/2 inch (13 mm)** thick.
- 2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
  - a) SS Tubolit
  - b) by Armacell.
  - c) ImcoLock by Imcoa.
  - d) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:

- 1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
  - a) Armacell 520.
  - b) Nomaco K-Flex R-373.
  - c)
4. PP-R Piping, Above And Below Grade:
  - a. Insulation:
    - 1) 1/2 inch (13 mm) thick.
    - 2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
      - a) SS Tubolit by Armacell.
      - b) ImcoLock by Imcoa.
      - c) Nomalock or Therma-Cel by Nomaco.
  - b. Joint Sealant:
    - 1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
      - a) Armacell 520.
      - b) Nomaco K-Flex R-373.
5. PVC or ABS Piping, Above And Below Grade - Facility Storm Drain:
  - a. Insulation:
    - 1) 1/2 inch (13 mm) thick.
    - 2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
      - a) SS Tubolit by Armacell.
      - b) ImcoLock by Imcoa.
      - c) Nomalock or Therma-Cel by Nomaco.
  - b. Joint Sealant:
    - 1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
      - a) Armacell 520.
      - b) Nomaco K-Flex R-373.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Above Grade Piping:
  1. Apply insulation to clean, dry piping with joints tightly butted.
  2. Install insulation in manner to facilitate removal for repairs. Place sections or blocks so least possible damage to insulation will result from inspection or repairs of piping or equipment.
  3. Piping up to 1-1/4 inch Diameter:
    - a. Adhere 'factory applied vapor barrier jacket lap' smoothly and securely at longitudinal laps with white vapor barrier adhesive.
    - b. Adhere 3 inch wide self-sealing butt joint strips over end joints.
  4. Piping 1-1/2 inches Diameter And Larger:
    - a. Use broken-joint construction in application of two-layer covering.
    - b. Fill cracks and depressions with insulating cement mixed to thick plastic paste.
      - 1) Apply by hand in several layers to make up total specified thickness.
      - 2) Final layer shall have smooth uniform finish before application of covering.
  5. Fittings, Valves, And Accessories:
    - a. Do not apply insulation over flanged joints or victaulic couplings until piping has been brought up to operating temperature and flange bolts have been fully tightened. Insulate valves so wheel, stem, and packing nut are exposed.
    - b. Insulate with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.
    - c. Piping Up To 1-1/4 Inch Diameter:
      - 1) Cover insulation with one piece fitting cover secured by stapling or taping ends to adjacent pipe covering.
      - 2) Alternate Method:

- a) Insulate fittings, valves, and accessories with one inch of insulating cement and vapor seal with two **1/8 inch** wet coats of vapor barrier mastic reinforced with glass fabric extending **2 inches** onto adjacent insulation.
  - d. Piping **1-1/2 inches To 2 Inches** :
    - 1) Insulate with hydraulic setting insulating cement or equal, to thickness equal to adjoining pipe insulation.
    - 2) Apply final coat of fitting mastic over insulating cement.
  - e. Piping **2-1/2 inch** And Larger:
    - 1) Insulate with segments of molded insulation securely wired in place and coated with skim coat of insulating cement.
    - 2) Apply fitting mastic, fitting tape and finish with final coat of fitting mastic.
6. Pipe Hangers:
- a. Do not allow pipes to come in contact with hangers.
  - b. Pipe Shield:
    - 1) Provide schedule 40 PVC by **6 inch** long at each clevis and/or unistrut type hanger.
    - 2) Provide **16 ga** by **6 inch** long galvanized shields at each pipe hanger to protect pipe insulation from crushing by clevis hanger.
    - 3) Provide **22 ga** by **6 inch** long galvanized shield at each pipe hanger to protect insulation from crushing by Unistrut type hanger.
  - c. At Pipe Hangers:
    - 1) Provide rigid calcium silicate insulation (**100 psi** compressive strength) at least **2 inches** beyond shield.
7. Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.
- B. Below Grade Piping:
1. Slip underground pipe insulation onto pipe and seal butt joints.
  2. Where slip-on technique is not possible, slit insulation, apply to pipe, and seal seams and joints.
- 3.2 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.
- 3.3 PREPARATION
- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.
- 3.4 GENERAL APPLICATION REQUIREMENTS
- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
  - B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping 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 insulation with longitudinal seams at top and bottom of horizontal pipe runs.
  - E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
  - F. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
  - G. Keep insulation materials dry during application and finishing.
  - H. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
  - I. Apply insulation with the least number of joints practical.
  - J. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
  - K. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments. Insulation around hanger or pipe clamp will not be acceptable.
  2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
  3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- L. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- M. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- N. Apply insulation with integral jackets as follows:
1. Pull jacket tight and smooth.
  2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
  3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
    - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
  4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
  5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.
- 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. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
  4. Seal metal jacket to roof flashing with vapor-retarder mastic.
- P. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
1. Firestopping and fire-resistive joint sealers are specified in Section "Firestopping."

### 3.5 MINERAL-FIBER INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
  2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
  3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
  4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

### 3.6 Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.
- B. Apply insulation to fittings and elbows as follows:
  1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
  3. Cover fittings with standard PVC fitting covers.
- C. Apply insulation to valves and specialties as follows:
  1. Apply premolded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
  2. Apply insulation to flanges as specified for flange insulation application.
  3. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
  4. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

### 3.7 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
  1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
  2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
  3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply insulation to flanges as follows:
  1. Apply preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same thickness as pipe insulation.
  4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.
- C. Apply insulation to fittings and elbows as follows:
  1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  2. When premolded sections of insulation are not available, apply mitered sections of phenolic-foam insulation. Secure insulation materials with wire, tape, or bands.
  3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- D. Apply insulation to valves and specialties as follows:
  1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  2. When premolded sections of insulation are not available, apply mitered sections of phenolic-foam insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
  3. Apply insulation to flanges as specified for flange insulation application.
  4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

### 3.8 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
  1. Follow 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 pipe surface.
- B. Apply insulation to flanges as follows:
  1. Apply pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- C. Apply insulation to fittings and elbows as follows:
  1. Apply mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- D. Apply insulation to valves and specialties as follows:
  1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
  2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
  3. Apply insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

### 3.9 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.
- B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.
  1. Draw jacket material smooth and tight.
  2. Apply lap or joint strips with the same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.
- C. Apply metal jacket where indicated, with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

### 3.10 PIPING SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
  1. Flexible connectors.
  2. Fire-suppression piping.
  3. Drainage piping located in crawl spaces, unless otherwise indicated.

4. Below-grade piping, unless otherwise indicated.
5. Chrome-plated pipes and fittings, unless potential for personnel injury.
6. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

### 3.11 INTERIOR INSULATION APPLICATION SCHEDULE

- A. Service: Domestic water piping.
  1. Operating Temperature: 60 to 80 deg F
  2. Insulation Material: Mineral Fiber
  3. Insulation Thickness: 1" thick.
  4. Field-Applied Jacket: Foil and Paper(ASJ)
  5. Vapor Retarder Required: Yes.
  6. Finish: None.
- B. Service: Domestic hot and recirculated hot water.
  1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
  2. Insulation Material: Mineral fiber
  3. Insulation Thickness: 1" thick
  4. Field-Applied Jacket: Foil and Paper(ASJ)
  5. Vapor Retarder Required: No
  6. Finish: None.
- C. Service: Condensate and equipment drain piping.
  1. Operating Temperature: 40 to 60 deg F
  2. Insulation Material: Flexible elastomeric, only on first ten feet of pipe from trap.
  3. Insulation Thickness: 3/4"
  4. Field-Applied Jacket: None.
  5. Vapor Retarder Required: No.
  6. Finish: Two coats of the insulation manufacturer's recommended protective coating.
- D. Service: Refrigerant suction and hot-gas piping.
  1. Operating Temperature: 35 to 50 deg F
  2. Insulation Material: Flexible elastomeric.
  3. Insulation Thickness: 1" thick.
  4. Field-Applied Jacket: Aluminum Jacket on building exterior application only.
  5. Vapor Retarder Required: Yes.
  6. Finish: None.
- E. Service: For obtaining fire/smoke rating in return air plenum (calbes, PE, PB, PP, ABS, PVC, CPVC, etc).
  1. Operating Temperature: 35 to 90 deg F
  2. Insulation Material: 3M Fire Barrier Plenum Wrap 5 A or equal.
  3. Insulation Thickness: larger of 1" or mfr's recommendations.
  4. Field-Applied Jacket: scrim reinforced foil
  5. Vapor Retarder Required: None.
  6. Finish: None.

### 3.12 EXTERIOR INSULATION APPLICATION SCHEDULE

- A. Service: Domestic water.
  1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
  2. Insulation Material: Mineral fiber.
  3. Insulation Thickness: Apply the following insulation thicknesses: 1"
  4. Field-Applied Jacket: Aluminum.
  5. Vapor Retarder Required: Yes.
  6. Finish: None.
- B. Service: Refrigerant suction.
  1. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
  2. Insulation Material: Flexible elastomeric.

3. Insulation Thickness: Apply the following insulation thicknesses: ½”
4. Field-Applied Jacket: Aluminum
5. Vapor Retarder Required: Yes.
6. Finish: None.

END OF SECTION



## SECTION 22 11 16 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Includes But Not Limited To:
  - 1. Perform excavating and backfilling required by work of this Section.
  - 2. Furnish and install potable water piping complete with necessary valves, connections, and accessories inside building and connect with outside utility lines **5 feet** from building perimeter as described in Contract Documents.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Domestic Water Distribution Piping: 125 psig..

#### 1.3 SUBMITTALS

- A. Action Submittals:
  - 1. Product Data: For pipe, tube, fittings, and couplings.
  - 2. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- B. Informational Submittals:
  - 1. Test And Evaluation Reports:
    - b. Written report of sterilization test.
- C. Shop Drawings:
  - b. Piping Layout:
    - 1) Provide as-built drawings at end of project.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
  - 1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.
  - 2. California only: California Assembly Bill 1953 (AB1953) Compliant for Lead Free.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic, potable domestic water piping and components.
- D. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

## PART 2 - PRODUCTS

### 2.1 SYSTEMS

#### A. Manufacturers:

1. Manufacturer Contact List:
  - b. Aquatherm, Inc.,
  - c. Cash Acme,
  - d. Cla-Val Company,
  - e. Conbraco Industries Inc,
  - f. Hammond Valve,
  - g. Handy & Harmon Products Div,
  - h. Honeywell Inc,
  - i. Leonard Valve Co,
  - j. Milwaukee Valve Co,
  - k. Nibco Inc,
  - l. Rehau,
  - m. Sloan Valve Co,
  - n. Spence Engineering Co,
  - o. Symmons Industries, Braintree,
  - p. Uponor Inc,
  - q. Viega ProPress, Wic
  - r. Watts Regulator Co,
  - s. Wilkins (Zurn Wilkins),
  - t. Zurn PEX, Inc.

#### B. Materials:

1. Design Criteria:
  - b. All drinking water products, components, and materials above and below grade used in drinking water systems must meet NSF International Standards for Lead Free.
  - c. No CPVC allowed.
2. Pipe:
  - b. Copper:
    - 3) Above-Grade:
      - a) Meet requirements of ASTM B88, Type K & L.
      - b) Hard Copper Tube: ASTM B 88, Types K and L, water tube, drawn tempered.
      - c) Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
      - d) Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
      - e) Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
      - f) Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
      - g) Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.
    - 4) Below-Grade:
      - a) Meet requirements of ASTM B88, Type K. **3/4 inch** minimum under slabs.
      - b) **2 inches** And Smaller: Annealed soft drawn.
      - c) **2-1/2 inches** And Larger: Hard Drawn.

- 5) Fittings:
  - a) For Copper Pipe: Wrought copper.
3. Connections For Copper Pipe:
  - b. Above-Grade:
    - 3) Sweat copper type with 95/5 or 96/4 Tin-Antimony solder, Bridgit solder, or Silvabrite 100 solder. Use only lead-free solder.
    - 4) Viega ProPress System
  - c. Below Grade:
    - 3) Brazed using following type rods:
      - a) Copper to Copper Connections:
        - 2) AWS Classification BCuP-4 Copper Phosphorus (6 percent silver).
        - 3) AWS Classification BCuP-5 Copper Phosphorus (15 percent silver).
        - 4) Copper to Brass or Copper to Steel Connections: AWS Classification BAg-5 Silver (45 percent silver).
        - 5) Do not use rods containing Cadmium.
      - 6) Brazing Flux:
        - a) Approved Products:
          - 1) Stay-Silv white brazing flux by Harris Product Group.
          - 2) High quality silver solder flux by Handy & Harmon.
      - 7) Joints under slabs acceptable only if allowed by local codes.
  4. Ball Valves:
    - b. Use ball valves exclusively unless otherwise specified. Ball valves shall be by single manufacturer from approved list below.
    - c. Valves shall be two-piece, full port for **150 psi** SWP.
      - 3) Operate with flow in either direction, suitable for throttling and tight shut-off.
      - 4) Body: Bronze, **150 psig** wsp at **350 deg F** and **400 psig** wog.
      - 5) Seat: Bubble tight at **100 psig** under water.
    - d. Class One Quality Standard: Nibco T585 or S585.
      - 3) Equal by Conbraco 'Apollo,' Hammond, Milwaukee, or Watts.
  5. Combination Pressure Reducing Valve / Strainer:
    - b. Integral stainless steel strainer, or separate 'Y' strainer installed upstream of pressure reducing valve.
    - c. Built-in thermal expansion bypass check valve.
    - d. Class One Quality Standard: Watts LFU5B:
      - 3) Equal by Cash Acme, Cla-Val Hi Capacity, Conbraco 36C, Honeywell-Braukmann, Spence Hi Capacity, Watts, or Wilkins. See Section 01 6200.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Below Grade:
  1. Install piping under slabs without joints where possible.
  2. Insulate water piping buried within building perimeter.
  3. Bury water piping **6 inches** minimum below bottom of slab and encase in **2 inches** minimum of sand.
- B. Locate cold water lines a minimum of **6 inches** from hot water line.

### 3.2 FIELD QUALITY CONTROL

- A. Field Tests:
  1. Before pipes are covered, test systems in presence of Architect/Engineer at **125 psig** hydrostatic pressure for four (4) hours and show no leaks.

2. Disconnect equipment not suitable for 125 psig pressure from piping system during test period.

### 3.3 ADJUSTING

- A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
  2. Adjust calibrated balancing valves to flows indicated.

### 3.4 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
  1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    - b. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - c. Fill and isolate system according to either of the following:
      - 3) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 4) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
    - d. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - e. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
- D. Water system will not be accepted until negative bacteriological test is made on water taken from system. Repeat dosing as necessary until such negative test is accomplished.

END OF SECTION

## SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Includes But Not Limited To:

1. Balancing valves.
2. Washer-supply outlets.
3. Key-operation hydrants.
4. Trap seal primer valves.
5. Drain valves.
6. Miscellaneous piping specialties.
7. Sleeve penetration systems.
8. Flashing materials.

#### 1.2 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.

### PART 2 - PRODUCTS

#### 2.1 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.

B. Manufacturers:

1. Armstrong Pumps, Inc.
2. Flow Design, Inc.
3. ITT Industries; Bell & Gossett Div.
4. Taco, Inc.
5. Watts Industries, Inc.; Water Products Div.
6. 2" and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
7. 2" and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
8. 2.5" and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

C. B. Memory-Stop Balancing Valves, NPS 2 (DN 50) and smaller: MSS SP-110, ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include two-piece, copper-alloy body with full-port, chrome-plated brass ball, replaceable seats and seals, threaded or solder-joint ends, and vinyl-covered steel handle with memory-stop device.

D. Manufacturers:

1. Conbraco Industries, Inc.
2. Crane Co., Crane Valve Group; Crane Valves.
3. Grinnell Corporation.
4. NIBCO INC.
5. Red-White Valve Corp.

#### 2.2 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.

1. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
2. NPS 2 (DN 50) and Smaller: Bronze body, with female threaded ends.

3. NPS 2-1/2 (DN 65) and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.

### 2.3 OUTLET BOXES

#### A. Manufacturers:

1. Acorn Engineering Company.
2. Gray, Guy Manufacturing Co., Inc.
3. Symmons Industries, Inc.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections, and wood-blocking reinforcement.

C. Clothes Washer Outlet Boxes: With hot- and cold-water hose connections, drain, and the following:

1. Box and Faceplate: [Stainless steel] [Enameled or epoxy-painted steel].
2. Shutoff Fitting: Two hose bibbs.
3. Supply Fittings: Two NPS 1/2 (DN 15) gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
4. Drain: NPS 2 (DN 50) standpipe, P-trap, and direct waste connection to drainage piping.
5. Inlet Hoses: Two ASTM D 3571, 60-inch- (1500-mm-) long, rubber household clothes washer inlet hoses with female hose-thread couplings.
6. Drain Hose: One 48-inch- (1200-mm-) long, rubber household clothes washer drain hose with hooked end.

D. Icemaker Outlet Boxes: With hose connection and the following:

1. Box and Faceplate: Stainless steel.
2. Shutoff Fitting: Hose bibb.
3. Supply Fitting: NPS 1/2 (DN 15) gate, globe, or ball valve and NPS 1/2 (DN 15) copper, water tubing.

### 2.4 KEY-OPERATION HYDRANTS

#### A. Manufacturers:

1. Josam Co.
2. Smith, Jay R. Mfg. Co.
3. Woodford Manufacturing Co.

B. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig.

1. Inlet: 3/4 " or NPS 1" threaded or solder joint.
2. Outlet: ASME B1.20.7, garden-hose threads.
3. Operating Keys: One with each key-operation hydrant.

C. Moderate-Climate, Concealed-Outlet Wall Hydrants: ASSE 1019, self-drainable with flush-mounting box with cover, integral nonremovable hose-connection vacuum breaker, and concealed outlet.

1. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.

D. Hot and Cold, Nonfreeze Concealed-Outlet Wall Hydrants: With deep flush-mounting box with cover; hot- and cold-water casings and operating rods to match wall thickness; concealed outlet; wall clamps; and factory- or field-installed, nonremovable and manual drain-type, hose-connection vacuum breaker complying with ASSE 1011.

### 2.5 ROOF HYDRANTS

#### A. Design Criteria:

1. Provide dual check backflow preventer.
2. Non-freeze.
3. Drain port - connect to drain

### 2.6 TRAP SEAL PRIMER VALVES

A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

#### B. Manufacturers:

1. Josam Co.
2. MIFAB Manufacturing, Inc.
3. Precision Plumbing Products, Inc.
4. Smith, Jay R. Mfg. Co.
5. 125-psig (860-kPa) minimum working pressure.

6. Bronze body with atmospheric-vented drain chamber.
7. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
8. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
9. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

## 2.7 MISCELLANEOUS PIPING SPECIALTIES

- A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.
- B. Manufacturers:
  1. Josam Co.
  2. Smith, Jay R. Mfg. Co.
  3. Tyler Pipe; Wade Div.
  4. Zurn Industries, Inc.; Specification Drainage Operation.
- C. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig (860 kPa); integral [or field-installed,] nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.
- D. Roof Flashing Assemblies: Manufactured assembly made of [4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-)] [6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch- (2.4-mm-)] thick, lead flashing collar and skirt extending at least [6 inches (150 mm)] [8 inches (200 mm)] [10 inches (250 mm)] from pipe with galvanized steel boot reinforcement, and counterflashing fitting.
- E. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.
- F. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.
- G. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
- H. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.
- I. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.
- J. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

## 2.8 SLEEVE PENETRATION SYSTEMS

- A. Manufacturers:
  1. ProSet Systems, Inc.
- B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
  1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
  2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
  3. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

## 2.9 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
  1. General Use: 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
  2. Vent Pipe Flashing: 3-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
  3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

- B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
- C. Fasteners: Metal compatible with material and substrate being fastened.
- D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- E. Solder: ASTM B 32, lead-free alloy.
- F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.
  - 1. Not required to meet NSF International Standards for Lead Free.
  - 2. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Jay R. Smith: 5907.
    - 2) Prier: P-RH2.
    - 3) Woodford: RHY2-MS.
  - 3. Water Hammer Arrestors:
    - 1. Design Criteria:
      - 1) Meet NSF International Standards for Lead Free.
      - 2) Nesting type, air pre-charged bellows with casing.
      - 3) Bellows constructed of stabilized 18-8 stainless steel.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.
- B. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.
- C. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- D. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- E. Install expansion joints on vertical risers, stacks, and conductors if indicated.

#### 3.2 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Ground equipment.
- C. 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.
- D. Connect plumbing specialties and devices that require power.

#### 3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

#### 3.4 FIELD QUALITY CONTROL



- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.
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. Remove malfunctioning units, replace with new units, and retest.
  3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

## SECTION 22 13 13 - FACILITY SANITARY SEWERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Includes But Not Limited To:

1. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines **5 feet** out from building where applicable.
2. Perform excavation and backfill required by work of this Section.

#### 1.2 ADMINISTRATIVE REQUIREMENTS

##### A. Pre-Cover Observation.

1. Contact Architect/Engineer prior to covering any section of pipe.
2. All piping all be under pressure during observation

#### 1.3 REFERENCES

##### A. Reference Standards:

1. International Code Council:
  - a. ICC IPC-2012, 'International Plumbing Code'.

#### 1.4 PERFORMANCE REQUIREMENTS

##### A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

#### 1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings: For solvent drainage system, include plans, elevations, sections, and details.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

#### 1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

### PART 2 - PRODUCTS

#### 2.1 PVC PIPING

- A. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
  1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- B. PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.
- C. Plenum Vent Lines: In areas of building with a return air plenum.
  1. Approved Types:
    - a. Service weight, single-hub or no-hub type cast iron soil pipe meeting requirements of ASTM A74.
    - b. Vent lines **2-1/2 inches** or smaller may be Schedule 40 galvanized steel.
    - c. Joint Material:
      - 1) Single-Hub: Rubber gaskets meeting requirements of ASTM C564.
      - 2) No-Hub Pipe: Neoprene gaskets with stainless steel cinch bands.
    - d. Fittings:
    - e. Cast Iron Pipe: Hub and spigot, except fittings for no-hub pipe shall be no-hub, and meet requirements of ASTM A74.
      - 1) Joint Material: Rubber gaskets meeting requirements of ASTM C564.
      - 2) Galvanized Pipe: Screwed Durham tarred drainage type.

#### 2.2 EXECUTION

#### 2.3 PIPING INSTALLATION

- A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- B. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.
- C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep ¼ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8- bend fittings if 2 fixture are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- D. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- E. Re-verify building drainage piping slope before covering pipe in trench if left uncovered over a 24 hour period of subjected to exterior water. If slope of piping has changed, provide new shoring material to maintain original slope after trench has been covered.
- F. Install soil and waste drainage and vent piping at the code required minimum slopes, unless otherwise indicated:
- G. Install engineered soil and waste drainage and vent piping systems in locations indicated and as follows:
  - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
  - 2. Cast-Iron, Sovent, Single Stack: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
  - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- I. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- J. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

#### 2.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Section "Plumbing Fixtures."
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger

#### 2.5 FIELD QUALITY CONTROL

- A. Field Tests:
  - 1. Conduct tests for leaks and defective work. Notify Architect before testing.
  - 2. Thermoplastic Pipe System:
    - a. Before backfilling and compacting of trenches, Fill waste and vent system with water to roof level or **10 feet** minimum, and show no leaks for two hours. Correct leaks and defective work.
    - b. After backfilling and compacting of trenches is complete but before placing floor slab, re-test as specified above. Uncover pipe and correct leaks and defective work. Re-backfill and compact and re-test.

- B. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- E. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

## 2.6 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

## SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Products Furnished But Not Installed Under this Section as described in Contract Documents.
  - 1. Cleanouts.
  - 2. Floor drains.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Sanitary Waste and Vent Piping: 10-foot head of water.
  - 2. Storm Drainage Piping: 10-foot head of water.

#### 1.3 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
  - 1. Cleanouts, floor drains, and roof drains.
  - 2. Roof flashing assemblies.
  - 3. Grease interceptors(if applicable)
  - 4. Sleeve penetration systems.

### PART 2 - PRODUCTS

#### 2.1 SLEEVE PENETRATION SYSTEMS

- A. Manufacturers:
  - 1. ProSet Systems, Inc.
- B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
  - 1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
  - 2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
    - a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

#### 2.2 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
  - 1. General Use: 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
  - 2. Vent Pipe Flashing: 3-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
  - 3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.
- B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
- C. Fasteners: Metal compatible with material and substrate being fastened.
- D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- E. Solder: ASTM B 32, lead-free alloy.
- F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

#### 2.3 CLEANOUTS

- A. Cleanouts: Comply with [ASME A112.36.2M] [ASME A112.3.1] <Insert other>.
  - 1. Application: [Floor cleanout] [Wall cleanout] [For installation in exposed piping].
  - 2. Products:

- a. Josam Co.
- b. Mifab
- c. Smith, Jay R. Mfg. Co.
- d. Tyler Pipe, Wade Div.
- e. Zurn Industries, Inc., Specification Drainage Operation.

## 2.4 FLOOR DRAINS

### A. Floor Drains.

1. Products:
  - a. Josam Co.
  - b. Mifab
  - c. Smith, Jay R. Mfg. Co.
  - d. Tyler Pipe, Wade Div.
  - e. Zurn Industries, Inc.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- D. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- E. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
- F. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- G. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- H. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
- I. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.
- J. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
    - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
    - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
  3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

- K. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
  - 1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  - 2. Position roof drains for easy access and maintenance.
- L. Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
  - 1. Flush with In-Ground Installation: Set unit and extension, if required, with cover flush with finished grade.
  - 2. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- M. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- N. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- O. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
- P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### 3.2 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Ground equipment.
- C. 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.
- D. Connect plumbing specialties and devices that require power according to Division Sections.
- E. Interceptor Connections: Connect piping, flow-control fittings, and accessories.
  - 1. Grease Interceptors: Connect inlet and outlet to unit, and flow-control fitting and vent to unit inlet piping.

### 3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.
  - 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. Remove malfunctioning units, replace with new units, and retest.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION



## SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Includes But Not Limited To:
  - 1. Furnish and install electric water heater as specified in Contract Documents.
- B. Related Requirements:
  - 1. Section 22 0501: 'Common Plumbing Requirements'.
  - 2. Section 22 1116: 'Domestic Water Piping'.

#### 1.2 REFERENCES

- A. Reference Standard:
  - 1. NSF International Standard / American National Standards Institute:
    - a. NSF/ANSI 61-2012, 'Drinking Water System Components - Health Effects'.
    - b. NSF/ANSI 372-2011, 'Drinking Water System Components - Lead Content'.

#### B. SUBMITTALS

- C. Closeout Submittals:
  - 1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Operations and Maintenance Data:
      - 1) Maintenance and operational instructions.
    - b. Warranty Documentation:
      - 1) Final, executed copy of Warranty.
    - c. Record Documentation:
      - 1) Manufacturers documentation:
        - a) Manufacturer's literature or cut sheet.

#### 1.3 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
  - 1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.
  - 2. California only: California Assembly Bill 1953 (AB1953) Compliant for Lead Free.

#### 1.4 WARRANTY

- A. Special Warranty:
  - 1. Three-year non-prorated warranty on water heaters of 20 gallon capacity and larger.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLIES

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. A O Smith Water Products Co,
    - b. Bradford-White Corp, Ambler,.
    - c. Rheem / Ruud Water Heater Div
    - d. Ruud Manufacturing Co.,
    - e. State Industries Inc,
- B. Materials:
  - 1. Design Criteria:
    - a. All (wetted) drinking water products, components, and materials used in drinking water systems must meet NSF International Standards for Lead Free.
    - b. All water heaters require 'Tempered Water Temperature Control' (mixing valves) as specified in Section 22 1116.
  - 2. 30 Gallon to 50 Gallon Regular Height:
    - a. Glass lined storage tank pressure tested and rated for 125 psi (862 kPa) working pressure.

- b. Water heaters shall each have ASME rated temperature-pressure relief valve rated at MBH input of heater minimum set to relieve at 120 psi (827 kPa).
- c. 9 Kw.
- d. 3 inches (75 mm) minimum glass fiber or polyurethane foam insulation.
- e. Complete with two stage thermostat, magnesium anode, electric sheath rod type heating element, and high limit control.
- f. Heater shall be pre-wired and entire unit bear UL label.
- g. Manufactures
  - 1) American:
  - 2) A O Smith:
  - 3) Bradford White:
  - 4) Rheem
  - 5) State Industries: SB6-40.

## 2.2 ACCESSORIES

### A. Anchoring Components:

- 1. One inch (25 mm) by 18 ga (1.2 mm) galvanized steel straps.
- 2. No. 10 by 2-1/2 inch (64 mm) screws.

### B. Thermal Expansion Absorbers:

- 1. Bladder type for use with potable water systems.

### C. Type One Acceptable Products.

- a. Therm-X-Trol ST-12-C by Amtrol Inc, West Warwick, RI [www.amtrol.com](http://www.amtrol.com).
- b. Equal as approved by Architect before bidding.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install temperature-pressure relief valve on hot water heater and pipe discharge to directly above funnel of floor drain.

### 3.2 ADJUSTING

- A. Set discharge water temperature at 140 deg F (60 deg C). Final hot water temperature shall be 110 deg F (43 deg C) after missing valve. If no mixing valve set discharge temperature at 110 deg F (43 deg C).

END OF SECTION

## SECTION 22 42 00 - COMMERCIAL PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes plumbing fixtures and related components.

#### 1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

#### 1.4 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. TAS: Texas Accessibility Standards.

#### 1.6 COORDINATION

- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. For fixture descriptions in other Part 2 articles where the subparagraph titles "Products," and "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.

#### 2.2 LAVATORY FAUCETS

- A. Lavatory Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.
  - 1. Products:
    - a. American Standard.
    - b. Eljer.
    - c. Kohler.

#### 2.3 SINK FAUCETS

A. Sink Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

1. Manufacturers:

- a. American Standard.
- b. Eljer
- c. Kohler

#### 2.4 TOILET SEATS

A. Toilet Seat: Solid plastic.

1. Manufacturers:

- a. Bemis.
- b. Beneke.
- c. Centoco.
- d. Church.

#### 2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard, Manufactured, plastic enclosure for covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.

1. Manufacturers:

- a. Engineered Brass Co.
- b. Plumerex
- c. Truebro.

#### 2.6 FIXTURE SUPPORTS

A. Water-Closet Support: Water-closet combination carrier designed for accessible and standard mounting heights. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

1. Manufacturers:

- a. Mifab
- b. Josam.
- c. Wade.
- d. Zurn

B. Urinal Support: Not required

C. Lavatory Support: Not required

D. Sink Support: Type II, sink carrier with hanger plate, bearing studs, and tie rod. Include steel uprights with feet.

1. Manufacturers:

- a. Josam.
- b. J.R. Smith
- c. Zurn.

#### 2.7 WATER CLOSETS

A. Water Closets: Accessible, wall-hanging, back-outlet, vitreous-china fixture designed for flushometer valve operation.

1. Products:

2. American Standard, Inc.
3. Kohler Co.
4. TOTO USA, Inc.

B. Water Closets: Ligature Resistant Institutional Combination Lavatory/Toilet

1. Products:

- a. ACORN
- b. All others shall be submitted for pre-approval prior to bid date.

#### 2.8 LAVATORIES, SINKS

A. Lavatories,: Accessible, counter top, vitreous-china fixture.

1. Products:

- a. American Standard, Inc.
- b. Kohler Co.
- c. Toto
- d. CRANE

## 2.9 SINKS

A. Sinks: Commercial, counter-mounting, stainless-steel fixture.

1. Products:

- a. Elkay Manufacturing Co.
- b. Just Manufacturing Co.

## 2.10 SERVICE SINKS

A. Service/Mop Sinks: Floor-mounting, enameled, sink with front apron, raised back, and coated, wire rim guard.

1. Products:

- a. Commercial Enameling Co.
- b. Kohler Co.
- c. Fiat

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
  - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  - 2. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-hanging fixtures with tubular waste piping attached to supports.
- F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- G. Install counter-mounting fixtures in and attached to casework.
- H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - 1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 15 Section "Valves" for general-duty valves.
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- M. Install toilet seats on water closets.
- N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

- Q. Install traps on fixture outlets.
- R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.
- S. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.
- D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
- E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.
- F. Ground equipment.
  - 1. 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.

### 3.4 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

### 3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.

### 3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.

### 3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

## SECTION 22 47 13 - DRINKING FOUNTAINS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Drinking fountains.
  - 2. Self-contained water coolers.
  - 3. Fixture supports.

#### 1.3 DEFINITIONS

- A. Accessible Drinking Fountain and Water Cooler: Fixture that can be approached and used by people with disabilities.
- B. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
- C. Fitting: Device that controls flow of water into or out of fixture.
- D. Fixture: Drinking fountain or water cooler, unless one is specifically indicated.
- E. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

#### 1.4 SUBMITTALS

- A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of fixture indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For fixtures to include in maintenance manuals specified in Division.

#### 1.5 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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" about fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- E. TAS: Texas Accessibility Standards.

#### 1.6 COORDINATION

- A. Coordinate roughing-in and final fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified below.
  - 1. Elkay.
  - 2. Halsey Taylor.
  - 3. Haws Corporation.

#### 2.2 DRINKING FOUNTAINS

- A. Drinking Fountains,: Accessible, Style W, wall-hanging fixture made of stainless steel.
  - 1. Receptor Shape: Rectangular.
  - 2. Back Panel: Stainless-steel wall plate behind drinking fountain.
  - 3. Bubblers: Two, with automatic stream regulator, located on deck.
  - 4. Control: Push button.

5. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
6. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME Standards.
7. Support: Type I, water-cooler carrier. Refer to "Fixture Supports" Article.

### 2.3 SELF-CONTAINED WATER COOLERS

- A. Water Coolers: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-hanging fixture.
  1. Cabinet: Bilevel with two attached cabinets, enameled steel with stainless-steel top.
  2. Bubbler: One, with automatic stream regulator, located on each cabinet deck.
  3. Control: Push button.
  4. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve and filter.
  5. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME Standards.
  6. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
    - a. Capacity: 8 gph (0.0084 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
    - b. Electrical Characteristics: 1/5 hp; 120-V ac; single phase; 60 Hz.
  7. Support: Type II, water-cooler carrier. Refer to "Fixture Supports" Article.

### 2.4 FIXTURE SUPPORTS

- A. Off-Floor, Plumbing Fixture Supports: ASME A112.6.1M, water-cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
  1. Available Manufacturers:
  2. Manufacturers:
    - a. Josam Co.
    - b. Smith, Jay R. Mfg. Co.
    - c. Tyler Pipe; Wade Div.
    - d. Zurn Specifications Drainage Operation.
  3. Type I: Hanger-type carrier with two vertical uprights.
  4. Type II: Bilevel, hanger-type carrier with three vertical uprights.
  5. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

- A. Use carrier off-floor supports for wall-hanging fixtures, unless otherwise indicated.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

### 3.3 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-hanging fixtures, unless otherwise indicated.
- B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
- C. Install fixtures level and plumb.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Refer to Division Section "Valves" for general-duty valves.
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Refer to Division Section "Basic Mechanical Materials and Methods" for escutcheons.
- G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division for sealant and installation requirements.



### 3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.
- D. Ground equipment.
  - 1. 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.

END OF SECTION

SECTION 23 00 00 - HEATING, VENTILATION AND AIR-CONDITIONING (HVAC)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
- B. Mechanical Contract Documents were prepared for the Project by:

Trinity MEP Engineering, LLC  
3533 Moreland Dr. Ste. A  
Weslaco, Texas 78596  
Phone Number: (956) 973-0500  
Contact Person: Leonardo Munoz, P.E.

C. General Scope of Work:

1. Install AC equipment and ductwork as shown on the contract documents. Refer to drawings for schedule of equipment that will be installed. After installing equipment, connect power to unit.
2. HVAC: Provide all materials and labor associated with a complete operational installation of new HVAC systems including, but not limited to:
  - DX Split System A/C Units
  - Exhaust fans
  - Sheet metal, Ductwork
  - Diffusers and Grilles
  - Duct accessories, including grilles, and louvers
  - Air Test and Balance

1.3 COORDINATION

- A. All mechanical work shall be done under sub-contract to a General Contractor. Mechanical Contractor shall coordinate all work through General Contractor, even in areas where only mechanical work is to take place.
- B. Coordination between all trades shall take place on a regular basis to avoid conflicts between disciplines and equipment clearances.
- C. Work shall take place with minimal disruption to Owner's operations in areas surrounding the new building.
- D. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.
- E. Fully coordinate with electrical contractor for providing power to mechanical equipment.
- F. Mechanical Contractor is responsible for all control wiring including thermostat(s). This includes all conduit, wire, and accessories both low voltage and source voltage for the controls' system. Mechanical Contractor will provide all the necessary actuators, relays, software, hardware, and all necessary accessories required for a fully functional controls' system.

1.4 UTILITIES

1. Coordinate with power, water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

1.5 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
    - 1. Owner Occupancy: Allow for Owner occupancy and use by the public.
    - 2. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
  - B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
    - 1. Temporary fencing around construction areas.
    - 2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
    - 3. Temporary fencing around equipment while site work is in progress.
- 1.6 SUBMITTALS
- 1. To expedite the submittal process more efficiently, DO NOT piece-meal the submittals. Submit entire mechanical or plumbing in a bound enclosure. This will eliminate delays in the submittal process.

END OF SECTION

## SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

#### 1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Dielectric fittings.
5. Flexible connectors.
6. Mechanical sleeve seals.
7. Equipment nameplate data requirements.
8. Nonshrink grout for equipment installations.
9. Field-fabricated metal and wood equipment supports.
10. Installation requirements common to equipment specification sections.
11. Cutting and patching.
12. Touchup painting and finishing.

#### 1.3 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, crawl spaces, 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:
- G. PVC: Polyvinyl chloride plastic.
- H. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene propylene diene terpolymer rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.
- B. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
  1. Planned piping layout, including valve and specialty locations and valve-stem movement.
  2. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
  3. Sizes and location of required concrete pads and bases.
  4. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

5. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

#### 1.5 QUALITY ASSURANCE

- A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

#### 1.6 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 prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes, ductwork, equipment, and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### 1.7 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in architectural section.
- G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

#### 1.8 OPERATION PRIOR TO ACCEPTANCE

- A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated.
- B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments, and complete punch list items before final acceptance by the Owner.
- C. The date of acceptance by the Engineer, for beneficial use by the Owner, shall be the beginning date of the warranty period.

#### 1.9 SPACE AND EQUIPMENT ARRANGEMENT

- A. The size of each item of mechanical equipment shown on the Drawings is based on the dimensions of a particular manufacturer as indicated. While other manufacturers may be acceptable, it shall be the responsibility of the Contractor to determine whether or not the equipment he proposes to furnish will fit into the space. Shop drawings shall be prepared when required by the engineer to indicate a suitable arrangement.
- B. Install equipment in a manner to permit access to all surfaces. Install valves, motors, drives, lubricating devices, filters, and other accessory items in a position to allow removal for service without requiring the disassembly of another part.
- C. Provide access panels acceptable to the Engineer for equipment that is concealed above ceiling space.
- D. Large equipment assemblies or components which will be installed in the building, and which are too large to permit access through doorways, stairways or shafts, shall be brought to the site and placed in the appropriate spaces before the enclosing structure is completed. Provisions shall be implemented by the Contractor to insure that the equipment will not be damaged in any way during the associated construction procedures.

#### 1.10 START-UP OF EQUIPMENT AND SYSTEMS

- A. Whenever the manufacturer of a particular item of equipment or a particular system makes available a start-up service after completion of the installation, such manufacturer's start-up service (rendered by the manufacturer or his authorized representative) shall be provided.
- B. Witnessing and explanations of start-up services shall be included as part of the "Instruction of Owner's Personnel" as specified below.

#### 1.11 INSTRUCTION OF OWNER'S PERSONNEL

- A. Provide the services of competent engineers or technicians acceptable to the Engineer to instruct representatives of the Owner in complete and detailed operation and maintenance of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.
- B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.
- C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include piping diagrams, valve identification charts, control and interlocking wiring diagrams, manufacturers' operation and maintenance manuals, parts lists (with sources identified), and other data as appropriate for each system, and as required elsewhere in the Specifications to be furnished to the Owner prior to final acceptance of the project.
- D. Provide the Owner with three (3) complete sets of all maintenance manuals, pamphlets, brochures or instructions. This material shall be catalogued, indexed and bound into books.

#### 1.12 ACCEPTABLE MANUFACTURERS

- A. A. Provide equipment and materials from listed manufacturers listed within this specification. Deviations from this specification will not be acceptable. When one manufacturer is listed, alternate materials and equipment may be provided "equal to" the listed. When more than one manufacturer is listed, equipment and material must be provided by one of the listed manufacturers.

### PART 2 - PRODUCTS

#### 2.1 STANDARD PRODUCTS

- A. Each item of equipment furnished under this Division of the Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same kind or class of equipment are required, these shall be the products of a single manufacturer; however, the component parts of the equipment need not be the products of one manufacturer.
- B. Materials and equipment shall be of the base quality normally used in good commercial practice, and shall be the products of reputable domestic manufacturers unless otherwise specified. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

#### 2.2 QUALITY AND CLASSIFICATION OF MATERIALS

- A. Materials and equipment shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site, but shall be replaced with new materials or equipment identical with those damaged.
- B. Wherever a UL standard has been established for a particular type of material or equipment, each such material or equipment provided on this project shall meet the requirements of the UL standard in every way and shall be UL listed and labeled.

#### 2.3 LOCAL PARTS AND SERVICE

- A. Each item of equipment furnished on this project shall have local representation, factory-authorized service, and an adequate stock of repair parts. "Local" shall be defined, for this purpose, as "within 50 miles of the project site."

#### 2.4 FLAME SPREAD PROPERTIES OF MATERIALS

- A. Materials used for insulation, acoustical linings, adhesives, jackets and coatings, and combinations of these materials, shall each have a flame spread rating of 25 or less, and a smoke developed rating of 50 or less, as determined by an independent testing laboratory in accordance with NFPA-255.

## 2.5 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Dielectric Unions:
  - a. Watts Industries, Inc.; Water Products Div.
  - b. Zurn Industries, Inc.; Wilkins Div.
- 2. Mechanical Sleeve Seals:
  - a. Calpico, Inc.
  - b. Metraflex Co.
  - c. Thunderline/Link-Seal.

## 2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

## 2.7 PIPING SPECIALTIES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

- 1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
- 2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
- 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - a. Underdeck Clamp: Clamping ring with set screws.

- B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

- 1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
- 2. OD: Completely cover opening.
- 3. Cast Brass: One piece, with set screw.
  - a. Finish: Rough brass.
  - b. Finish: Polished chrome-plate.

- 4. Cast-Iron Floor Plate: One-piece casting.

## 2.8 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

- 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
- 2. Design Mix: 5000-psi, 28-day compressive strength.
- 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Sections specify unique piping installation requirements.
- B. General Locations and Arrangements: 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 at indicated slope.
- D. Install components with pressure rating equal to or greater than system operating pressure.

- E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- F. Install piping free of sags and bends.
- G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- K. Install fittings for changes in direction and branch connections.
- L. Install couplings according to manufacturer's written instructions.
- M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
  - 1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish.
  - 2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
  - 3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
  - 4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
  - 5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.
- N. Sleeves are not required for core drilled holes.
- O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
- P. 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 above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Build sleeves into new walls and slabs as work progresses.
  - 3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials: Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
    - b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
  - 5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.
- Q. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe or pipe insulation and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
  - 3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
  - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.



2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
  4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  5. 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:
    - a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    - b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    - c. Align threads at point of assembly.
    - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    - e. 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.
  6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
  7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
  8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
    - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
    - b. PVC Nonpressure Piping: ASTM D 2855.
    - c. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.
  9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
    - a. Plain-End Pipe and Fittings: Use butt fusion.
    - b. Plain-End Pipe and Socket Fittings: Use socket fusion.
- W. Piping Connections: Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
  2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
  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.

### 3.2 EQUIPMENT AND MATERIAL INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment and material to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. 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.
- E. Install equipment and ductwork giving right of way to piping installed at required slope.
- F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

### 3.3 PAINTING AND FINISHING

- A. Refer to paint materials, surface preparation, and application of paint.
- B. Do not paint piping specialties with factory-applied finish.
- C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

#### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi, 28-day compressive-strength concrete and reinforcement or as specified.

#### 3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

#### 3.6 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

#### 3.7 GROUTING

- A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases to provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION

## SECTION 23 05 39 - HANGER & SUPPORTS FOR HVAC PIPING & EQUIPMENT

### PART 1 GENERAL

#### 1.1 SUMMARY

- .1 Section includes:

- .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

#### 1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 03 30 00 - Cast-in-Place Concrete.
- .4 Section 05 12 23 - Structural Steel for Buildings.
- .5 Section 05 50 00 - Metal Fabrications.

#### 1.3 REFERENCES

- .1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1, Power Piping, (SI Edition).
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM A125, Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).
  - .1 Materials Safety Data Sheets (MSDS).
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 ANSI/MSS SP-69, Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC)

#### 1.4 SYSTEM DESCRIPTION

- .1 Design Requirements
  - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  - .2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 or ASME B31.1.
  - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
  - .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
  - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.
- .2 Performance Requirements
  - .1 Design supports, platforms, catwalks, hangers, to withstand seismic events for location as per the National Building Code

#### 1.5 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: submit drawings stamped and signed for approval by Owner's Representative.
- .3 Submit shop drawings and product data for following items:
  - .1 Bases, hangers and supports.
  - .2 Connections to equipment and structure.
  - .3 Structural assemblies.

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- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
    - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
    - .2 Instructions: submit manufacturer's installation instructions.
      - .1 Owner's Representative will make available 1 copy of systems supplier's installation instructions.
  - .5 Closeout Submittals:
    - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals
- 1.6 QUALITY ASSURANCE
- .1 Health and Safety:
    - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- .1 Packing, shipping, handling and unloading:
    - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
    - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .2 Waste Management and Disposal:
    - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58 and SP-89.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

### 2.2 PIPE HANGERS

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture.
  - .2 Use electro-plating galvanizing process or hot dipped galvanizing process.
  - .3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
- .2 Upper attachment structural: Suspension from lower flange of I-Beam.
  - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
    - .1 Rod: 9 mm UL listed, 13 mm FM approved.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed, FM approved where required to MSS-SP58 and MSS-SP69.
- .3 Upper attachment structural: Suspension from upper flange of I-Beam.
  - .1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved where required to MSS SP69.
  - .2 Cold piping NPS 2 1/2 or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed, FM approved where required.
- .4 Upper attachment to concrete.
  - .1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
  - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved where required to MSS SP-69.
- .5 Shop and field-fabricated assemblies.
  - .1 Trapeze hanger assemblies: MSS SP-89.

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- .2 Steel brackets: MSS SP-89.
  - .3 Sway braces for seismic restraint systems: to MSS SP-89.
  - .6 Hanger rods: threaded rod material to MSS SP-58.
    - .1 Ensure that hanger rods are subject to tensile loading only.
    - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
    - .3 Do not use 22 mm or 28 mm rod.
  - .7 Pipe attachments: material to MSS SP-58.
    - .1 Attachments for steel piping: carbon steel galvanized.
    - .2 Attachments for copper piping: copper plated black steel.
    - .3 Use insulation saddles for hot pipework.
    - .4 Oversize pipe hangers and supports for insulated pipes.
  - .8 Adjustable clevis: material to MSS SP-69, UL listed FM approved, where required clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
    - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
  - .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.
  - .10 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A563.
    - .1 Finishes for steel pipework: galvanized.
    - .2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated or epoxy coated.
  - .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-69.
- 2.3 RISER CLAMPS
- .1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP-58, type 42, UL listed FM approved where required.
  - .2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.
  - .3 Bolts: to ASTM A307.
  - .4 Nuts: to ASTM A563.
- 2.4 INSULATION PROTECTION SHIELDS
- .1 Insulated cold piping:
    - .1 64 kg/m<sup>3</sup> density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
  - .2 Insulated hot piping:
    - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-69.
- 2.5 CONSTANT SUPPORT SPRING HANGERS
- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report(CMTR).
  - .2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
  - .3 Provide upper and lower factory set travel stops.
  - .4 Provide load adjustment scale for field adjustments.
  - .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
  - .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.
- 2.6 VARIABLE SUPPORT SPRING HANGERS
- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
  - .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
  - .3 Variable spring hanger to be complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

- .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

## 2.7 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

## 2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

## 2.9 PLATFORMS AND CATWALKS

- .1 To Section 05 50 00 - Metal Fabrication.

## 2.10 HOUSE-KEEPING PADS

- .1 For base-mounted equipment: Concrete, at least 100 mm high, 50 mm larger all around than equipment, and with chamfered edges.
- .2 Concrete: to Section 03 30 00 - Cast-in-place Concrete by Division 3.

## 2.11 OTHER EQUIPMENT SUPPORTS

- .1 From structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.
- .2 Submit structural calculations with shop drawings.

## PART 3 - EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

### 3.2 INSTALLATION

- .1 Install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
  - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.
- .3 Clamps on riser piping:
  - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  - .2 Bolt-tightening torques to be to industry standards.
  - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: Install below joint.
- .4 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
  - .1 vertical movement of pipework is 13 mm or more,
  - .2 transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
  - .1 transfer of load to adjacent piping or to connected equipment is not critical.
  - .2 variation in supporting effect does not exceed 25 % of total load.

### 3.3 HANGER SPACING

- .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Hydronic, steam, condensate, rigid, and flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

Maximum Pipe Size: NPS	Maximum Spacing: Steel	Maximum Spacing: Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

- .6 Within 300 mm of each elbow.
- .7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members, comprised of angel iron or c-channel.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

END OF SECTION

## SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

#### 1.2 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
  1. Equipment nameplates.
  2. Equipment markers.
  3. Access panel and door markers.
  4. Pipe markers.
  5. Duct markers.
  6. Valve tags.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.4 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.

### PART 2 - PRODUCTS

#### 2.1 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.
  4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

#### 2.2 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 semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least **3 mils (0.08 mm)** thick with pressure-sensitive, permanent-type, self-adhesive back.
  1. Width for Markers on Pipes with OD, Including Insulation, Less Than **6 Inches (150 mm)**: **3/4 inch (19 mm)** minimum.
  2. Width for Markers on Pipes with OD, Including Insulation, **6 Inches (150 mm)** or Larger: **1-1/2 inches (38 mm)** minimum.

### 2.3 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.

### 2.4 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 Architect] <Insert other>. Provide **5/32-inch (4-mm)** hole for fastener.
  1. Material: **3/32-inch- (2.4-mm-)** thick laminated plastic with 2 black surfaces and white inner layer.
  2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Divisions. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

### 3.2 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. Include nameplates for the following general categories of equipment:
  1. Pumps, compressors, chillers, condensers, and similar motor-driven units.
  2. Heat exchangers, coils, evaporators, and similar equipment.
  3. Fans, blowers, primary balancing dampers, and mixing boxes.
  4. Packaged HVAC central-station and zone-type units.
- 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 two-thirds to three-fourths 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. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    - e. Heat exchangers, coils, evaporators, and similar equipment.
    - f. Fans, blowers, primary balancing dampers, and mixing boxes.
    - g. Packaged HVAC central-station and zone-type units.
    - h. 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. Orange: For combination cooling and heating 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 two-thirds to three-fourths 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.
  - 4. Include signs for the following general categories of equipment:
    - a. Main control and operating valves, including safety devices.
    - b. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    - c. Heat exchangers, coils, evaporators, and similar equipment.
    - d. Fans, blowers, primary balancing dampers, and mixing boxes.
    - e. Packaged HVAC central-station and zone-type units.
    - f. Tanks and pressure vessels.
    - g. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- D. Install access panel markers with screws on equipment access panels.

### 3.3 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.
  - 2. Pipes with OD, Including Insulation, **6 Inches (150 mm)** and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least **1-1/2 inches (38 mm)** wide, lapped at least **3 inches (75 mm)** at both ends of pipe marker, and covering full circumference of pipe.
- 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.

### 3.4 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. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
  - 3. ASME A13.1 Colors and Designs: For hazardous material exhaust.
  - 4. 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 two-thirds to three-fourths the size of principal lettering.
- B. 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.

### 3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
  - B. 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. Cold Water: 1-1/2 inches (38 mm), round.
      - b. Hot Water: 1-1/2 inches (38 mm), round.
      - c. Fire Protection: 2 inches (50 mm), round.
    - C. Valve-Tag Color:
      - a. Cold Water: Green.
      - b. Hot Water: Yellow.
      - c. Fire Protection: Red.
    - 2. Letter Color:
      - a. Cold Water: White.
      - b. Hot Water: White.
      - c. Fire Protection: White.
- 3.6 VALVE-SCHEDULE INSTALLATION
- A. Mount valve schedule on wall in accessible location in each major equipment room.
- 3.7 ADJUSTING
- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.
- 3.8 CLEANING
- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

## SECTION 23 05 93 - TESTING, ADJUSTING & BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
  - 1. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
  - 2. Adjusting total HVAC systems to provide indicated quantities.
  - 3. Measuring electrical performance of HVAC equipment.
  - 4. Setting quantitative performance of HVAC equipment.
  - 5. Verifying that automatic control devices are functioning properly.
  - 6. Reporting results of the activities and procedures specified in this Section.
- B. Related Sections include the following:
  - 1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
  - 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

#### 1.2 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.
- M. AABC: Associated Air Balance Council.
- N. CTI: Cooling Tower Institute.
- O. NEBB: National Environmental Balancing Bureau.
- P. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

#### 1.3 SUBMITTALS

- A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
- B. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

- C. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

#### 1.4 QUALITY ASSURANCE

- A. Agent Qualifications for larger projects: Engage a testing, adjusting, and balancing agent certified by AABC.
- B. Agent Qualifications for smaller projects: Engage a testing, adjusting, and balancing agent certified by NEBB.
- C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
  - 2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."
- E. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- F. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
- G. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- H. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

#### 1.5 PROJECT CONDITIONS

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

#### 1.6 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 testing, adjusting, and balancing activities.
- B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

#### 1.7 WARRANTY

- A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

#### PART 2 - PRODUCTS (Not Applicable)

#### PART 3 - EXECUTION

##### 3.1 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
  - 1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
  - 2. 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 specifications.
- D. Examine Architect's and Engineer's 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 the 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 Specification 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 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 air-handling equipment to ensure 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 and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
- L. Examine equipment for installation and for properly operating safety interlocks and controls.
- M. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices operate 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. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
  - 5. Sensors are located to sense only the intended conditions.
  - 6. Sequence of operation for control modes is according to the Contract Documents.
  - 7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
  - 8. Interlocked systems are operating.
  - 9. Changeover from heating to cooling mode occurs according to design values.
- N. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

### 3.2 PREPARATION

- A. 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, fire dampers are open.
  - 5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 6. Windows and doors can be closed so design conditions for system operations can be met.

### 3.3 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards and this Section.
- B. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- C. 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 the insulation Specifications for this Project.
- D. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

### 3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

- 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. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling unit components.

### 3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

- A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems.
- B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the 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.
  - 2. Measure static pressure across each air-handling unit component.
    - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
  - 3. 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.
  - 4. Adjust fan speed higher or lower than design with the approval of the Architect. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
  - 5. 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 no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
- C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design 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 submains 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 submains and branch ducts to design airflows within specified tolerances.
- D. Measure terminal outlets and inlets without making adjustments.
  - 1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.
- E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.
  - 1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### 3.6 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 if high-efficiency motor.
  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.
- 3.7 CONDENSING UNITS
- A. Verify proper rotation of fans and measure entering- and leaving-air temperatures. Record compressor data.
- 3.8 HEAT-TRANSFER COILS
- A. Electric-Heating Coils: Measure the following data for each coil:
    1. Nameplate data.
    2. Airflow.
    3. Entering- and leaving-air temperatures at full load.
    4. Voltage and amperage input of each phase at full load and at each incremental stage.
    5. Calculated kW at full load.
    6. Fuse or circuit-breaker rating for overload protection.
- 3.9 TEMPERATURE TESTING
- A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.
  - B. Measure outside-air, wet- and dry-bulb temperatures.
- 3.10 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. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
  - E. Verify free travel and proper operation of control devices such as damper and valve operators.
  - F. Verify 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. Confirm interaction of electrically operated switch transducers.
  - H. Confirm interaction of interlock and lockout systems.
  - I. Verify main control supply-air pressure and observe compressor and dryer operations.
  - J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.
  - K. Note operation of electric actuators using spring return for proper fail-safe operations.
- 3.11 TOLERANCES
- A. Set HVAC system airflow and water flow rates within the following tolerances:
    1. Supply and Exhaust Fans: Plus 5 to plus 10 percent.
    2. Air Outlets and Inlets: 0 to minus 10 percent.
    3. Cooling-Water Flow Rate: 0 to minus 5 percent.
- 3.12 FINAL REPORT
- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-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 the instruments used for procedures, along with proof of calibration.
  - C. Final Report Contents: In addition to the certified field report data, include the following:
    1. Fan curves.
    2. Manufacturers' test data.
    3. Field test reports prepared by system and equipment installers.
    4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.



- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
1. Title page.
  2. Name and address of testing, adjusting, and balancing Agent.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of testing, adjusting, and balancing Agent who certifies the report.
  10. Summary of contents, including the following:
    - a. Design versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  11. Nomenclature sheets for each item of equipment.
  12. Data for terminal units, including manufacturer, type size, and fittings.
  13. Notes to explain why certain final data in the body of reports vary from design values.
  14. 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. Settings for supply-air, static-pressure controller.
    - g. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams 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.
- F. Roof Top Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches (mm), and bore.
    - i. Number of belts, make, and size.
    - j. Number of filters, type, and size.
  2. Motor Data: Include the following:
    - a. Make and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
  3. Test Data: Include design and actual values for the following:

- a. Total airflow rate in cfm (L/s).
  - b. Total system static pressure in inches wg (Pa).
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg (Pa).
  - e. Preheat coil static-pressure differential in inches wg (Pa).
  - f. Cooling coil static-pressure differential in inches wg (Pa).
  - g. Heating coil static-pressure differential in inches wg (Pa).
  - h. Outside airflow in cfm (L/s).
  - i. Return airflow in cfm (L/s).
  - j. Outside-air damper position.
  - k. Return-air damper position.
  - l. Discharge air temperature
- G. Electric-Coil Test Reports: For electric duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data: Include the following:
    - a. System identification.
    - b. Location.
    - c. Coil identification.
    - d. Capacity in Btuh (kW).
    - e. Number of stages.
    - f. Connected volts, phase, and hertz.
    - g. Rated amperage.
    - h. Discharge air temperature
  2. Test Data: Include design and actual values for the following:
    - a. Heat output in Btuh (kW).
    - b. Airflow rate in cfm (L/s).
    - c. Air velocity in fpm (m/s).
    - d. Entering-air temperature in deg F (deg C).
    - e. Leaving-air temperature in deg F (deg C).
    - f. Voltage at each connection.
    - g. Amperage for each phase.
- H. Fan Test Reports: For exhaust fans, include the following:
1. Fan Data: Include the following:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
  2. Motor Data: Include the following:
    - a. Make and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Number of belts, make, and size.
  3. Test Data: Include design and actual values for the following:
    - a. Total airflow rate in cfm (L/s).
    - b. Total system static pressure in inches wg (Pa).
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg (Pa).
    - e. Suction static pressure in inches wg (Pa).

- I. Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, include the following:
  1. Unit Data: Include the following:
    - a. Unit identification.
    - b. Location.
    - c. Unit make and model number.
    - d. Manufacturer's compressor serial numbers.
    - e. Compressor make.
    - f. Compressor model and serial numbers.
    - g. Refrigerant weight in lb (kg).
  2. Test Data: Include design and actual values for the following:
    - a. Entering-air, dry-bulb temperature in deg F (deg C).
    - b. Leaving-air, dry-bulb temperature in deg F (deg C).
    - c. Control settings.
    - d. Unloader set points.
    - e. Low-pressure-cutout set point in psig (kPa).
    - f. High-pressure-cutout set point in psig (kPa).
    - g. Suction pressure in psig (kPa).
    - h. Suction temperature in deg F (deg C).
    - i. Condenser refrigerant pressure in psig (kPa).
    - j. Condenser refrigerant temperature in deg F (deg C).
    - k. Oil pressure in psig (kPa).
    - l. Oil temperature in deg F (deg C).
    - m. Voltage at each connection.
    - n. Amperage for each phase.
    - o. The kW input.
    - p. Number of fans.

### 3.13 ADDITIONAL TESTS

- A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

END OF SECTION

## SECTION 23 07 13 - DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

#### 1.2 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

#### 1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, 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.

#### 1.4 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.
- B. Deliver and store all insulation with protective material until installation. Any material left exposed to moisture and/or particulates shall be removed and replaced.
- C. Any installed insulation left temporarily incomplete shall be covered with protective material until final connections can be installed.

#### 1.5 COORDINATION

- A. Coordinate clearance requirements with duct Installer for insulation application.

#### 1.6 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

### PART 2 - PRODUCTS

#### 2.1 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.

#### 2.2 INSULATION MATERIALS

- A. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film

#### 2.3 Field Applied Jacket

- A. Foil and paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

#### 2.4 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. Adhesive-Attached 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.
  - 1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.

#### 2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

### PART 3 - EXECUTION

### 3.1 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.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 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.

### 3.4 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. Install anchor pins and speed washers on sides and bottom of horizontal ducts and all 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.
3. Impale insulation over anchors and attach speed washers.
  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. 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.
  7. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round duct elbows with individually mitered gores cut to fit the elbow.
  8. 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.
  9. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

### 3.5 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 dishwasher ductwork.
- D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
  1. Factory-insulated flexible ducts.
  2. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
  3. Flexible connectors.
  4. Vibration-control devices.
  5. Testing agency labels and stamps.
  6. Nameplates and data plates.
  7. Access panels and doors in air-distribution systems.

### 3.6 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: Round and rectangular, supply-air ducts, concealed.
  1. Material: Mineral-fiber blanket.
  2. Thickness: 3 inches (R-8 or greater)
  3. Number of Layers: One.
  4. Field-Applied Jacket: Foil and paper.
  5. Vapor Retarder Required: Yes.
- B. Service: Round and rectangular, return-air ducts, outside air duct, concealed or exposed.
  1. Material: Mineral-fiber blanket.
  2. Thickness: 2 inches (50 mm).
  3. Number of Layers: One.
  4. Field-Applied Jacket: Foil and Paper
  5. Vapor Retarder Required: Yes.
- C. Service: Round and rectangular, supply and return-air ducts, exposed and in mechanical rooms.
  1. Material: 2" liner insulation
  2. Thickness: 2 inches (50 mm).
  3. Number of Layers: One.
  4. Field-Applied Jacket: None.
  5. Vapor Retarder Required: No
- D. Service: Round and rectangular, exhaust air ducts, concealed & exposed and in mechanical rooms.

1. Material: 1" Interior liner
2. Thickness: 1 inches
3. Number of Layers: One.
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No

END OF SECTION

SECTION 23 09 23 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1- GENERAL

1.1 DESCRIPTION

- A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.
- B. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet.  
The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.
- C. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms specified in Sequence of Operations for HVAC Controls” shall be BACnet objects.

1.2 APPROVED CONTROL SYSTEM MANUFACTURERS

- A. The following are approved control system suppliers, manufacturers, and product lines:

Supplier	Manufacturer	Product Line
Trane	Trane	Tracer SC

1.3 QUALITY ASSURANCE

- A. Installer and Manufacturer Qualifications

- 1. Installer shall have an established working relationship with Control System Manufacturer.
- 2. Installer shall have successfully completed Control System Manufacturer’s control system training. Upon request, Installer shall present record of completed training including course outlines.

1.4 ARCHITECTURE/COMMUNICATION

- A. Wireless equipment controllers and auxiliary control devices shall conform to:
- B. IEEE 802.15.4 radios to minimize risk of interference and maximize battery life, reliability, and range.
- C. Operating range shall be a minimum of 200 feet; open range shall be 2,500 ft. (762 m) with less than 2% packet error rate.
- D. To maintain robust communication, mesh networking and two-way communications shall be used to optimize the wireless network health.
- E. Certifications shall include FCC CFR47 - RADIO FREQUENCY DEVICES - Section 15.247 & Subpart E
- F. Shall be ZigBee Building Automation Certified to allow wireless integration with products from multiple suppliers.

1.4 GRAPHICS PACKAGE

- A. All floor plan graphics shall be represented in a 3D extruded wall thermograph.
- B. All equipment graphics shall by 3D representations of actual equipment at site.

1.5 CODES AND STANDARDS

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to the receipt of bids of the following codes:

- 1. ANSI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for Building Automation and Control Systems

- B. Schedules:

- 1. Within one month of contract award, provide a schedule of the work indicating the following:
  - a. Intended sequence of work items
  - b. Start date of each work item
  - c. Duration of each work item
  - d. Planned delivery dates for ordered material and equipment and expected lead times
  - e. Milestones indicating possible restraints on work by other trades or situations.
- 2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

1.6 WARRANTY



A. Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. If the engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, the engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve the contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.
5. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

1.7 OWNERSHIP OF PROPRIETARY MATERIAL

- A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
1. Graphics
  2. Record drawings
  3. Database
  4. Application programming code
  5. Documentation

1.8 TRAINING

- A. Provide training for a designated staff of Owner's representatives in two four hour sessions. Training shall be provided via web-based or computer-based training, classroom training, or a combination of training methods.
- B. Training shall enable students to accomplish the following objectives.
1. Day-to-day Operators:
    - a. Proficiently operate the system
    - b. Understand control system architecture and configuration
    - c. Understand DDC system components
    - d. Understand system operation, including DDC system control and optimizing routines (algorithms)
    - e. Operate the workstation and peripherals
    - f. Log on and off the system
    - g. Access graphics, point reports, and logs
    - h. Adjust and change system set points, time schedules, and holiday schedules
    - i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
    - j. Understand system drawings and Operation and Maintenance manual
    - k. Understand the job layout and location of control components
    - l. Access data from DDC controllers and ASCs
    - m. Operate portable operator's terminals

PART -2 SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

2.1 SECTION INCLUDES:

- A. Rooftop Units
- B. Fan Powered Box
- C. Variable Air Volume
- D. DX Single Zone Unit
- E. Exhaust Fan

2.2 ROOFTOP UNITS (RTU-1 AND 2)

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Pre-Cool, Occupied / Unoccupied and

Heat / Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints.

**Occupied Mode:**

During occupied periods, the supply fan shall run continuously and the outside air damper shall open to maintain minimum ventilation requirements. The unit controller shall control the supply fan VFD to maintain the current duct static pressure setpoint (adj.). The DX cooling shall stage to maintain the current discharge air temperature setpoint. If economizing is enabled the outside air damper shall modulate to maintain the current discharge air temperature setpoint.

**Unoccupied Mode:**

When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan variable frequency drive (VFD) shall operate as necessary to maintain duct static pressure setpoint (adj.), the outside air damper shall open if economizing is enabled and remain closed if economizing is disabled and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F minus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop, the DX cooling shall be disabled and the outside air damper shall close.

**Optimal Start:**

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

**Pre-Cool Mode:**

During optimal start, if the average space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling or economizer. The outside air damper shall remain closed, unless economizing. When the average space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

**Optimal Stop:**

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint.

**Occupied Bypass:**

The BAS shall monitor the status of the "on" and "cancel" buttons of the space temperature sensors. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

**Cooling Mode:**

The unit controller shall use the discharge air temperature sensor and discharge air temperature cooling setpoint to determine when to initiate requests for cooling. Discharge air setpoint shall be maintained by modulating the economizer or staging the DX cooling as required to maintain the discharge air setpoint.

**Supply Air Temperature Reset Control:**

The discharge air temperature setpoint, 55.0 deg. F - 65.0 deg. F (adj.) shall be reset based on either the outside air temperature or space average temperature (adj.). The minimum discharge air setpoint shall be set at 55.0 deg. F (adj.). The discharge temperature sensor shall prevent the discharge air temperature from falling below the minimum discharge air setpoint (adj.). If the discharge air temperature continues to fall, the discharge temperature sensor shall act as a low discharge temperature limit, a low temperature alarm shall be annunciated, and the unit shall shut down. If the discharge temperature rises above the high limit setpoint the sensor shall act as a high discharge temperature limit and shall keep the unit running, a high temperature alarm shall be annunciated.

**Outdoor Air Temperature Reset:**

The discharge air temperature setpoint shall be adjusted based on the outside air temperature and the cooling load of the building.

**Space Temperature Reset:**

The discharge air temperature setpoint shall be adjusted based on the temperature of the critical space(s).

**Economizer:**

The supply air sensor shall measure the dry bulb temperature of the air leaving the evaporator coil while economizing. When economizing is enabled and the unit is operating in the cooling mode, the economizer damper shall be modulated between its minimum position and 100% to maintain the discharge air temperature setpoint. The economizer damper shall modulate toward minimum position in the event the mixed air temperature falls below the low limit temperature setting. Compressors shall be delayed from operating until the economizer has opened to 100%.

**Supply Fan:**

The supply fan shall be enabled while in the occupied mode and cycled on during the unoccupied mode. A differential

pressure switch shall monitor the differential pressure across the fan. If the switch does not open within 40 seconds after a request for fan operation a fan failure alarm shall be annunciated at the BAS, the unit shall stop, requiring a manual reset.  
Critical Zone Reset (Static Pressure Control):

The duct static pressure setpoint shall be reset to the optimal setpoint communicated by the BAS. The BAS shall reset the duct static pressure setpoint based on the position of the furthest open VAV damper. The supply duct static pressure sensor shall also act as a high duct static pressure safety and shall shut down the unit in the event that the duct static pressure reaches 3.00 inches of W.C. (adj.). A manual reset shall be required to re-start the unit. When the unit is in the unoccupied mode the controller shall modulate the speed of the VFD to 50%. If the duct static pressure sensor fails, the VFD shall modulate its speed to 50% and an alarm shall be annunciated at the BAS.

Filter Status:

A differential pressure switch shall monitor the differential pressure across the filter when the fan is running. If the switch closes for 2 minutes after a request for fan operation a dirty filter alarm shall be annunciated at the BAS.

2.3 FAN POWERED BOX (TYPICAL OF 7)

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied and Unoccupied commands. The BAS may also send a Heat/Cool mode, priority shutdown commands, space temperature and/or space temperature setpoint. If communication is lost with the BAS, the VAV controller shall operate using its local setpoints.

Occupancy Mode:

The occupancy mode shall be communicated or hardwired to the VAV via a binary input. Valid Occupancy modes for the VAV shall be:

Occupied:

Normal operating mode for occupied spaces or daytime operation. When the unit is in the occupied mode the VAV shall maintain the space temperature at the active occupied heating or cooling setpoint. Applicable ventilation and airflow setpoints shall be enforced. The occupied mode shall be the default mode of the VAV.

Occupied Standby:

The occupancy sensor shall be used to indicate that the space is unoccupied, even though the BAS has scheduled the space as occupied. In the occupied standby mode, the active cooling and heating setpoints shall be relaxed (see below) and both the ventilation airflow and minimum airflow setpoints shall be lowered (see VAV schedule).

Unoccupied:

Normal operating mode for unoccupied spaces or nighttime operation. When the unit is in unoccupied mode the VAV controller shall maintain the space temperature at the stored unoccupied heating or cooling setpoint regardless of the presence of a hardwired or communicated setpoint. When the space temperature exceeds the active unoccupied setpoint the VAV shall modulate fully closed.

Occupied Bypass:

Mode used to temporarily place the unit into the occupied operation. Tenants shall be able to override the unoccupied mode from the space sensor. The override shall last for a maximum of 4 hours (adj.). The tenants shall be able to cancel the override from the space sensor at any time. During the override the unit shall operate in occupied mode.

Heat/Cool Mode:

The Heat/Cool mode shall be set by a communicated value or automatically by the VAV. In standalone or auto mode the VAV shall compare the primary air temperature with the configured auto changeover setpoint to determine if the air is "hot" or "cold". Heating mode shall command the VAV to heat only; it implies the primary air temperature is hot. Cooling mode shall command the VAV to cool only; it implies the primary air temperature is cold

Heat/Cool Setpoint:

The space temperature setpoint shall be determined either by a local (e.g., thumbwheel) setpoint, the VAV default setpoint or a communicated value. The VAV shall use the locally stored default setpoints when neither a local setpoint nor communicated setpoint is present. If both a local setpoint and communicated setpoint exist, the VAV shall use the communicated value.

Cooling Mode:

When the unit is in cooling mode, the VAV controller shall maintain the space temperature at the active cooling setpoint by modulating the airflow between the active cooling minimum airflow setpoint to the maximum cooling airflow setpoint. Based on the VAV controller occupancy mode, the active cooling setpoint shall be one of the following:

Setpoint	Default Value
Occupied Cooling Setpoint	74.0 deg. F
Unoccupied Cooling Setpoint	85.0 deg. F
Occupied Standby Cooling Setpoint	78.0 deg. F

Occupied Min Cooling Airflow Setpoint	See VAV Schedule
Occupied Max Cooling Airflow Setpoint	See VAV Schedule

The VAV shall use the measured space temperature and the active cooling setpoint to determine the requested cooling capacity of the unit. The outputs will be controlled based on the unit configuration and the requested cooling capacity.

**Heating Mode:**

When the unit is in heating mode, the VAV controller shall maintain the space temperature at the active heating setpoint by modulating the airflow between the active heating minimum airflow setpoint to the maximum heating airflow setpoint. Based on the VAV controller occupancy mode, the active heating setpoint shall be one of the following:

Setpoint	Default Value
Occupied Heating Setpoint	71.0 deg. F
Unoccupied Heating Setpoint	60.0 deg. F
Occupied Standby Heating Setpoint	67.0 deg. F
Occupied Min Heating Airflow Setpoint	See VAV Schedule
Occupied Max Heating Airflow Setpoint	See VAV Schedule

The VAV controller shall use the measured space temperature and the active heating setpoint to determine the requested heating capacity of the unit. The outputs will be controlled based on the unit configuration and the requested heating capacity.

**Continuous Fan Control:**

The VAV fan shall operate continuously in all occupied modes. During the unoccupied mode, the primary air valve shall modulate fully closed. The terminal fan and heat shall cycle as needed to maintain a reduced space temperature.

**Reheat Control:**

Reheat will only be allowed when the primary air temperature is 5.0 deg. F below the configured reheat enable setpoint of 70.0 deg. F (adj.). The reheat shall be enabled when the space temperature drops below the active cooling setpoint and the airflow is at the minimum cooling airflow setpoint. During reheat the VAV shall operate at its minimum heating airflow setpoint and energize the heat as follows:

**Pulse Width Modulated Reheat (PWM):**

If the space temperature is at the heating setpoint, energize first stage of heat. The second stage of heating shall be energized based on time and temperature deviation from setpoint. Duty cycle these stages on a three-minute window. Stage 1 shall modulate from 0-50% deviation and be on continuously above 50%. Stage 2 shall modulate from 50-100% deviation

**Space Sensor Failure:**

If there is a fault with the operation of the zone sensor an alarm shall be annunciated at the BAS. Space sensor failure shall cause the VAV to drive the damper to minimum air flow if the VAV is in the occupied mode, or drive it closed if the VAV is in the unoccupied mode. The series fan shall be enabled and the reheat will be disabled.

**2.4 VARIABLE AIR VOLUME (TYPICAL OF 4)**

**Building Automation System Interface:**

The Building Automation System (BAS) shall send the controller Occupied and Unoccupied commands. The BAS may also send a Heat/Cool mode, priority shutdown commands, space temperature and/or space temperature setpoint. If communication is lost with the BAS, the VAV controller shall operate using its local setpoints.

**Occupancy Mode:**

The occupancy mode shall be communicated or hardwired to the VAV via a binary input. Valid Occupancy modes for the VAV shall be:

**Occupied:**

Normal operating mode for occupied spaces or daytime operation. When the unit is in the occupied mode the VAV shall maintain the space temperature at the active occupied heating or cooling setpoint. Applicable ventilation and airflow setpoints shall be enforced. The occupied mode shall be the default mode of the VAV.

**Unoccupied:**

Normal operating mode for unoccupied spaces or nighttime operation. When the unit is in unoccupied mode the VAV controller shall maintain the space temperature at the stored unoccupied heating or cooling setpoint regardless of the

presence of a hardwired or communicated setpoint. When the space temperature exceeds the active unoccupied setpoint the VAV shall modulate fully closed.

**Occupied Bypass:**

Mode used to temporarily place the unit into the occupied operation. Tenants shall be able to override the unoccupied mode from the space sensor. The override shall last for a maximum of 4 hours (adj.). The tenants shall be able to cancel the override from the space sensor at any time. During the override the unit shall operate in occupied mode.

**Heat/Cool Mode:**

The Heat/Cool mode shall be set by a communicated value or automatically by the VAV. In standalone or auto mode the VAV shall compare the primary air temperature with the configured auto changeover setpoint to determine if the air is "hot" or "cold". Heating mode shall command the VAV to heat only; it implies the primary air temperature is hot. Cooling mode shall command the VAV to cool only; it implies the primary air temperature is cold.

**Heat/Cool Setpoint:**

The space temperature setpoint shall be determined either by a local (e.g., thumbwheel) setpoint, the VAV default setpoint or a communicated value. The VAV shall use the locally stored default setpoints when neither a local setpoint nor communicated setpoint is present. If both a local setpoint and communicated setpoint exist, the VAV shall use the communicated value.

**Cooling Mode:**

When the unit is in cooling mode, the VAV controller shall maintain the space temperature at the active cooling setpoint by modulating the airflow between the active cooling minimum airflow setpoint to the maximum cooling airflow setpoint. Based on the VAV controller occupancy mode, the active cooling setpoint shall be one of the following:

Setpoint	Default Value
Occupied Cooling Setpoint	74.0 deg. F
Unoccupied Cooling Setpoint	85.0 deg. F
Occupied Standby Cooling Setpoint	78.0 deg. F
Occupied Min Cooling Airflow Setpoint	See VAV Schedule
Occupied Max Cooling Airflow Setpoint	See VAV Schedule

The VAV shall use the measured space temperature and the active cooling setpoint to determine the requested cooling capacity of the unit. The outputs will be controlled based on the unit configuration and the requested cooling capacity.

**Space Sensor Failure:**

If there is a fault with the operation of the zone sensor an alarm shall be annunciated at the BAS. Space sensor failure shall cause the VAV to drive the damper to minimum air flow if the VAV is in the occupied mode, or drive it closed if the VAV is in the unoccupied mode.

**2.5 DX SINGLE ZONE UNIT**

**Run Conditions – Scheduled through BAS:**

The unit shall be controlled using a BACnet communicating thermostat.

Alarms shall be provided as follows:

**Zone Setpoint Adjust:**

The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

The supply fan shall run anytime the unit is commanded to run, unless shutdown on internal safeties.

**Cooling Stages:**

The controller shall measure the zone temperature and stage the cooling to maintain its cooling setpoint.

**Electric Heating Stages:**

The controller shall measure the zone temperature and stage the heating to maintain its heating setpoint.

**2.6 MISCELLANEOUS CONTROL POINTS**

**Outdoor Air Temperature and Humidity:**

A temperature and humidity sensor mounted on the north side of the building will continually broadcast their information on the network as global information

**Building Exhaust Fan:**

When any RTU is active the BAS will energize the exhaust fan. The exhaust fan will be off when the RTU is inactive.

Temperature monitor of elevator equipment room served by minisplits. Alarms shall be provided as follows:

High Temp: When temp is above user defined setpoint an alarm will be initiated.

END OF SECTION

## SECTION 23 23 00 - REFRIGERANT PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install piping and specialties for refrigeration systems as described in Contract Documents.

B. Products Installed But Not Furnished Under This Section:

#### 1.2 REFERENCES

A. Association Publications:

1. Federal Emergency Management Agency (FEMA) / Vibration Isolation and Seismic Control Manufacturers Association (VISCMA) / American Society of Civil Engineers (ASCE):
  - a. FEMA 412, 'Installing Seismic Restraints For Mechanical Equipment' (December 2002).
2. Vibration Isolation and Seismic Control Manufacturers Association (VISCMA):
  - a. VISCMA 101-12, 'Seismic Restraint Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.
  - b. VISCMA 102-12, 'Vibration Isolation Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.

B. Definitions:

1. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.
2. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.

C. Reference Standards:

1. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
  - a. ANSI/ASHRAE Standard 15-2010, 'Safety Standard for Refrigeration Systems'.
  - b. ANSI/ASHRAE Standard 34-2010, 'Designation and Classification of Refrigerants'.
2. American National Standards Institute / American Welding Society:
  - a. ANSI/AWS A5.8M/A5.8-2011, 'Specification for Filler Metals for Brazing and Braze Welding'.
3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
  - a. '2011 ASHRAE Handbook - HVAC Applications'.
    - 1) Chapter 48, 'Noise and Vibration Control'.
4. ASTM International:
  - a. ASTM A36/A36M-08, 'Standard Specification for Carbon Structural Steel'.
  - b. ASTM B280-08, 'Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service'.
5. National Fire Protection Association / American National Standards Institute:
  - a. NFPA 90A-2012, 'Installation of Air Conditioning and Ventilating Systems'.
6. Underwriters Laboratories:
  - a. UL 2182, 'Refrigerants' (2nd Edition).

#### 1.3 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Show each individual equipment and piping support.

B. Informational Submittals:

1. Qualification Statements: Technician certificate for use of HFC and HCFC refrigerants.

#### 1.4 QUALITY ASSURANCE

##### A. Regulatory Agency Sustainability Approvals:

###### 1. Refrigerants:

###### a. Underwriters Laboratories / Underwriters Laboratories of Canada:

- 1) Comply with requirements of UL 2182.

##### B. Qualifications. Section 01 4301 applies, but is not limited to the following:

1. Installer: Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of HFC and HCFC refrigerants.

#### PART 2 - PRODUCTS

##### 2.1 COMPONENTS

###### A. Manufacturers:

###### 1. Manufacturer Contact List:

- a. Airtec,
- b. Cush-A-Clamp by ZSI Manufacturing,
- c. Elkhart Products Corp.,
- d. Emerson Climate Technologies,
- e. Handy & Harman Products
- f. Harris Products Group,
- g. Henry Valve Co,
- h. Hilti Inc,
- i. Hydra-Zorb Co,
- j. JB Industries,
- k. Mueller Steam Specialty,
- l. Nibco Inc,
- m. Packless Industries, Parker Corp,
- n. Sporlan Valve Co.
- o. Sherwood Valves,.
- p. Thomas & Betts,
- q. Unistrut, Div of Atkore International, Inc.
- r. Universal Metal Hose.
- s. Vibration Mountings & Controls,
- t. Virginia KMP Corp,

###### B. Materials:

###### 1. Refrigerant Piping:

- a. Meet requirements of ASTM B280, hard drawn straight lengths. Soft copper tubing not permitted.
- b. Do not use pre-charged refrigerant lines.

###### 2. Refrigerant Fittings:

- a. Wrought copper with long radius elbows.
- b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
  - 1) Mueller Streamline.
  - 2) Nibco Inc.
  - 3) Elkhart.

###### 3. Suction Line Traps:

- a. Manufactured standard one-piece traps.
- b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
  - 1) Mueller Streamline.
  - 2) Nibco Inc.
  - 3) Elkhart.

###### 4. Tee Access:

- a. Brass:
  - 1) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
    - a) JB Industries: Part #A3 Series with Factory Cap and Valve Core.

5. Connection Material:
  - a. Brazing Rods in accordance with ANSI/AWS A5.8M/A5.8:
    - 1) Copper to Copper Connections:
      - a) Classification BCuP-4 Copper Phosphorus (6 percent silver).
      - b) Classification BCuP-5 Copper Phosphorus (15 percent silver).
    - 2) Copper to Brass or Copper to Steel Connections: Classification BAg-5 Silver (45 percent silver).
    - 3) Do not use rods containing Cadmium.
  - b. Flux:
    - 1) Type Two Acceptable Products:
      - a) Stay-Silv White Brazing Flux by Harris Products Group.
      - b) High quality silver solder flux by Handy & Harmon.
      - c) Equal as approved by Architect before use. See Section 01 6200.
6. Valves:
  - a. Expansion Valves:
    - 1) For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
    - 2) Size valves to provide full rated capacity of cooling coil served. Coordinate selection with evaporator coil and condensing unit.
    - 3) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      - a) Emerson Climate Technologies.
      - b) Henry.
      - c) Mueller.
      - d) Parker.
      - e) Sporlan.
  - b. Manual Refrigerant Shut-Off Valves:
    - 1) Ball valves designed for refrigeration service and full line size.
    - 2) Valve shall have cap seals.
    - 3) Valves with hand wheels are not acceptable.
    - 4) Provide service valve on each liquid and suction line at compressor.
    - 5) If service valves come as integral part of condensing unit, additional service valves shall not be required.
    - 6) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      - a) Henry.
      - b) Mueller.
      - c) Sherwood.
      - d) Virginia.
7. Filter-Drier:
  - a. On lines **3/4 inch (19 mm)** outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
  - b. On lines smaller than **3/4 inch (19 mm)** outside diameter, filter-drier shall be sealed type with brazed end connections.
  - c. Size shall be full line size.
  - d. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
    - 1) Emerson Climate Technologies.
    - 2) Mueller.
    - 3) Parker.
    - 4) Sporlan.
    - 5) Virginia.
8. Sight Glass:
  - a. Combination moisture and liquid indicator with protection cap.
  - b. Sight glass shall be full line size.
  - c. Sight glass connections and sight glass body shall be solid copper or brass, no copper-coated steel sight glasses allowed.



- d. Category Four Approved Product. See Section 01 6200 for definitions of Categories:
  - 1) HMI by Emerson Climate Technologies.
- 9. Flexible Connectors:
  - a. Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.
  - b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Vibration Absorber Model VAF by Packless Industries.
    - 2) Vibration Absorbers by Virginia KMP Corp.
    - 3) Anaconda 'Vibration Eliminators' by Universal Metal Hose.
    - 4) Style 'BF' Spring-flex freon connectors by Vibration Mountings.
- 10. Refrigerant Piping Supports:
  - a. Base, Angles, And Uprights: Steel meeting requirements of ASTM A36.
  - b. Securing Channels:
    - 1) At Free-Standing Pipe Support:
      - a) Class One Quality Standard: P-1000 channels by Unistrut.
      - b) Acceptable Manufacturers: Hilti, Thomas & Betts.
      - c) Equal as approved by Architect before installation. See Section 01 6200.
    - 2) At Wall Support:
      - a) Class One Quality Standard: P-3300 channels by Unistrut.
      - b) Acceptable Manufacturers: Hilti, Thomas & Betts.
      - c) Equal as approved by Architect before installation. See Section 01 6200.
    - 3) At Suspended Support:
      - a) Class One Quality Standard: P-1001 channels by Unistrut.
      - b) Acceptable Manufacturers: Hilti, Thomas & Betts.
      - c) Equal as approved by Architect before installation. See Section 01 6200.
    - 4) Angle Fittings:
      - a) Class One Quality Standard: P-2626 90 degree angle by Unistrut.
      - b) Acceptable Manufacturers: Hilti, Thomas & Betts.
      - c) Equal as approved by Architect before installation. See Section 01 6200.
  - c. Pipe Clamps:
    - 1) Type Two Acceptable Manufacturers:
      - a) Hydra-Zorb.
      - b) ZSI Cush-A-Clamp.
      - c) Hilti Cush-A-Clamp.
      - d) Equal as approved by Architect before installation. See Section 01 6200.
  - d. Protective Cover: 18 ga (1.2 mm) steel, hot-dipped galvanized.
- 11. Locking Refrigerant Cap:
  - a. Provide and install on charging valves:
    - 1) Class One Quality Standard: 'No Vent' locking refrigerant cap.
    - 2) Acceptable Manufacturers: Airtec.
    - 3) Equal as approved by Architect before installation. See Section 01 6200.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refrigerant Lines:
  - 1. Install as high in upper mechanical areas as possible. Do not install underground or in tunnels.
  - 2. Slope suction lines down toward compressor one inch/10 feet (25 mm in 3 meters). Locate traps at vertical rises against flow in suction lines.
- B. Connections:
  - 1. Refrigeration system connections shall be copper-to-copper, copper-to-brass, or copper-to-steel type properly cleaned and brazed with specified rods. Use flux only where necessary. No soft solder (tin, lead, antimony) connections will be allowed in system.
  - 2. Braze manual refrigerant shut-off valve, sight glass, and flexible connections.

3. Circulate dry nitrogen through tubes being brazed to eliminate formation of copper oxide during brazing operation.

C. Specialties:

1. Install valves and specialties in accessible locations. Install refrigeration distributors and suction outlet at same end of coil.
2. Install thermostatic bulb as close to cooling coil as possible. Do not install on vertical lines.
3. Install equalizing line in straight section of suction line, downstream of and reasonably close to thermostatic bulb. Do not install on vertical lines.
4. Provide flexible connectors in each liquid line and suction line at both condensing unit and evaporator on systems larger than five tons. Anchor pipe near each flexible connector.

D. Refrigerant Supports:

1. Support Spacing:
  - a. Piping 1-1/4 inch (32 mm) And Larger: 8 feet (2.450 m) on center maximum.
  - b. Piping 1-1/8 inch (28.5 mm) And Smaller: 6 feet (1.80 m) on center maximum.
  - c. Support each elbow.
2. Isolate pipe from supports and clamps with Hydrozorb or Cush-A-Clamp systems.
3. Run protective cover continuous from condensing units to risers or penetrations at building wall.

3.2 FIELD QUALITY CONTROL

A. Field Tests:

1. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
  - a. Draw vacuum on each entire system with two stage vacuum pump. Draw vacuum to 300 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
  - b. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 300 microns without vacuum pump running.
  - c. Conduct tests at 70 deg F (21 deg C) ambient temperature minimum.
  - d. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
  - e. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
  - f. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.

B. Non-Conforming Work:

1. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

END OF SECTION

## SECTION 23 31 13 - METAL DUCTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

#### 1.2 SUMMARY

- B. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg

#### 1.3 DEFINITIONS

- A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula  $Btu \times in./h \times sq. \text{ ft.} \times deg \text{ F}$  or  $W/m \times K$  at the temperature differences specified. Values are expressed as Btu or W.

#### 1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect.

#### 1.5 SUBMITTALS

- A. Product Data: For duct liner and sealing materials.
- B. Shop Drawings: Show details of the following:
  - 1. Duct layout indicating pressure classifications and sizes on plans.
  - 2. Fittings.
  - 3. Penetrations through fire-rated and other partitions.
  - 4. Coordination with other trades and including but not limited to: structural members, electrical lights and conduits, plumbing lines, & fire sprinkler lines.
- C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
  - 1. Ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
  - 2. Coordination with ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.
- D. Duct Construction Standards: Provide a copy of the duct construction standards to be used for each pressure classification in this project. Duct Construction Standards must comply with the latest edition of SMACNA "HVAC Duct Construction Standards – Metal and Flexible."
- E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- F. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

#### 1.6 QUALITY ASSURANCE

- A. Welding Standards: Qualify welding procedures and welding personnel to perform welding processes for this Project 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. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.
- C. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.
- D. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Chapter 3, "Duct System," for range hood ducts, unless otherwise indicated.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.
- C. Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation
- D. Deliver and store all ductwork with protective material until installation. Any material left exposed to moisture and/or particulates shall be removed and replaced.
- E. Any installed ductwork or piping system left temporarily incomplete shall be covered with protective material until final connections can be installed.
- F. All ductwork and/or liner insulation to be wrapped with protective material until installation. Any ductwork or insulation left exposed to the environment or contaminating particulate matter shall be replaced at the contractor's expense.

## PART 2 - PRODUCTS

### 2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.
- C. Stainless Steel: ASTM A 480/A 480M, Type 316, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish for concealed ducts.
- D. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- E. 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).

### 2.2 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.
  - 1. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
  - 2. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

### 2.3 HANGERS AND SUPPORTS

- A. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
  - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
  - 2. Straps and Rod Sizes: Comply with latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.
- B. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- C. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
  - 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 ductwork.

### 2.4 RECTANGULAR DUCT FABRICATION

- A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to the latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply 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 classification.
  - 2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

- B. Fabricate range hood exhaust ducts with 0.0598-inch- thick, galvanized sheet for concealed ducts and 0.0500-inch-thick stainless steel for exposed ducts. Weld and flange seams and joints. Comply with NFPA 96.
- C. Fabricate dishwasher hood exhaust ducts with 0.0500-inch- thick stainless steel. Weld and flange seams and joints.
- D. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
  - 1. Supply Ducts between AHU and Air Terminal Units: 3-inch wg.
  - 2. Supply Ducts after air terminal units and on constant volume supply equipment: 1-inch wg (250 Pa), positive pressure
  - 3. Return Ducts: 1-inch wg ,negative pressure.
  - 4. Exhaust Ducts: 1-inch wg negative pressure.
- E. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.

## 2.5 ROUND FABRICATION

- A. Round Ducts: Fabricate spiral seam supply and return ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Snap Lock Longitudinal seam ductwork will not be allowed. Adjustable elbows will not be allowed.
- B. Spiral seam round or oval duct may be substituted for rectangular duct at the contractors option. Spiral seam ductwork sizing must result in the same or less pressure drop than the rectangular duct indicated on the plans.

## 2.6 DUCT STORAGE

- A. All duct must have end capped with plastic covers on both ends from end of fabrication to duct installation. If this is not provided at the field, vacuum ducts before final acceptance to remove dust and debris.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION, GENERAL

- A. Duct installation requirements are specified in other Division Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.
- B. Construct and install each duct system for the specific duct pressure classification indicated.
- C. Install round ducts in lengths not less than 10 feet (3 m), unless interrupted by fittings.
- D. Install ducts with fewest possible joints.
- E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
- F. Install couplings tight to duct wall surface with a minimum of projections into duct.
- G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- L. Electrical Equipment Spaces: Route ductwork 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 space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening 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 damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division Section "Duct Accessories." Firestopping materials and installation methods are specified in other Divisions

### 3.2 SEAM AND JOINT SEALING

- A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." All duct to be sealed to SMACNA seal class A which requires sealing all transverse joints, longitudinal seams and duct wall penetrations regardless of pressure classification.
- B. Seal externally insulated ducts before insulation installation.

- C. All ducts shall be inspected after sealing is complete and prior to insulation installation. Provide the engineer with a minimum 7 days notice prior to beginning duct insulation.
- 3.3 RANGE HOOD EXHAUST DUCT INSTALLATIONS
- A. Install ducts to allow for thermal expansion of ductwork through 2000 deg F 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 15-foot intervals; locate on sides of duct a minimum of 1-1/2 inches from bottom; and fit with grease-tight covers of same material as duct.
  - D. Do not penetrate fire-rated assemblies.
- 3.4 DISHWASHER EXHAUST DUCT INSTALLATIONS
- A. Install dishwasher exhaust ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- 3.5 HANGING AND SUPPORTING
- A. Install rigid round and rectangular metal duct with support systems indicated in the latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
  - B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
  - C. Support vertical ducts at a maximum interval of 16 feet and at each floor.
  - D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- 3.6 CONNECTIONS
- A. Connect equipment with flexible connectors according to Section "Duct Accessories."
  - B. For branch, outlet and inlet, and terminal unit connections, comply with the latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- 3.7 DUCT APPLICATION
- A. Service: Round and rectangular, supply/return/outside -air ducts, concealed.
  - B. Sheet-metal with wrap insulation
  - C. Service: Round and rectangular, supply/return/outside -air ducts, exposed and in mechanical rooms.
    - 1. Sheet-metal double wall with lined insulation in-between.
    - 2. Inner sheet-metal duct shall be perforated in areas with acoustical requirements, ref. plans.
- 3.8 FIELD QUALITY CONTROL
- A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
  - B. 25% of the duct installed after the air handling units and (prior to the air terminal units, when applicable) shall be tested in the presence of the Architect, at static pressures equal to maximum design pressure of system or section being tested. The sections of duct to be tested shall be chosen by the architect or engineer after installation of the duct. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
  - C. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."
  - D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg.
  - E. Remake leaking joints and retest until leakage is less than maximum allowable.
- 3.9 CLEANING
- A. After completing system installation, including outlet fittings and devices, inspect the system.

END OF SECTION

## SECTION 23 33 00 - HVAC DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Backdraft dampers.
  - 2. Manual-volume dampers.
  - 3. Fire dampers.
  - 4. Turning vanes.
  - 5. Duct-mounted access doors and panels.
  - 6. Flexible ducts.
  - 7. Flexible connectors.
  - 8. Duct accessory hardware.

#### 1.2 SUBMITTALS

- A. Product Data: For the following:
  - 1. Backdraft dampers.
  - 2. Manual-volume dampers.
  - 3. Fire dampers.
  - 4. Duct-mounted access doors and panels.
  - 5. Flexible ducts.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:
  - 1. Special fittings and manual- and automatic-volume-damper installations.
  - 2. Fire-damper installations, including sleeves and duct-mounted access doors and panels.
- C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

#### 1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA standards:
  - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
  - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

#### 1.4 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.

### PART 2 - PRODUCTS

#### 2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.
- C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. 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).

#### 2.2 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. Blades: 0.025-inch- (0.6-mm-) thick, roll-formed aluminum.
- D. Blade Seals: Vinyl.

- E. Blade Axles: Galvanized steel.
- F. Tie Bars and Brackets: Galvanized steel.
- G. Return Spring: Adjustable tension.

### 2.3 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.
- B. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
  - 1. 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.
  - 2. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.
  - 3. Blade Axles: Galvanized steel.
  - 4. Tie Bars and Brackets: Galvanized steel.
- 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.

### 2.4 FIRE DAMPERS

- A. General: Labeled to UL 555.
- B. Fire Rating: One and one-half hours.
- C. Fire Rating: One and one-half hours.
- 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 deg F (74 deg C) rated as indicated.

### 2.5 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

### 2.6 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. General: Fabricate doors and panels airtight and suitable for duct pressure class.
- B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.
- C. 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.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.



## 2.7 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 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 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.

## 2.8 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1.
- B. 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: Polyethylene film.
  - 3. Inner Liner: Polyethylene film.
- C. Pressure Rating: 6-inch wg (1500 Pa) positive, 1/2-inch wg (125 Pa) negative.

## 2.9 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.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.
- B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.
- C. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- D. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.
  - 1. Install fusible links in fire dampers.
- E. 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.
- F. Label access doors according to Division "Mechanical Identification."

### 3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Section "Testing, Adjusting, and Balancing."

END OF SECTION

## SECTION 23 33 46 - FLEXIBLE DUCTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Includes But Not Limited To:

1. Furnish and install supply air branch duct runouts to diffusers as described in Contract Documents.

#### 1.2 REFERENCES

##### A. Reference Standards:

1. National Fire Protection Association / American National Standards Institute:
  - a. NFPA 90A: 'Standard for the Installation of Air-Conditioning and Ventilating Systems' (2012 Edition).
2. Underwriters Laboratories:
  - a. UL 181, 'Factory-Made Ducts and Air Connectors' (10th Edition).
  - b. UL 181B, 'Closure Systems for Use With Flexible Air Ducts and Air Connectors' (3rd Edition).

### PART 2 - PRODUCTS

#### 2.1 SYSTEM

##### A. Manufacturers:

1. Manufacturer Contact List:
  - a. Anco Products Inc,
  - b. Thermaflex by Flexible Technologies
  - c. Flexmaster USA Inc, Houston, TX

##### B. Materials:

1. Ducts:
  - a. Formable, flexible, circular duct which shall retain its cross-section, shape, rigidity, and shall not restrict airflow after bending.
  - b. Insulation:
    - 1) Nominal 1-1/2 inches (38 mm), 3/4 lb per cu ft (12 kg per cu m) density fiberglass insulation with air-tight, polyethylene or polyester core, sheathed in seamless vapor barrier jacket factory installed over flexible assembly.
  - c. Assembly, including insulation and vapor barrier, shall meet Class I requirement of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.
  - d. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) ANCO-FLEX 4625 by Anco Products.
    - 2) M-KC by Thermaflex by Flexible Technologies.
    - 3) Type 4m Insulated by Flexmaster.
2. Cinch Bands: Nylon, 3/8 inch removable and reusable type.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install duct in fully extended condition free of sags and kinks, using 60 inch maximum lengths.
- B. Make duct connections by coating exterior of duct collar for 3 inches with duct sealer and securing duct in place over sheet metal collar with specified cinch bands.

END OF SECTION

## SECTION 23 34 16 - CENTRIFUGAL HVAC FANS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes centrifugal fans and vent sets.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base air ratings on actual site elevations.
- B. Operating Limits: Classify according to AMCA standards.

#### 1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each unit scheduled 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.
- C. Maintenance Data: For centrifugal fans to include in maintenance manuals specified in specifications.

#### 1.4 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.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

#### 1.6 COORDINATION

- A. Coordinate size and location of structural support members and/or shaft locations.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in these documents.

#### 1.7 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. Belts: One set for each belt-driven unit.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cook, Loren Company.
  - 2. Greenheck.

#### 2.2 HOUSINGS

- A. Roof Mounted Centrifugal Exhaust Fan.
  - 1. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid

aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. Bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

### 2.3 WHEELS

#### A. Roof Mounted Centrifugal Exhaust Fan

1. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

### 2.4 SHAFTS

- A. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
- B. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
- C. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

### 2.5 BEARINGS

- A. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.
  1. Ball-Bearing Rating Life: ABMA 9, L<sub>50</sub> of 200,000 hours.
  2. Roller-Bearing Rating Life: ABMA 11, L<sub>50</sub> of 200,000 hours.

### 2.6 BELT DRIVES

- A. Description: Factory mounted, with final alignment and belt adjustment made after installation.
  1. Service Factor Based on Fan Motor: 1.5.
- B. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
- C. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with motors larger than 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
- D. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
- E. Motor Mount: Adjustable for belt tensioning.

### 2.7 ACCESSORIES

- A. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.
- B. Companion Flanges: Galvanized steel, for duct connections.
- C. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
- D. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
- E. Spark-Resistant Construction: AMCA 99 (where required).
- F. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
- G. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

### 2.8 MOTORS

- A. Refer to Section "Motors" for general requirements for factory-installed motors.
- B. Motor Construction: NEMA MG 1, general purpose, continuous duty, high efficiency, Design B.
- C. Enclosure Type: [Open dripproof] [Totally enclosed, fan cooled].

### 2.9 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."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install centrifugal fans level and plumb.

- B. Install units with clearances for service and maintenance.
- C. Label fans according to requirements specified in Section "Mechanical Identification."

### 3.2 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 Division 23 Section "Duct Accessories."
- B. Install ducts adjacent to fans 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.

### 3.3 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.
- 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 "Testing, Adjusting, and Balancing" 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.

### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Lubricate bearings.

### 3.5 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.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.
  - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
  - 2. Review data in maintenance manuals. Refer to specifications Section "Closeout Procedures."
  - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

## SECTION 23 37 13 - DIFFUSERS, REGISTERS AND GRILLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

#### 1.2 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.

#### 1.3 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.
  - 3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
  - 4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.
- B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

#### 1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURED UNITS

- A. Diffusers, registers, and grilles are scheduled on Drawings.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Titus.
  - 2. Price

#### 2.2 SOURCE QUALITY CONTROL

- A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

### PART 3 - EXECUTION

#### 3.1 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.

#### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- B. Ceiling-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. Coordinate device locations with ceiling grid, sprinklers, and lights. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 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



## SECTION 26 00 00 - ELECTRICAL

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Specification Sections and other Sections, apply to this Section.

#### 1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
- B. General Scope of Work:
  - 1. Providing new panels, feeders, conduits, disconnect, fire alarm, rough-in for telephone and data system, and new light fixtures.

#### 1.4 COORDINATION

- A. All electrical work shall be done under sub-contract to a General Contractor. Electrical Contractor shall coordinate all work through General Contractor, even in areas where only electrical work is to take place.
- B. Work shall take place with minimal disruption to Owner's operations in areas surrounding the new building.
- C. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.
- D. Fully coordinate with mechanical contractor for providing power to mechanical equipment.

#### 1.5 UTILITIES

- 1. Coordinate with power company and provide conduit, and trenching from transformer to power source. Coordinate with water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
- 2. Obtain any approvals required from utilities to relocate utilities.
- 3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

#### 1.6 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
  - 1. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
  - 1. Temporary fencing around construction areas.
  - 2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
  - 3. Temporary fencing around equipment while site work is in progress.

#### 1.7 SUBMITTALS

1. To expedite the submittal process more efficiently, do not piece-meal the submittals. Submit entire electrical in a bound enclosure. This will eliminate delays in the submittal process. Unbound submittals shall be returned without review. Submit 10 copies minimum.

END OF SECTION

SECTION 26 01 20 OPERATION AND MAINTENANCE OF LOW-VOLTAGE ELECTRICAL DISTRIBUTION

PART1- GENERAL

1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions, Specification Sections and all relevant documents shall form a part of this Section of the Specifications, and shall be incorporated in this Section and each Section 260000 hereinafter as if repeated verbatim herein. All conditions imposed by these documents shall be applicable to all portions of the work under this Section. Certain specific paragraphs of said references may be referred to hereinafter in this Section. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.
- B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve him of responsibility. The omission of details of other portions of the work from this Section shall not be used as a basis for a request for additional compensation.
- C. The specific features and details for other portions of the work related to the construction in progress or to the adjacent building shall be determined by examination at the site.

1.2 SCOPE OF WORK

- A. The requirements contained in this Section apply to all work performed under these Specifications.
- B. The work covered by this Section of the Specifications comprises the furnishing of labor, material, equipment, transportation, tools and services, and performing operations required for, and reasonably incidental to, the installation of the work in accordance with the applicable Contract Documents, and subject to the terms and conditions of the Contract.
- C. Refer to other Sections of the Specifications for related work.

1.3 DEFINITION OF "CONTRACTOR"

- A. Where the word "Contractor" is used under any Section of this Section of the Specifications, it shall mean the Contractor engaged to execute the work included under that Section, even though this Contractor may be technically described as a Subcontractor, or an authorized representative.
- B. If the Contractor, engaged to execute a portion of the work, employs a Subcontractor to perform some of that work, he shall be completely responsible for the proper execution of this Subcontractor's work, in full conformity with the Contract Documents.

1.4 RESPONSIBILITY OF THE CONTRACTOR

- A. The Contractor shall be responsible for all work of every description in connection with this Section of the Specifications. The Contractor shall specifically and distinctly assume, and does zeso assume, all risk for damage or injury from whatever cause to property or person used or employed on or in connection with this work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection with the work, and undertake the responsibility to defend the Owner against all claims on account of any such damage or injury.
- B. The Contractor will be held responsible for the satisfactory execution and completion of the work in accordance with the true intent of the Contract Documents. The Contractor shall provide without extra charge all incidental items required as part of the work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, the Contractor shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the work.

1.5 TERMINOLOGY

- A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and similar phrases occur, it is the intent that the materials, equipment and devices described be furnished, installed and connected under this Section, complete for operation, unless specifically noted to the contrary.
- B. It is also the intent, unless specifically noted to the contrary, that all materials, equipment and devices described and specified under this Section of the Specifications be similarly furnished, installed and connected under this Section, whether or not a phrase as described in the preceding paragraph has been actually included.
- C. Whenever the words "Owner's Representative" occurs, it is intended to refer to the Architect, Engineer and/or specific Owner's Representative responsible for or capable of providing the necessary direction pertaining to the referenced issue.

#### 1.6 ORDINANCES, PERMITS AND CODES

- A. It shall be the Contractor's duty to perform the work and provide the materials covered by these specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.
- B. All work herein shall conform to all applicable laws, ordinances and regulations of the local utility companies.
- C. The Contractor shall obtain and pay for all permit and connection fees as required for the complete installation of the specified systems, equipment, devices and materials.
- D. The Contractor shall obtain permits, plan checks, inspections and approvals applicable to the work as required by the regulatory authorities. Fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.
- E. The work shall be in accordance with, but shall not be limited to, the requirements of:
  - 1 National Fire Protection Association
  - 2 National Electrical Code
  - 3 National Safety Code
  - 4 State of Texas Safety Code
  - 5 Local City Building Codes
  - 6 State of Texas Building Codes
- F. Codes and standards referred to are minimum standards. Where the requirements of the Drawings or Specifications exceed those of the codes and regulations, the Drawings and Specifications govern.

#### 1.7 MATERIALS, EQUIPMENT AND DEVICE DESCRIPTION

- A. Materials, equipment and devices shall be of the best quality customarily applied in quality commercial practice, and shall be the products of reputable manufacturers. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.
- B. Materials, equipment and devices furnished under this Section of the Specifications shall be essentially the standard product of the specified manufacturer, or where allowed, an alternate manufacturer. Where two or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one manufacturer.
- C. In describing the various materials, equipment and devices, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Contract Documents.
- D. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer

whether indicated or not. The Contractor shall verify that all materials, equipment and devices proposed for use on this project are within the constraints of the allocated space.

1.8 QUALITY ASSURANCE

- A. Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall not be repaired at the job site, but shall be replaced with new materials, equipment or devices identical with those damaged, unless specifically approved otherwise by the Owner's Representative.
- B. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.

1.9 REFERENCE STANDARDS

- A. Materials, equipment, devices and workmanship shall comply with applicable local, county, state and national codes, laws and ordinances, utility company regulations and industry standards.
- B. In case of differences between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Owner's Representative in writing of any such difference. Should the Contractor perform any work that does not comply with local codes, laws and ordinances, industry standards or other governing regulations, the work shall be corrected of noncompliance deficiencies with the Contractor bearing all costs.
- C. In addition to the aforementioned ordinances, industry standards published by the following organizations shall apply:

AABM	-	American Association of Battery Manufacturers
ADA	-	American's with Disabilities Act
AIA	-	American Institute of Architects
ANSI	-	American National Standards Institute
ASTM	-	American Society for Testing and Materials
CBM	-	Certified Ballast Manufacturers Association
ETL	-	Electrical Testing Laboratories
FM	-	Factory Mutual
ICEA	-	Insulated Cable Engineers Associated
IEEE	-	Institute of Electrical and Electronic Engineers
IES	-	Illuminating Engineering Society
IRI	-	Industrial Risk Insurance
NBS	-	National Bureau of Standards
NEC	-	National Electrical Code
NECA	-	National Electrical Contractors Association
NEMA	-	National Electrical Manufacturers Association
NESC	-	National Electrical Safety Code
NETA	-	National Electrical Testing Association
NFPA	-	National Fire Protection Association
UL	-	Underwriters Laboratories

#### 1.10 DRAWINGS AND SPECIFICATIONS

- A. The interrelation of the Drawings (including the schedules) and the Specifications are as follows:
  - 1 The Drawings establish quantities, locations, dimensions and details of materials, equipment and devices. The schedules on the Drawings indicate the capacities, characteristics and components.
  - 2 The Specifications provide written requirements for the quality, standard and nature of the materials, equipment, devices and construction systems.
- B. The Drawings and Specifications shall be considered as being compatible; therefore, the work called for by one and not by the other shall be furnished and installed as though called for by both. Resolution of conflicts between Drawings and Specifications shall be as follows:
  - 1 If the Drawings and Specifications disagree in themselves, or with each other, the Contractor's pricing shall be based on furnishing and installing the most expensive combination of quality and quantity of work indicated for a complete operable system. Contractor is responsible to notifying the Architect and Engineer. In the event of this type of disagreement, the resolution shall be determined by the Owner's Representative. The contractor shall assume for an operable system at the most expensive combination as per the latest National Electrical Code. The contractor shall review all drawings and specifications prior to bid date.
  - 2 The Contractor shall be responsible for bringing any conflicts in the Drawings and the Specifications to the attention of the Owner's Representative immediately, prior to bid date.
  - 3 In general, if there is conflict between the Drawings and Specifications, the Drawings shall govern the Specifications.
  - 4 Where the Specifications do not fully agree with schedules on the Drawings, the schedules shall govern. Actual numerical dimensions indicated on the Drawings govern scale measurements and large scale details govern small scale drawings.
  - 5 Materials, equipment and devices called for on the Drawings and not indicated herein, shall be completely provided and installed as though it were fully described herein.
  - 6 Materials, equipment and devices called for herein shall be completely provided and installed, whether or not it is fully detailed, scheduled or indicated on the Drawings.
- C. The Contractor shall examine the Drawings and Specifications of the other portions of the work for fixtures and finishes in connection with this work. The Contractor shall carefully examine the Drawings to determine the general construction conditions, and shall familiarize himself with all limitations caused by such conditions.
- D. When discrepancies exist between scale and dimension, or between the Drawings of the various portions of the work, they shall be called to the attention of the Owner's Representative for further instruction, whose instructions shall be final and binding and work promptly resumed without any additional cost to the Owner.
- E. Review the construction details of the building(s) as illustrated on the Drawings of the other portions of the work, i.e., architectural, structural, civil, landscape, etc., and be guided thereby. Route conduits and set all boxes as required by the pace of the general construction.
- F. The Drawings diagrammatically show the sizes and locations of the various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, control wiring and other installation requirements. Carefully layout the work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the work. In cooperation with other Contractors, determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Owner's Representative, without additional cost to the Owner.
- G. The Drawings and Specifications are intended to describe and illustrate systems which will not interfere with the structure of the building(s), fit into the available spaces, and insure complete and satisfactory

operating installations. Prepare installation drawings as required for all critical areas illustrating the installation of the work in this Section as related to the work of all other Sections and correct all interferences with the other portions of the work or with the building structures before the work proceeds.

- H. The Drawings do not indicate the existing electrical installations other than to identify modifications or extensions thereto. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work. Failure to comply with this shall not constitute grounds for any additional payment in connection with removing or modifying any part of the existing installation or installing any new or temporary work under this Section.

#### 1.11 SUBMITTALS

- A. Submit product data and shop drawings in accordance with the Specifications.
- B. Process product data and shop drawings to insure that the proposed materials, equipment and devices conform to the requirements of the Contract Documents, and that there are no omissions or duplications. Provide layouts, fabrication information and data for systems, materials, equipment and devices proposed for the project.
- C. Submittals shall be provided for review and approval on all systems, equipment, devices and materials proposed for use on this project. Submittals shall include, but not be limited to, the following:
  - 1 Lighting and Appliance Panelboards
  - 2 Disconnect Switches
  - 3 Circuit Breakers and Fuses
  - 4 Materials: conduit, conductors, connectors, supports, etc.
  - 5 Lighting Fixtures, Lamps and Control Systems/Devices
  - 6 Wiring Devices
  - 7 Transformers
  - 8 Distribution Panelboards
  - 9 Motor Control Center
  - 10 As indicated on each submittal section
- D. The product data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.
- E. Do not submit detailed quantitative listings of materials, equipment and devices. It is the Contractor's responsibility to provide proper sizes and quantities to conform to Contract Documents.
- F. Assemble submittals on related items procured from a single manufacturer in bound brochures or other suitable package form, rather than submitting a multiplicity of loose sheets.
- G. Prepare shop drawings whenever equipment proposed varies in physical size and arrangement from that indicated thus causing rearrangement of equipment space, where tight spaces require extreme coordination between this work and other work, where called for elsewhere in these Specifications and where specifically requested by the Owner's Representative. Shop drawings shall be prepared at a scale of not less than 1/4 inch equals 1 foot.
- H. The Contractor shall sign the submittal as an indication of compliance with the Contract Documents. If there are any deviations from the Contract Documents, he shall so indicate on the submittal. Any deviations not so indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor's expense.

#### 1.12 SUBSTITUTIONS

- A. Where a single manufacturer is mentioned by trade name or manufacturer's name, unless specifically noted otherwise, it is the only manufacturer that will be accepted.
- B. Where multiple manufacturers are listed, none other than those manufacturers will be accepted.
- C. Manufacturers not listed will be considered for substitution prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum seven (7)

business days prior to bid with each sub-paragraph noted with the comment, "compliance", "deviation", "alternate" or "not applicable". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.

- 1 By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
  - 2 By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
  - 3 By noting the term "alternate" or "A", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.
  - 4 By noting the term "not applicable" or "N/A", it shall be understood that the specified item is not applicable to the project.
- D. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or specifications, provide as part of the submittal 1/4 inch equals 1 foot scaled drawings showing that the substitute can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.
- E. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Owner's Representative, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork or wiring resulting from the equipment or device selection without any additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.
- F. The Owner's Representative reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.
- G. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

#### 1.13 INSTALLATION DRAWINGS

- A. Prepare installation drawings for coordinating the work of this Section with the work of other Sections, to illustrate its concealment in finished spaces, to avoid obstructions, and to demonstrate the adaptability of any item of material, equipment or device in the space upon which the Contract Documents are based.
- B. Use these drawings in the field for the actual installation of this work. Provide three (3) copies, not for approval, to the Owner's Representative for his information, review and record.

#### 1.14 WORKMANSHIP AND INSTALLATION

- A. In no case shall the Contractor provide a class of material, equipment, device or workmanship less than that required by the Contract Documents or applicable codes, regulations, ordinances or standards. All modifications which may be required by a local authority having legal jurisdiction over all or any part of the work shall be made by the Contractor without any additional charge. In all cases where such authority requires deviations from the requirements of the Drawings or Specifications, the Contractor shall report same to the Owner's Representative and shall secure his approval before the work is started.
- B. The work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.



- C. The NECA "Standards of Installation" as published by the National Electrical Contractors Association shall be considered a part of these Specifications, except as specifically modified by other provisions contained in these Specifications.

#### 1.15 INSPECTION OF SITE

- A. The accompanying drawings do not indicate existing installations other than to identify modifications of and extensions thereto. The Contractor shall visit the site, inspect the installations and ascertain the conditions to be met and the work to be performed. Failure to comply with this shall not constitute ground for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work under this Section.
- B. Review construction details of the adjacent building presently under construction during the site inspection and include all work required to modify the existing installations and install new materials, comprising a part of the installation. Review all construction details of the new building as illustrated on the drawings and be guided thereby.

#### 1.16 WARRANTY

- A. All materials, equipment, devices and workmanship shall be warranted for a period of one year from the date of acceptance by the Owner's Representative for beneficial use by the Owner, except that where specific equipment is noted to have extended warranties. The warranty shall be in accordance with AIA Document A201. The Contractor shall be responsible for the proper registration of these warranties so that the Owner can make all proper claims should future need develop.
- B. The Contractor shall furnish to the Owner's Representative for transmittal to the Owner, the name, address and telephone number of those persons responsible for service on systems and equipment covered by the warranty.

#### 1.17 OPERATION PRIOR TO ACCEPTANCE

- A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, the Contractor may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments and complete punch list items before final acceptance by the Owner.

#### 1.18 INSTRUCTION OF OWNER'S PERSONNEL

- A. Provide the services of competent engineers and/or technicians acceptable to the Owner's Representative to instruct other representatives of the Owner in the complete and detailed operation of each item of equipment or device of all the various electrical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.
- B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.
- C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

#### 1.19 SCHEDULE AND SEQUENCE OF WORK

- A. The Contractor shall meet and cooperate with the Owner and Owner's Representative to schedule and sequence this work so as to insure meeting scheduled completion dates and avoid delaying other portions of the work. Work requiring special sequencing shall be at no additional cost to the Owner and shall have

no impact on the schedule.

#### 1.20 INSTALLATION INSPECTIONS AND CERTIFICATIONS

- A. Obtain timely inspections of the installation by the regulatory authorities. Remedy any deficiencies to the satisfaction of the inspecting official.
- B. Upon final completion of the work, obtain certificates of acceptance from the regulatory authorities. Deliver the certificates to the Owner's Representative for transmission to the Owner.

#### 1.21 EQUIPMENT INSTALLATION

- A. Install equipment and devices in a manner to permit access to all surfaces or components, requiring such access, without the need to disassemble other unrelated parts of the work.
- B. Equipment specified to be factory assembled and tested prior to shipment shall not be disassembled at the job site and reassembled at its final location. Apparatus not so specified may be disassembled and reassembled in the proper location.
- C. Furnish all scaffolding, rigging and hoisting required for the installation of all the work.

#### 1.22 CONCRETE HOUSEKEEPING PADS

- A. Concrete housekeeping pads shall be provided for all floor mounted equipment, unless noted or required otherwise.
- B. All pads shall be not less than 3-1/2" high and extend a maximum 3" beyond the actual equipment size. Coordinate the proper size of the pad with the equipment furnished. Pads shall be poured in forms built of new dressed lumber with corners chamfered using sheet metal or triangular wood strips nailed to the form. Use 6 x 6 No. 3 mesh for reinforcing. Install heavy duty adjustable anchor bolts, set in the form and positioned using templates, prior to pouring concrete. After the equipment is set on the pad, the equipment shall be aligned, leveled and fully grouted to the pad and all void spaces shall be filled with a non-shrinking grout.
- C. Perform all concrete work specified to be provided under this Section in strict accordance with the applicable provisions of Section, CONCRETE.

#### 1.23 SLEEVES

- A. Each conduit, regardless of material, which passes through a concrete slab, masonry wall, or roof or portion of the building structure shall be free from the structure and shall pass through a sleeve.
- B. All sleeves shall be constructed from electrical-metallic tubing or equivalent weight galvanized steel tubing and shall be flush on both sides of the surface penetrated, unless noted otherwise. All sleeves penetrating the roof areas shall extend a minimum 10 inches above the roof with approved weatherproof counterflashing attached to the conduit above the roof. All sleeves penetrating floors shall extend a minimum of 6 inches above the finished floors. The sleeves shall be sized to allow free passage of the conduit to be inserted.
- C. Sleeves passing through walls or floors on or below grade or in moist areas shall be constructed of galvanized rigid steel and shall be designed with a suitable flange in the center to form a waterproof passage. After the conduit has been installed in the sleeves, the void space around the conduit shall be caulked and filled with an asphalt-base compound to insure a waterproof penetration. Jute twine caulking shall not be used due to susceptibility to termite infestation.

#### 1.24 ESCUTCHEONS

- A. In each finished space, provide a chromium plated, sectional escutcheon on each conduit, or hanger rod penetrating a wall, floor or ceiling.
- B. Size escutcheons and collars to fit snugly around conduit and rods.
- C. Where required, provide escutcheons with set screws so that they fit snugly against the finished surface.

#### 1.25 ACCESS PANELS

- A. Provide wall and ceiling access panels for unrestricted access to all concealed electrical equipment items and devices installed behind furrings, chases or non-removable suspended ceilings.

- B. Access panels shall be UL listed and labeled as required to suit the fire rating of the surface in which installed, with mounting straps, concealed hinges, screwdriver locks, 180 degree open door design, 16 gauge steel construction and door and frame finished in prime coat finish. Panels shall be 12-inch by 12-inch minimum size, but shall be larger as the access requirement of the concealed electrical equipment item or device increases.

#### 1.26 SEALING OF PENETRATIONS

- A. All penetrations in horizontal or vertical fire-rated construction shall be sealed using approved fire-rated sealing materials equivalent to the following:
  - 1 Foam: Dow Corning 3-6548 RTV silicone foam, liquid component Part 4 (black) and liquid component Part B (off-white).
  - 2 Sealant: Dow Corning 96-081 RTV silicone adhesive sealant.
  - 3 Damming Materials: Mineral fiberboard, mineral fiber matting, mineral fiber putty, plywood or particle board, as selected by applicator.
- B. Preparation: Remove combustible materials and loose impediments from penetration opening and involved surfaces. Remove free liquid and oil from penetration surfaces.
- C. Installation: In accordance with manufacturer's instructions, install damming materials and sealant to cover and seal penetration openings; inject foam mixtures into openings.
- D. In addition to the Dow Corning products, equal products by Spec Seal Firestop Products, 3M Fire Barrier or CS240 Firestop are acceptable.

#### 1.27 PROTECTION OF APPARATUS

- A. At all times take every precaution to properly protect apparatus from damage due to dust, dirt, water, etc. or from damage due to physical forces. Include the erection of temporary shelters as required, to adequately protect any apparatus stored at the site, the cribbing of any apparatus directly above the construction, and the covering of apparatus in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above to the entire satisfaction of the Owner's Representative will be sufficient cause for the rejection of the pieces of apparatus in question.
- B. Responsibility for the protection of apparatus extend also to existing apparatus involved in this Section of the work, whether such apparatus is designated to be used temporarily and later removed, or is to be reused as a part of the permanent installation. Erect temporary sheltering structures, provide temporary bracing and supports, or cover equipment as required or directed to afford proper protection for that equipment.
- C. The Contractor shall protect this work and the work of all other Contractors from damage by his work or workmen and shall make good any damage thus caused. He shall also be responsible for the proper protection of his equipment, machinery, materials and accessories delivered and installed on the job.

#### 1.28 INSTALLATION OF CONTROL AND OPERATING DEVICES

- A. The highest operable part of controls (light switches, dimmer switches, emergency power off devices, etc.), receptacles (electrical and communications) and other operable devices shall be 48" above finish floor. The lowest operable part shall be no less than 15" above finished floor. For purposes of uniformity, unless noted otherwise, the top of a device shall be maximum 48" AFF and the bottom of a device shall be minimum 15" AFF. Refer to the electrical symbols list on the Drawings for specific requirements.
- B. Visual alarm appliances shall be placed 80" above finished floor (the highest floor level within a space) or 6" below the ceiling, whichever is lower.

#### 1.29 INSTALLATION AND CONNECTION OF OTHER SECTION'S EQUIPMENT

- A. Verify the electrical requirements of all equipment furnished under other Sections, separate contracts, or by the Owner. Install conduit, power wiring, control wiring, devices, etc. as required for complete operation of all equipment.

#### 1.30 OPTION TO RELOCATE OUTLETS AND RELATED DEVICES

- A. The location of power, data and telephone outlets, wall switches and other related devices may be relocated at the Owner's option, at no additional cost to the Owner, to a point within 10 feet of their present location provided the Contractor is notified prior to installation.

#### 1.31 COOPERATION AND CLEAN-UP

- A. It shall be the responsibility of the Contractor to cooperate fully to keep the job site in a clean and safe condition. Upon the Contractor shall immediately remove all of his tools, equipment, surplus materials and debris.
- B. After the installation is complete and before the equipment is energized, clean the interior and exterior of all equipment thoroughly. Clean equipment, removing all debris, rubbish and foreign materials. Each component shall be cleaned and all dust and other foreign material. Components shall be cleaned of oxidation. The inside and outside of all switchgear shall also be wiped clean with lemon-oil rag after all other cleaning is complete. Any portion of the work requiring touch-up finishing shall be so finished to equal the specified finish on the product.

#### 1.32 RECORD DRAWINGS AND DOCUMENTATION FOR OWNER

- A. The Contractor shall obtain at his own expense a complete set of blue-line prints on which to keep an accurate record of the installation of all materials, equipment and devices covered by the Contract. The Contractor shall record up to date information at least once a week and retain the set of prints on site for periodic review by the Architect/Engineer. The record drawings shall indicate the location of all equipment and devices, and the routing of all systems. If the Contractor prepared large scale installation drawings of electrical rooms, conduit routing, busduct, routing, etc., these drawings or reproducible sepia's therefrom shall be revised as required to accurately illustrate the actual installation. All conduit buried in concrete slabs, walls and below grade shall be located by dimension; both horizontally and by vertical elevation, unless a surface mounted device in each space indicates the exact location.
- B. Upon anticipated completion of the job, obtain one complete reproducible set of the original drawings on which to neatly, legibly and accurately transfer all project related notations and deliver these record drawings to the Architect/Engineer at job completion before final payment and delivery to the Owner. This information shall be delivered prior to final acceptance.
- C. The Contractor shall accumulate in duplicate during the job progress, the following data prepared in indexed 3-ring looseleaf, hard-back binders sized for 8-1/2 inch by 11 inch sheets. No binder shall exceed 3-1/2 inches thick. This data shall be turned over to the Owner's Representative for review and subsequent delivery to the Owner prior to final acceptance.
  - 1 Warranties, guarantees and manufacturer's directions on material, equipment and devices covered by the Contract.
  - 2 Approved lighting fixture brochures, wiring diagrams and control diagrams.
  - 3 Copies of approved submittals and shop drawings.
  - 4 Operating instructions and recommended maintenance procedures for major apparatus.
  - 5 Copies of all other data and/or drawings required during construction.
  - 6 Repair parts list of major apparatus, including name, address and telephone number of local supplier or representative.
  - 7 Tag charts and diagrams hereinbefore specified.

#### 1.33 FINAL OBSERVATION

- A. The purpose of the final observation is to determine whether the Contractor has completed the construction in accordance with the Contract Documents and that in the Owner Representative's opinion the installation is satisfactory for final acceptance by the Owner.
- B. It shall be the responsibility of the Contractor to assure that the installation is ready for final acceptance prior to calling upon the Owner's Representative to make a final observation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

## SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

### 1.1 GENERAL

### 1.2 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

### 1.3 SUMMARY

This Section includes the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete equipment bases.
7. Electrical demolition.
8. Cutting and patching for electrical construction.
9. Touchup painting.

### 1.4 DEFINITIONS

EMT: Electrical metallic tubing.

FMC: Flexible metal conduit.

IMC: Intermediate metal conduit.

LFMC: Liquidtight flexible metal conduit.

RNC: Rigid nonmetallic conduit.

### 1.5 SUBMITTALS

Product Data: For electricity-metering equipment.

Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

### 1.6 QUALITY ASSURANCE

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.

Comply with NFPA 70.

## 1.7 COORDINATION

Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

Coordinate electrical service connections to components furnished by utility companies.

2. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
3. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Section "Access Doors."

Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

## 1.8 PRODUCTS

### 1.9 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

Meter Sockets: Comply with requirements of electrical power utility company.

Modular Meter Centers: Factory-coordinated assembly of a main meter center circuit-breaker unit with wireways, tenant meter socket modules, and tenant branch circuit breakers arranged in adjacent vertical sections, complete with interconnecting buses.

1. Housing: NEMA 250, Type 3R enclosure.
2. Tenant Branch Circuit Breakers: Series combination rated to protect circuit breakers in downstream panelboards that have 10,000-A interrupting capacity,
3. minimum.

### 1.10 CONCRETE BASES

Concrete Forms and Reinforcement Materials: As specified in Section "Cast-in-Place Concrete."

Concrete: 3000-psi, 28-day compressive strength as specified in Section "Cast-in-Place Concrete."

### 1.11 TOUCHUP PAINT

For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

## PART 2 - PRODUCTS

## PART 3 - EXECUTION

### 3.1 ELECTRICAL EQUIPMENT INSTALLATION

Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

Right of Way: Give to raceways and piping systems installed at a required slope.

### 3.2 RACEWAY AND CABLE INSTALLATION

Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

Use temporary raceway caps to prevent foreign matter from entering.

Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not



less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.

Install telephone and signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.

Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

Set floor boxes level and trim after installation to fit flush to finished floor surface.

### 3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

Dry Locations: Steel materials.

Support Clamps for PVC Raceways: Click-type clamp system.

Selection of Supports: Comply with manufacturer's written instructions.

Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

### 3.4 SUPPORT INSTALLATION

Install support devices to securely and permanently fasten and support electrical components.

Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

Install 1/4-inch-diameter or larger threaded steel hanger rods, unless otherwise indicated.

Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

Simultaneously install vertical conductor supports with conductors.

Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24

inches from the box.

Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.
  - a. Field Welding: Comply with AWS D1.1.
7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

### 3.5 IDENTIFICATION MATERIALS AND DEVICES

Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

Self-Adhesive Identification Products: Clean surfaces before applying.

Identify raceways and cables with color banding as follows:

1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
3. Colors: As follows:
  - a. Fire Alarm System: Red.
  - b. Security System: Blue and yellow.
  - c. Telecommunication System: Green and yellow.

Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

4. Phase A: Black.
5. Phase B: Red.
6. Phase C: Blue.
7. Neutral: White.
8. Ground: Green.

Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

9. Phase A: BROWN.
10. Phase B: ORANGE.
11. Phase C: YELLOW.
12. Neutral: White with a colored stripe or gray.
13. Ground: Green.

Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

### 3.6 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

### 3.7 FIRESTOPPING

Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Section "Firestopping."

### 3.8 CONCRETE BASES

Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-

strength concrete and reinforcement as specified in Section "Cast-in-Place Concrete."

### 3.9 CUTTING AND PATCHING

Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

### 3.10 FIELD QUALITY CONTROL

Inspect installed components for damage and faulty work, including the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete bases.
7. Electrical demolition.
8. Cutting and patching for electrical construction.
9. Touchup painting.

Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.

10. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
11. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
12. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
13. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
14. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

### 3.11 REFINISHING AND TOUCHUP PAINTING

Refinish and touch up paint. Paint materials and application requirements are specified in Section "Painting."

Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.

1. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
3. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.12 CLEANING AND PROTECTION

1. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
2. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

## SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTOR AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

#### 1.3 SUBMITTALS

- A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

#### 1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
- B. Comply with NFPA 70.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wires and cables according to NEMA WC 26.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

### PART 2 - PRODUCTS

#### 2.1 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. Wires and Cables:
    - a. American Insulated Wire Corp.; Leviton Manufacturing Co.
    - b. BICC Brand-Rex Company.
    - c. Carol Cable Co., Inc.
    - d. Senator Wire & Cable Company.
    - e. Southwire Company.
  - 2. Connectors for Wires and Cables:
    - a. AMP Incorporated.
    - b. General Signal; O-Z/Gedney Unit.
    - c. Monogram Co.; AFC.
    - d. Square D Co.; Anderson.
    - e. 3M Company; Electrical Products Division.

#### 2.2 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
- B. Rubber Insulation Material: Comply with NEMA WC 3.
- C. Thermoplastic Insulation Material: Comply with NEMA WC 5.
- D. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.
- E. Conductor Material: Copper.

F. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

G. Plenum rated cable for all cables above the ceiling.

### 2.3 CONNECTORS AND SPLICES

A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 WIRE AND INSULATION APPLICATIONS

A. Service Entrance: Type RHW or THWN, in raceway.

B. Feeders: Type 75C insulation THHN/THWN, in raceway.

C. Fire-Pump Feeder: Type MI, 3-conductor.

D. Branch Circuits: Type THHN/THWN, in raceway.

E. Fire Alarm Circuits: Type THHN/THWN, in raceway.

F. Class 1 Control Circuits: Type THHN/THWN, in raceway.

G. Class 2 Control Circuits: Type THHN/THWN, in raceway.

H. Equipment or any device rated 100 amperes or less, conductor shall be rated 60C as per National Electrical Code.

I. Equipment or any device rated over 100 amperes, conductor shall be rated 75C as per National Electrical Code.

### 3.3 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."

B. Remove existing wires from raceway before pulling in new wires and cables.

C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section "Basic Electrical Materials and Methods."

G. Seal around cables penetrating fire-rated elements according to Section "Firestopping."

H. Identify wires and cables according to Section "Basic Electrical Materials and Methods."

I. Identify wires and cables according to Section "Electrical Identification."

### 3.4 CONNECTIONS

A. Conductor Splices: Keep to minimum.

B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

C. Use splice and tap connectors compatible with conductor material.

D. Use oxide inhibitor in each splice and tap connector for aluminum conductors.

E. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

F. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

G. 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.

### 3.5 FIELD QUALITY CONTROL

- A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION



## SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes grounding and bonding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. Related Sections include the following:
  - 1. List below only products, construction, and equipment that the reader might expect to find in this Section but are specified elsewhere.
  - 2. Section "Underground Ducts and Utility Structures" for ground test wells.

#### 1.3 SUBMITTALS

- A. Revise this Article to suit Project and office practice. Frequently, no product submittal is required for this Section.
- B. Product Data: For each type of product indicated.
- C. Retain paragraph above if Product Data are required for each product specified. Retain paragraph below if Product Data are required only for selected products.
- D. Product Data: For the following:
  - 1. Ground rods.
  - 2. Chemical rods.
  - 3. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- E. Field Test Reports: Submit written test reports to include the following:
  - 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.

#### 1.4 QUALITY ASSURANCE

- A. Retain paragraph and subparagraph below if Contractor or manufacturer selects testing agency. Delete if Contractor is allowed to perform ground-resistance testing.
- 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.
  - 1. Comply with UL 467.
- C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
- D. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

### PART 2 - PRODUCTS

#### 2.1 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. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. See Editing Instruction No. 1 in the Evaluations for cautions about naming products and manufacturers.
  2. Grounding Conductors, Cables, Connectors, and Rods:
    - a. Apache Grounding/Erico Inc.
    - b. Boggs, Inc.
    - c. Chance/Hubbell.
    - d. Copperweld Corp.
    - e. Dossert Corp.
    - f. Erico Inc.; Electrical Products Group.
    - g. Framatome Connectors/Burndy Electrical.
    - h. Galvan Industries, Inc.
    - i. Hastings Fiber Glass Products, Inc.
    - j. Ideal Industries, Inc.
    - k. ILSCO.
    - l. Kearney/Cooper Power Systems.
    - m. Korns: C. C. Korns Co.; Division of Robroy Industries.
    - n. Lightning Master Corp.
    - o. Lyncole XIT Grounding.
    - p. O-Z/Gedney Co.; a business of the EGS Electrical Group.
    - q. Raco, Inc.; Division of Hubbell.
    - r. Robbins Lightning, Inc.
    - s. Salisbury: W. H. Salisbury & Co.
    - t. Superior Grounding Systems, Inc.
    - u. Thomas & Betts, Electrical.
- 2.2 GROUNDING CONDUCTORS
- A. For insulated conductors, comply with Section "Conductors and Cables."
  - B. If only copper conductors are permitted in Division 16 Section "Conductors and Cables," delete paragraph below.
  - C. Material: copper.
  - D. Equipment Grounding Conductors: Insulated with green-colored insulation.
  - E. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
  - F. Grounding Electrode Conductors: Stranded cable.
  - G. Underground Conductors: stranded, unless otherwise indicated.
  - H. Sizes and types below are typical. Adjust to suit Project conditions and requirements.
  - I. Copper Bonding Conductors: As follows:
    1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
    2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
    3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
    4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
  - J. Delete paragraph and subparagraphs below if use of aluminum conductors is not permitted.
  - K. Ground Conductor and Conductor Protector for Wood Poles: As follows:
    1. No. 4 AWG minimum, soft-drawn copper conductor.
    2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.

- L. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

### 2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

### 2.4 GROUNDING ELECTRODES

- A. Copper-clad steel is most common. See Evaluations for discussion on where other materials might be more appropriate.
- B. Ground Rods: Copper-clad steel.
  - 1. Select paragraph above or paragraph and subparagraph below. Sectional types are used when rods longer than 10 feet (3 m) are installed.
  - 2. Size: 3/4 by 120 inches (19 by 3000 mm) in diameter.
- C. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.
- D. Test Wells: Provide handholes as specified in Section "Underground Ducts and Utility Structures."

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Delete paragraph below if only copper conductors are specified in Division 16 Section "Conductors and Cables."
- B. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- C. In raceways, use insulated equipment grounding conductors.
- D. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- E. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- F. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.
- G. Delete paragraph and subparagraphs below if grounding bus is not required, or edit to suit Project.
- H. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
  - 2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.
- I. Edit below to suit Project.
- J. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of the duct bank.

### 3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. NEC permits two basic types of equipment grounding conductors: metallic raceway or cable sheath as the conductor, or a separate equipment grounding conductor. The installation of an equipment grounding conductor provides an additional degree of safe operation when compared to relying on raceway as the conductor. Revise paragraphs and subparagraphs in this Article to suit Project.
- B. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- C. Install equipment grounding conductors in all feeders and circuits.
- D. Select paragraph above or paragraph and subparagraphs below.

- E. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
  - 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.
- F. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- G. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- H. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- I. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- J. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- K. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- L. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- M. Coordinate paragraph and subparagraphs below with Drawings and Specification Sections for systems referenced. Edit to suit Project.
- N. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4-by-50-by-300-mm) grounding bus.
  - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- O. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

### 3.3 INSTALLATION

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
  - 1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
  - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- D. Metal Water Service Pipe: Provide insulated 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 by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.
- I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250-81(c), using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

### 3.4 CONNECTIONS

- A. Coordinate paragraph and subparagraphs below with Drawings.
- B. General: Make connections so galvanic action or electrolysis possibility 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 to 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.
- C. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- D. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- E. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

- F. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
- G. Tighten screws and bolts for grounding and bonding 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.
- H. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- I. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.5 FIELD QUALITY CONTROL

- A. Retain one of three paragraphs below.
- B. Testing: Perform the following field quality-control testing:
  - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
  - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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. Perform tests, by the fall-of-potential method according to IEEE 81.
  - 3. Provide drawings locating each 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.
    - a. NFPA 70 has minimum value of 25 ohms. See Evaluations for discussion on appropriate grounding resistance values. Values listed below are typical; adjust to suit Project conditions.
    - b. Equipment Rated 500 kVA and Less: 10 ohms.
    - c. Equipment Rated 500 to 1000 kVA: 5 ohms.
    - d. Equipment Rated More Than 1000 kVA: 3 ohms.
    - e. Substations and Pad-Mounted Switching Equipment: 5 ohms.
    - f. Manhole Grounds: 10 ohms.
  - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

### 3.6 GRADING AND PLANTING

- A. Delete below if inappropriate or if surface restoration work is covered on Drawings or in Division 2 Sections. Coordinate with Drawings.
- B. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

## SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.
- B. Comply with this sections, as applicable. Refer to other sections for coordination of work.

#### 1.2 SCOPE OF WORK

- A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of supporting devices, including related systems and accessories.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Unistrut Corp.
- B. B-Line Systems, Inc.
- C. Midland Ross-Kindorf

#### 2.2 MATERIALS

##### A. Suspension Hangers

- 1. Suspension hangers for individual conduit runs shall be zinc plated formed steel type.

##### B. Vertical Supports

- 1. Malleable iron one hole pipe straps shall be used for vertical runs

##### C. Clamps

- 1. Beam clamps shall be used for bar joists and beams.

##### D. Anti-Vibration Hangers

- 1. Anti-vibration hangers shall be combination type having a double deflection neoprene element in series with a steel coil spring; double deflection of 0.30"; steel coil spring shall be selected from a 1" static deflection series with a minimum additional travel to solid of 1/2"; spring diameters shall be large enough to permit 15 degree angular misalignment of the rod connecting the hanger to the ceiling support without rubbing the hanger box.

#### 2.3 LIGHT FIXTURE HANGERS

- A. Refer to Section 26 51 00
- B. Corrosive Areas: PVC; at factory apply a minimum of 10-mil-thick PVC coating, bonded to metal, inside and outside.Z

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

##### A. Hangers

- 1. Approved hangers and stiff leg supports shall be installed in quantity and size as required to carry the weight of raceway and contents and shall be arranged to prevent vibration transmission to the building and allow for raceway movement.
- 2. Hangers shall be supported by means of uncoated solid steel rods which are threaded to allow vertical adjustments. Lock nuts shall be provided in sufficient number and location to lock all rod adjustments

permanently at the adjusted height. Two lock nuts shall be used unless the nut tightens against a threaded socket. Minimum rod diameters shall be as follows:

B. NOMINAL CONDUIT SIZE      ROD DIAMETER

1/2" through 2 1/4"

2-1/2" through 3 3/8"

4" and 5 1/2"

1. Hanger spacing shall be as required for proper and adequate support raceway, but in no case shall be less than one hanger per 8'-0" of raceway length except that conduit less than 1" diameter shall be supported at least every 6'-0".
2. Where numerous conduits are run parallel to one another, they may be supported from a trapeze type hanger arrangement with strut bottom.
3. Anti-vibration type hangers shall be provided for equipment as required to minimize vibration and/or as directed by the Architect/Engineer.

Supports

4. Support of hangers shall be by means of sufficient quantities of individual after set steel expansion shields, or beam clamps attached to structural steel.
5. Stiff-legs shall be furnished and installed in cases where support from overhead structure is not possible.
6. Ceiling mounted lighting fixtures shall be supported from the building structure at two opposite corners. The Contractor shall provide fixture hangers to properly interface with the ceiling system.
7. Furnish and install complete any additional structural support steel, brackets, fasteners, etc., as required to adequately support all raceway and equipment.
8. Support of hangers from concrete slabs shall be by means of sufficient quantity of "U" brackets attached with after set expansion shields and bolts.
9. Support of hangers from concrete tees shall be by means of sufficient quantity of angle iron brackets attached with after set expansion shields and bolts.

END OF SECTION



## SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
  - 1. Edit lists below to suit Project.
  - 2. Raceways include the following:
    - a. RMC.
    - b. IMC.
    - c. PVC externally coated, rigid steel conduits.
    - d. PVC externally coated, IMC.
    - e. EMT.
    - f. FMC.
    - g. LFMC.
    - h. LFNC.
    - i. RNC.
    - j. ENT.
    - k. Wireways.
    - l. Surface raceways.
  - 3. Boxes, enclosures, and cabinets include the following:
    - a. Device boxes.
    - b. Floor boxes.
    - c. Outlet boxes.
    - d. Pull and junction boxes.
    - e. Cabinets and hinged-cover enclosures.
- B. Related Sections include the following:
  - 1. List below only products and equipment for this Project that the reader might expect to find in this Section but are specified elsewhere. Verify that Section titles listed below are correct for this Project's Specifications because Section titles may have changed since this Section was updated.
  - 2. Section "Basic Electrical Materials and Methods" for raceways and box supports.
  - 3. Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RMC: Rigid metal conduit.
- H. RNC: Rigid nonmetallic conduit.

#### 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Delete below except for custom enclosures.
- C. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

## 1.5 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NECA's "Standard of Installation."
- C. Comply with NFPA 70.

## 1.6 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

## PART 2 - PRODUCTS

### 2.1 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. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Metal Conduit and Tubing:
    - a. Alflex Corp.
    - b. Anamet, Inc.; Anaconda Metal Hose.
    - c. Anixter Brothers, Inc.
    - d. Carol Cable Co., Inc.
    - e. Cole-Flex Corp.
    - f. Electri-Flex Co.
    - g. Flexcon, Inc.; Coleman Cable Systems, Inc.
    - h. Grinnell Co.; Allied Tube and Conduit Div.
    - i. Monogram Co.; AFC.
    - j. Spiraduct, Inc.
    - k. Triangle PWC, Inc.
    - l. Wheatland Tube Co.
  - 2. Nonmetallic Conduit and Tubing:
    - a. Anamet, Inc.; Anaconda Metal Hose.
    - b. Arnco Corp.
    - c. Breeze-Illinois, Inc.
    - d. Cantex Industries; Harsco Corp.
    - e. Certainteed Corp.; Pipe & Plastics Group.
    - f. Cole-Flex Corp.
    - g. Condux International; Electrical Products.
    - h. Electri-Flex Co.
    - i. George-Ingraham Corp.
    - j. Hubbell, Inc.; Raco, Inc.
    - k. Lamson & Sessions; Carlon Electrical Products.
    - l. R&G Sloan Manufacturing Co., Inc.
    - m. Spiraduct, Inc.
    - n. Thomas & Betts Corp.
  - 3. Conduit Bodies and Fittings:
    - a. American Electric; Construction Materials Group.
    - b. Crouse-Hinds; Div. of Cooper Industries.
    - c. Emerson Electric Co.; Appleton Electric Co.
    - d. Hubbell, Inc.; Killark Electric Manufacturing Co.
    - e. Lamson & Sessions; Carlon Electrical Products.
    - f. O-Z/Gedney; Unit of General Signal.

- g. Scott Fetzer Co.; Adalet-PLM.
  - h. Spring City Electrical Manufacturing Co.
4. Metal Wireways:
- a. Hoffman Engineering Co.
  - b. Keystone/Rees, Inc.
  - c. Square D Co.

## 2.2 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Rigid Aluminum Conduit: ANSI C80.5.
- C. IMC: ANSI C80.6.
- D. EMT and Fittings: ANSI C80.3.
  - 1. Fittings: Set-screw type.
- E. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

## 2.3 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.
- B. RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
- C. LFNC: UL 1660.

## 2.4 METAL WIREWAYS

- A. Material: Sheet metal sized and shaped as indicated.
- B. 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.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- D. Select 1 of 4 paragraphs below.
- E. Wireway Covers: Screw – cover type flanged-and-gasketed type.
- F. Finish: Manufacturer's standard enamel finish.

## 2.5 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1.
- B. Edit paragraph below. Aluminum is also available and suitable for use with steel raceways.
- C. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

## 2.6 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

## 2.7 ENCLOSURES AND CABINETS

- A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 WIRING METHODS

- A. Use a comprehensive wiring method schedule on Drawings or use this Article to specify where various raceway types are to be installed. Edit examples below, adding or deleting materials and methods to suit Project. Coordinate with Division 16 Section "Wires and Cables." Do not duplicate information on Drawings, in NFPA 70, or in other Division 16 Sections. List exceptions to stated requirements. Check code to avoid specifying uses not permitted.
- B. Outdoors: Use the following wiring methods:
  - 1. Exposed: Rigid steel.
  - 2. Concealed: Rigid steel.
  - 3. Underground, Single Run: RNC.
  - 4. Underground, Grouped: RNC.
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 6. Boxes and Enclosures: NEMA 250, Type 3R .
- C. Indoors: Use the following wiring methods:
  - 1. Exposed: EMT.
  - 2. Concealed: EMT.
  - 3. Underground, Single Run: RNC.
  - 4. Underground, Grouped: RNC
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
  - 6. Damp or Wet Locations: Rigid steel conduit.
  - 7. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
    - a. Select 1 of 2 subparagraphs below and add other specific box and enclosure requirements to suit Project.
    - b. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

### 3.3 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Select paragraph above or below.
- C. Minimum Raceway Size: **3/4-inch trade size (DN21)**.
- D. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.
- E. Keep raceways at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Install raceways level and square and at proper elevations. Provide adequate headroom.
- G. Complete raceway installation before starting conductor installation.
- H. Support raceways as specified in Section "Basic Electrical Materials and Methods."
- I. Use temporary closures to prevent foreign matter from entering raceways.
- J. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- K. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- L. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
- M. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- N. Raceways Embedded in Slabs (Must be indicated on drawings to be embedded. Please notify Engineer if required but not shown): Install in middle third of slab thickness where practical, and leave at least **1-inch (25-mm)** concrete cover.
  - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in concrete.
  3. Run conduit larger than **1-inch trade size (DN27)** parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
- O. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
1. Run parallel or banked raceways together, on common supports where practical.
  2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- P. Join raceways with fittings designed and approved for the purpose and make joints tight.
1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
  2. Use insulating bushings to protect conductors.
- Q. Tighten set screws of threadless fittings with suitable tools.
- R. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.
- S. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- T. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than **200-lb (90-kg)** tensile strength. Leave at least **12 inches (300 mm)** of slack at each end of the pull wire.
- U. Telephone and Signal System Raceways, **2-Inch Trade Size (DN53)** and Smaller: In addition to the above requirements, install raceways in maximum lengths of **150 feet (45 m)** and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- V. Delete paragraph below if not applicable.
- W. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-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 the boundaries of refrigerated spaces.
  2. Where otherwise required by NFPA 70.
- X. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used **6 inches (150 mm)** above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
- Y. Flexible Connections: Use maximum of **6 feet (1830 mm)** of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- Z. Delete paragraph below if no high-frequency installation.
- AA. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in a nonmetallic sleeve.
- BB. Do not install aluminum conduits embedded in or in contact with concrete.
- CC. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

DD. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.

1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
2. Where a surface raceway is used to supply a fluorescent lighting fixture having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
3. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.
4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the fixture canopy.

EE. Set floor boxes level and adjust to finished floor surface.

FF. Select paragraph above for metal floor boxes and below for nonmetallic floor boxes.

GG. Set floor boxes level and trim after installation to fit flush to finished floor surface.

HH. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

- II. NO PVC CONDUIT ALLOWED ABOVE THE CEILING OR IN THE A/C RETURN PLENUM. PROVIDE RIGID CONDUIT. Verify all MEP documents.

### 3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the 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.

### 3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

## SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

### PART1 -GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

#### 1.2 SCOPE OF WORK

- A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of all site electrical work.
- B. The site electrical work shall include, but not be limited to, the furnishing and installation of necessary materials and making arrangements for:
  - 1. The connection of electrical and telephone utilities.
  - 2. Underground conduit.

#### 1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Section for products specified under PARTS 2 PRODUCTS.

#### 1.4 REFERENCE STANDARDS

- A. National Electrical Code (NEC), Article 300
- B. Service installation standards of the serving utility company(s).

### PART 2 - PRODUCTS

#### 2.1 ELECTRICAL SERVICE

- A. Coordination: The location of the service entrance shall be coordinated with all other trades. Provide materials and equipment required to connect the electrical service. Contractor shall coordinate with the Power Company for all requirements prior to bid date. Contractor shall include all cost to for Utility Company to extend service to project site bid.
- B. Materials: Provide materials in accordance with other Sections of these Specifications.

#### 2.2 COMMUNICATION SERVICE

- A. Coordination: The location of the telephone, cable, and internet service entrance shall be coordinated with all other trades. Provide materials and equipment required to connect the telephone, cable and internet services. Contractor shall coordinate with the Telephone , cable, and internet company for all requirements prior to bid date. Contractor is responsible to coordinate with utility companies.
- B. Materials: Provide materials in accordance with other sections of this specification.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Underground installation of more than one conduit shall be in a duct arrangement as indicated. All conduits shall be laid so joints are staggered. All bends and stub-ups shall be rigid steel.
- B. Pour a red colored concrete envelope 3" thick over utility service, emergency generator and fire pump conduits. Where conduits cross a driveway, road or parking area, reinforcing rods shall be installed.
- C. Perform excavation, shoring, backfilling and concrete work in connection with electrical work in accordance with other sections of the Specifications.
- D. All conduit shall be sloped away from the building to negate water entering the building through the conduit system.

#### 3.2 UTILITIES

- A. The locations, elevations and voltage of electrical lines and the location of the telephone lines included within the area of this work are indicated on the Drawings or in the Specifications in accordance with information received by the Architect/Engineer and Owner.
- B. The Contractor shall examine the site and shall verify, to his own satisfaction, the location and elevation of all utilities, and shall adequately inform himself as to their relation to the work.

- C. Existing utility lines not indicated but encountered during construction shall be protected, relocated or capped as directed by the Architect/Engineer. All precautions shall be exercised to prevent damage to existing lines not shown, but should work become necessary, it must be authorized prior to execution except in an emergency situation.
- D. Before beginning excavations of any nature whatsoever, the Contractor shall make an attempt to locate all underground utilities of every nature occurring within the bounds of the area to be excavated. Contractor is responsible to call 811 prior to any work. The Contractor shall then proceed with caution in his excavation work so that no utility shall be damaged with a resultant loss of service.
- E. Should a damage result to any utility through the Contractor's negligence or failure to comply with the above directive, he shall be liable for such damage and for all expense incurred in the expeditious repair or replacement of such damaged utilities.
- F. Repair of damaged utilities shall be to a condition equal to or better than the adjacent undamaged portion of such utility and to the complete satisfaction of the Architect/Engineer and Owner.

END OF SECTION



SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.
- B. Comply with ELECTRICAL Sections, as applicable. Refer to other sections for coordination of work.

1.2 SCOPE OF WORK

- A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of electrical identification, including related accessories.
- B. Provide electrical identification for the following:
  - 1. Panelboards, motor starters, contactors, disconnect switches, circuit breakers and other electrical equipment with nameplate identifying the item of equipment and the equipment serving the same.
  - 2. Raceways, junction boxes and pull boxes.
  - 3. Label each panelboard index indicating the room #s to the related circuit. Also add the index sheet in a laminated white core, plastic with beveled edges, minimum 1/16 inch thick. Lettering shall be machine-engraved, not less than 1/4" high, cut through the black or red surface to the white core.
  - 4. Wiring devices.
  - 5. Wiring.
  - 6. Three phase motor rotation.

1.3 SUBMITTALS

- A. Submit product data in accordance with Section for products specified under PART 2 - PRODUCTS.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Brady
- B. Panduit
- C. Thomas & Betts
- D. Seton

2.2 IDENTIFICATION

- E. A. Nameplates
  - 1. Nameplates shall be black engraved surface on white core for normal power circuits and red engraved surface on white core for emergency power circuits.
  - 2. Provide for each distribution panelboard, branch circuit panelboard, transformer and any other similar equipment furnished under this section identification as to its given name, voltage and origination of service. Examples are as follows:

'LR1'  
120/240V  
FED FROM 'MDP'

'LR2'  
120/240V  
FED FROM 'MDP'

- 3. Provide for each motor starter enclosure, circuit breaker enclosure, disconnect switch and any other similar equipment furnished under this section, identification as to the specific load that it serves and the origination of service. Examples are as follows:

'AHU-1'      'CU-1'  
FED FROM 'MDP'      FED FROM 'MDP'

- 4. Provide for each feeder protective device in each distribution panelboard and any other similar equipment furnished under this section, identification as to the specific load that it serves.
- 5. Nameplates shall be laminated, white core, plastic with beveled edges, minimum 1/16 inch thick. Lettering

- shall be machine-engraved, not less than 1/4" high, cut through the black or red surface to the white core.
- F. B. Junction Boxes and Pull Boxes
    - 1. 1. Identification shall be with a black permanent marking pen on the top of 4" x 4" junction box covers or on the back of an outlet box cover plate identifying the branch circuits and systems within the conduit. Pull boxes shall be provided with a nameplate stating voltage and system served.
  - G. C. Wiring Device Wall Plates
    - 1. 1. On the back side of wiring device wall plates identify with a black permanent marking pen the panelboard and branch circuit number the device is served from.
  - H. D. Wire Markers
    - 1. 1. Wire markers for identification of wiring shall be self-adhesive type having letters and numerals indicating serving equipment and feeder or branch circuit number.
  - I. Rotation Tags
    - 1. 1. Rotation tags shall be brass or aluminum securely attached to equipment.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Surfaces to receive labels or nameplates shall be carefully prepared in accordance with the manufacturer's instructions and recommendations.

#### 3.2 NAMEPLATES

- J. A. Nameplates shall be properly attached to identify panelboards, feeder circuit breakers, disconnect switches, pull boxes and other similar equipment furnished under this section.

#### 3.3 WIRE MARKERS

- K. A. Wire markers shall be applied to each conductor or cable within panelboards, motor starter enclosures, circuit breaker enclosures, disconnect switches, cabinets, junction boxes, pull boxes, and other similar equipment identifying the serving equipment and feeder or branch circuit from which the conductors originate.

END OF SECTION

## SECTION 26 05 73- POWER SYSTEM STUDIES

### PART 1 -GENERAL

#### 1.1 SCOPE

- A. The contractor shall furnish short-circuit and protective device coordination studies which shall be prepared by the equipment manufacturer.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.5 and Informative Annex D.

#### 1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
  2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
  3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
  4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
  5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
  6. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations
- B. American National Standards Institute (ANSI):
  1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
  2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
  3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
  4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories
  5. ANSI C37.5 – Methods for Determining the RMS Value of a Sinusoidal Current Wave and Normal-Frequency Recovery Voltage, and for Simplified Calculation of Fault Currents
- C. The National Fire Protection Association (NFPA)
  1. NFPA 70 - National Electrical Code, latest edition
  2. NFPA 70E – Standard for Electrical Safety in the Workplace

#### 1.3 SUBMITTALS FOR REVIEW/APPROVAL

- A. The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

#### 1.4 SUBMITTALS FOR CONSTRUCTION

- A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. No more than five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Additional copies, where required, shall be provided on CD in PDF format.
- B. The report shall include the following sections:
  1. One-line diagram showing protective device ampere ratings and associated designations, cable size & lengths, transformer kVA & voltage ratings, motor & generator kVA ratings, and switchgear/switchboard/panelboard designations
  2. Descriptions, purpose, basis and scope of the study
  3. Tabulations of the worst-case calculated short circuit duties as a percentage of the applied device rating (automatic transfer switches, circuit breakers, fuses, etc.); the short circuit duties shall be upward-adjusted for X/R ratios that are above the device design ratings
  4. Protective device time versus current coordination curves with associated one line diagram identifying the plotted devices, tabulations of ANSI protective relay functions and adjustable circuit breaker trip unit settings

5. Multi-function relay setting file printouts including all ANSI protective relay functions and associated logic and control. Metering, communication, and control logic settings not associated with ANSI protective functions are not required.
6. Fault study input data, case descriptions, and current calculations including a definition of terms and guide for interpretation of the computer printout
7. Incident energy and flash protection boundary calculations
8. Comments and recommendations for system improvements, where needed
9. Executive Summary including source of information and assumptions made

#### 1.5 QUALIFICATIONS

- A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies. The Registered Professional Electrical Engineer shall be a full-time employee of the Engineering Services Organization.

### PART 2 PRODUCT

#### 2.1 STUDIES

- A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer. By using the equipment manufacturer the study allows coordination of proper breakers, fuses, and current transformers. The coordination study shall begin with the utility company's feeder protective device and include all of the electrical protective devices down to and include the largest feeder circuit breaker and motor starter in the 480 Volt motor control centers and power distribution panelboards. The study shall also include variable frequency drives, harmonic filters, power factor correction equipment, transformers and protective devices associated with variable frequency drives, emergency and standby generators associated paralleling equipment and distribution switchgear.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.5 and Informative Annex D.

#### 2.2 DATA COLLECTION

- A. Contractor shall furnish all field data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to eliminate unnecessary delays and assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
- B. Source combination may include present and future utility supplies, motors, and generators.
- C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner or Contractor.
- D. Include fault contribution of existing motors in the study, with motors < 50 hp grouped together. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

#### 2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

- A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standards 141, latest edition.
- B. Transformer design impedances and standard X/R ratios shall be used when test values are not available.
- C. Provide the following:
  1. Calculation methods and assumptions
  2. Selected base per unit quantities
  3. One-line diagram of the system being evaluated with available fault at each bus, and interrupting rating of devices noted
  4. Source impedance data, including electric utility system and motor fault contribution characteristics
  5. Typical calculations
  6. Tabulations of calculated quantities
  7. Results, conclusions, and recommendations
- D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
  1. Electric utility's supply termination point
  2. Incoming switchgear
  3. Unit substation primary and secondary terminals
  4. Low voltage switchgear
  5. Motor control centers
  6. Standby generators and automatic transfer switches
  7. Branch circuit panelboards

8. Other significant locations throughout the system
- E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
- F. Protective Device Evaluation:
  1. Evaluate equipment and protective devices and compare to short circuit ratings
  2. Adequacy of switchgear, motor control centers, and panelboard bus bracing to withstand short-circuit stresses
  3. Adequacy of transformer windings to withstand short-circuit stresses
  4. Cable and busway sizes for ability to withstand short-circuit heating
  5. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current

#### 2.4 PROTECTIVE DEVICE COORDINATION STUDY

- A. Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.
- B. Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
- D. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the curve sheets, where applicable:
  1. Electric utility's protective device
  2. Medium voltage equipment relays
  3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
  4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
  5. Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters
  6. Conductor damage curves
  7. Ground fault protective devices, as applicable
  8. Pertinent motor starting characteristics and motor damage points
  9. Pertinent generator short-circuit decrement curve and generator damage point
  10. Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center
- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.
- G. Select each primary protective device required for a delta-wye connected transformer so that the characteristics or operating band is within the transformer parameters which includes a parameter equivalent to 58% of the ANSI withstand point to afford protection for secondary line-to-ground faults.
- H. Separate low voltage power circuit breakers from each other and the associated primary protective device by a 16% current margin for coordination and protection in the event of secondary line-to-line faults.
- I. Engineer shall provide settings file printouts for all multifunction relays supplied under this contract including all ANSI protective relay functions and associated logic and control. Metering, communication, and control logic settings not associated with ANSI protective functions are not required.

#### 2.5 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2012, Informative Annex D.
- B. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.
- C. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- D. The Arc-Flash Hazard Analysis shall include all MV, 575v, & 480v locations and significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA.
- E. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.
- F. The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

- G. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.
- H. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2.

I.

## 2.6 REPORT SECTIONS

### A. Input Data:

- 1. Utility three-phase and line-to-ground available contribution with associated X/R ratios
- 2. Short-circuit reactance of rotating machines with associated X/R ratios
- 3. Cable type, construction, size, # per phase, length, impedance and conduit type
- 4. Bus duct type, size, length, and impedance
- 5. Transformer primary & secondary voltages, winding configurations, kVA rating, impedance, and X/R ratio
- 6. Reactor inductance and continuous ampere rating
- 7. Aerial line type, construction, conductor spacing, size, # per phase, and length

### B. Short-Circuit Data:

- 1. Source fault impedance and generator contributions
- 2. X to R ratios
- 3. Asymmetry factors
- 4. Motor contributions
- 5. Short circuit kVA
- 6. Symmetrical and asymmetrical fault currents

### C. Recommended Protective Device Settings:

- 1. Phase and Ground Relays:
  - a. Current transformer ratio.
  - b. Current setting.
  - c. Time setting.
  - d. Instantaneous setting.
  - e. Specialty non-overcurrent device settings.
  - f. Recommendations on improved relaying systems, if applicable.
- 2. Circuit Breakers:
  - a. Adjustable pickups and time delays (long time, short time, ground).
  - b. Adjustable time-current characteristic.
  - c. Adjustable instantaneous pickup.
  - d. Recommendations on improved trip systems, if applicable.

### D. Incident energy and arc flash boundary calculations.

- 1. Arcing fault magnitude
- 2. Device clearing time
- 3. Duration of arc
- 4. Arc flash boundary
- 5. Working distance
- 6. Incident energy
- 7. Recommendations for arc flash energy reduction

## PART 3 - EXECUTION

### 3.1 FIELD ADJUSTMENT

- A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.
- B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- C. Notify Owner in writing of any required major equipment modifications.
- D. Following completion of all studies, acceptance testing and startup by the field engineering service division of the equipment manufacturer, a 2-year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

### 3.2 ARC FLASH WARNING LABELS

- A. The vendor shall provide a 4 in. x 4 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

- B. The label shall have an orange header with the wording, “WARNING, SHOCK & ARC FLASH HAZARD”, and shall include the following information:
  - 1. Location designation
  - 2. Nominal voltage
  - 3. Arc flash boundary
  - 4. Incident energy
  - 5. Working distance
  - 6. Shock Boundaries
  - 7. Engineering report number, revision number and issue date
- C. Labels shall be machine printed, with no field markings
- D. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
  - 1. For each 600, 480 and applicable 208 volt panelboards and disconnects, one arc flash label shall be provided
  - 2. For each motor control center, one arc flash label shall be provided
  - 3. For each low voltage switchboard, one arc flash label shall be provided
  - 4. For each switchgear, one flash label shall be provided
  - 5. For medium voltage switches one arc flash label shall be provided
- E. Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

### 3.3 ARC FLASH TRAINING

- A. The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the requirements of NFPA 70E, Standard For Electrical Safety Requirements For Employee Workplaces, shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

END OF SECTION

## SECTION 26 09 23 - LIGHTING CONTROL DEVICES

### PART 1 GENERAL

#### 1.1 DESIGN / PERFORMANCE REQUIREMENTS

- A. WattStopper Digital Lighting Management (DLM) shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
- B. Approved Manufacturers for Interior Lighting Controls:
  - 1. Wattstopper
  - 2. Hubbell Building Automation (basis of design)
  - 3. nLight

#### 1.2 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. This specification red mark where the system does not comply. Any areas not red marked, it is assumed the system meets this specification. In the event it is found that the system does not meet this specification and this specification is not red marked, the specified system will be purchased and installed by the electrical contractor at no additional cost to the project.
  - 2. Catalog sheets and specifications.
  - 3. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
  - 4. Storage and handling requirements and recommendations.
  - 5. Installation instructions.
- B. Shop Drawings: Wiring diagrams a for the various components of the System specified including:
  - 1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
  - 2. Show location of all devices, including at minimum sensors, load controllers, switches/dimmers for each area on reflected ceiling plans, and in-room bus connections.
  - 3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
  - 4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.
- C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- D. Closeout Submittals:
  - 1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
  - 2. Operation and Maintenance Manual:
    - a. Include approved Shop Drawings and Product Data.
    - b. Include Sequence of Operation, identifying operation for each room or space.
    - c. Include manufacturer's maintenance information.
    - d. Operation and Maintenance Data: Include detailed information on device programming and setup.
    - e. Include startup and test reports.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.
- B. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.



#### 1.4 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.
- B. Review installation procedures and coordination required with related Work and the following:
  - 1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
  - 2. Review the specifications for low voltage control wiring and termination.
  - 3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
  - 4. Discuss requirements for integration with other trades
- C. Inspect and make notes of job conditions prior to installation:
  - 1. Record minutes of the conference and provide copies to all parties present and the specifier.
  - 2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
  - 3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the specifier.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

#### 1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
  - 1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
  - 2. Relative humidity: Maximum 90 percent, non-condensing.

#### 1.7 WARRANTY

- A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

### PART 2 PRODUCTS

#### 2.1 INTERIOR DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

- A. Provide a complete system with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the specifier for clarification prior to proceeding.
- B. Provide a lighting control system with the following features:
  - 1. Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
  - 2. Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase MLV, ELV, or LED control dimming outputs and integral current monitoring capabilities. Controllers include a manual override / dimming button for each channel on the controller. Polarity of each load output is reversible, via digital configuration, so that on is off and off is on. The Class 1 and Class 2 0-10 volt output automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. When room controllers are daisy chained the available power to operate devices is cumulative, so all in room devices can be daisy be chained and powered from a single room controller port. Single dimming controller can support up to 48 communicating devices; single switching room controller can support up to 24 communicating devices.

3. Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display, two-way active infrared (IR) communications, local PC interface, or network front end. Ceiling sensors offer two built-in RJ45 ports. Digital calibration and pushbutton configuration for the following variables:
  - a. Sensitivity, 0-100 percent in 10 percent increments
  - b. Time delay, 1-30 minutes in 1 minute increments
  - c. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
4. Switches: Single gang self-configuring pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall or reprogramming. Load and Scene button function may be reconfigured in the field for individual buttons from Load to Scene, and vice versa
5. Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
  - a. Single-zone closed loop automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads
  - b. Multi-zone open loop photocell automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
6. **(Optional)** Configuration Tools: Able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify devices by type and serial number. Handheld remote for room configuration and relay panel programming provides two-way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
7. (Required with Line Item 8) Building segment network: Linear topology, BACnet MS/TP network to connect multiple local networks for centralized control.
8. (Optional) Segment Manager: BACnet MS/TP-based controller with web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting. Automatic discovery of devices and relay panels on the segment networks in a standard navigation tree format. Allow information for all devices to be imported into the Segment Manager via a single XML based site file. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an "Export Table" that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance. Any device on the building network can be remotely accessed through a cellular VPN to verify system is ready for start-up, aid in remote trouble troubleshooting, and device programming for the first year. The VPN is isolated from the building network.
9. Programming and Configuration Software: Free PC-native application capable of accessing and saving control parameters within a room, for the local network, via a USB adapter, or globally, for many

segment networks simultaneously, via BACnet/IP communication.

10. (Optional) Digital Zone Controller: Connect up to 64 room controllers. Zone Controller accepts program changes from Two-way infrared (IR) handheld remote or USB programming adapter tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS).
11. (Optional) Network Bridge: Provides communication between local room networks, relay panels, segment manager, or BAS via BACNet MS/TP.

## 2.2 BACnet INFORMATION BY DEVICE

### A. Digital Room Controllers:

1. BACnet object information shall be available for the following objects:
  - a. Load status
  - b. Schedule state, normal or after-hours
  - c. Demand Response enable and disable
  - d. Room occupancy status
  - e. Total room lighting and plug loads watts
  - f. Electrical current
  - g. Total watts per controller
  - h. Total room watts/sq ft.
  - i. Force on/off all loads

### B. Digital Sensors:

1. BACnet object information shall be available for the following objects:
  - a. Detection state
  - b. Occupancy sensor time delay
  - c. Occupancy sensor sensitivity, PIR and Ultrasonic

### C. Digital Wall Switches:

1. BACnet object information shall be available for the following objects:
  - a. Button state
  - b. Switch lock control  
Switch lock status

### D. Digital Photocells:

1. BACnet object information shall be available for the following objects:
  - a. Light level
  - b. Day and night setpoints
  - c. Off time delay
  - d. On and off setpoints
  - e. Up to three zone setpoints
  - f. Operating mode - on/off, bi-level, tri-level or dimming

### E. Network Bridge:

1. BACnet object information shall be available for the following objects:
  - a. Read/write the normal or after hours schedule state for the room
  - b. Read the detection state of each occupancy sensor
  - c. Read the aggregate occupancy state of the room
  - d. Read/write the On/Off state of loads
  - e. Read/write the dimmed light level of loads
  - f. Read the button states of switches
  - g. Read total current in amps, and total power in watts through the load controller
  - h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
  - i. Activate a preset scene for the room
  - j. Read/write daylight sensor fade time and day and night setpoints
  - k. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells

- l. Set daylight sensor operating mode
- m. Read/write wall switch lock status
- n. Read watts per square foot for the entire controlled room
- o. Write maximum light level per load for demand response mode
- p. Read/write activation of demand response mode for the room
- q. Activate/restore demand response mode for the room

### 2.3 PREPARATION

- A. Do not begin installation until measurements have been verified and work areas have been properly prepared.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

### 2.4 INSTALLATION

- A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
- B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. In room wire substitution is not permitted
  1. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty.
  2. Low voltage wiring topology must comply with manufacturer's specifications.
  3. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.
- C. All line voltage connections shall be tagged to indicate circuit and switched legs.
- D. Test all devices to ensure proper communication.
- E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
- F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
  1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
  3. Load Parameters (e.g. blink warning, etc.)
- G. Post start-up tuning – Areas connected to a segment manager, adjust lighting control devices for the owner at no additional charge for the first year.
- H. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.
- I. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.
- J. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

### 2.5 START-UP:

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to have a preconstruction meeting, midway construction meeting and final meeting inspection.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to have components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and

Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

- C. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
1. Verify Class I and II wiring connections are terminated properly by validating system performance.
  2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
  3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
  4. Verify that the control of each space complies with the Sequence of Operation.
  5. Correct any system issues and retest..

## 2.6 DEMONSTRATION AND TRAINING

- A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
1. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

## 2.7 PRODUCT SUPPORT AND SERVICE

- A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION

## SECTION 26 09 43 - DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

### PART 1 GENERAL

#### 1.1 DESIGN / PERFORMANCE REQUIREMENTS

- A. WattStopper Digital Lighting Management (DLM) shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
- B. Approved Manufacturers for Interior Lighting Controls:
  - 1. Wattstopper
  - 2. Hubbell Building Automation (basis of design)
  - 3. Osram Encelium
- C. Approved Manufacturers for Exterior Wireless Lighting Controls:
  - 1. Synapse Wireless (basis of design)
  - 2. Hubbell Building Automation
  - 3. Wattstopper

#### 1.2 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. This specification red mark where the system does not comply. Any areas not red marked, it is assumed the system meets this specification. In the event it is found that the system does not meet this specification and this specification is not red marked, the specified system will be purchased and installed by the electrical contractor at no additional cost to the project.
  - 2. Catalog sheets and specifications.
  - 3. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
  - 4. Storage and handling requirements and recommendations.
  - 5. Installation instructions.
- B. Shop Drawings: Wiring diagrams a for the various components of the System specified including:
  - 1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
  - 2. Show location of all devices, including at minimum sensors, load controllers, switches/dimmers for each area on reflected ceiling plans, and in-room bus connections.
  - 3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
  - 4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.
- C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- D. Closeout Submittals:
  - 1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
  - 2. Operation and Maintenance Manual:
    - a. Include approved Shop Drawings and Product Data.
    - b. Include Sequence of Operation, identifying operation for each room or space.
    - c. Include manufacturer's maintenance information.
    - d. Operation and Maintenance Data: Include detailed information on device programming and setup.

- e. Include startup and test reports.

### 1.3 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.
- B. **System Components:** Demonstrate that individual components have undergone quality control and testing prior to shipping.

### 1.4 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.
- B. Review installation procedures and coordination required with related Work and the following:
  - 1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
  - 2. Review the specifications for low voltage control wiring and termination.
  - 3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
  - 4. Discuss requirements for integration with other trades
- C. Inspect and make notes of job conditions prior to installation:
  - 1. Record minutes of the conference and provide copies to all parties present and the specifier.
  - 2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
  - 3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the specifier.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

### 1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
  - 1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
  - 2. Relative humidity: Maximum 90 percent, non-condensing.

### 1.7 WARRANTY

- A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

### 1.8 EXTRA MATERIALS

- A. If any of the following products are part of the design, provide 5% attic stock for each type:
  - Ceiling Sensor
  - Indoor Digital Daylighting Photocell
  - Digital Wall Switches
  - Digital Switching Room Controller

Digital Dimming Room Controller  
Digital Dimming Room Controller with Current Monitoring  
Network Bridge

## PART 2 PRODUCTS

### 2.1 INTERIOR DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

- A. Provide a complete system with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the specifier for clarification prior to proceeding.
- B. Provide a lighting control system with the following features:
1. Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
  2. Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase MLV, ELV, or LED control dimming outputs and integral current monitoring capabilities. Controllers include a manual override / dimming button for each channel on the controller. Polarity of each load output is reversible, via digital configuration, so that on is off and off is on. The Class 1 and Class 2 0-10 volt output automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. When room controllers are daisy chained the available power to operate devices is cumulative, so all in room devices can be daisy be chained and powered from a single room controller port. Single dimming controller can support up to 48 communicating devices; single switching room controller can support up to 24 communicating devices.
  3. Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display, two-way active infrared (IR) communications, local PC interface, or network front end. Ceiling sensors offer two built-in RJ45 ports. Digital calibration and pushbutton configuration for the following variables:
    - a. Sensitivity, 0-100 percent in 10 percent increments
    - b. Time delay, 1-30 minutes in 1 minute increments
    - c. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
  4. Switches: Single gang self-configuring pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall or reprogramming. Load and Scene button function may be reconfigured in the field for individual buttons from Load to Scene, and vice versa
  5. Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
    - a. Single-zone closed loop automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads
    - b. Multi-zone open loop photocell automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON



and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.

6. **(Optional)** Configuration Tools: Able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify devices by type and serial number. Handheld remote for room configuration and relay panel programming provides two-way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
7. **(Required with Line Item 8)** Building segment network: Linear topology, BACnet MS/TP network to connect multiple local networks for centralized control.
8. **(Optional)** Segment Manager: BACnet MS/TP-based controller with web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting. Automatic discovery of devices and relay panels on the segment networks in a standard navigation tree format. Allow information for all devices to be imported into the Segment Manager via a single XML based site file. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an "Export Table" that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance. Any device on the building network can be remotely accessed through a cellular VPN to verify system is ready for start-up, aid in remote trouble troubleshooting, and device programming for the first year. The VPN is isolated from the building network.
9. Programming and Configuration Software: Free PC-native application capable of accessing and saving control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
10. **(Optional)** Digital Zone Controller: Connect up to 64 room controllers. Zone Controller accepts program changes from Two-way infrared (IR) handheld remote or USB programming adapter tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS).
11. **(Optional)** Network Bridge: Provides communication between local room networks, relay panels, segment manager, or BAS via BACnet MS/TP.

## 2.2 BACnet INFORMATION BY DEVICE

### A. Digital Room Controllers:

1. BACnet object information shall be available for the following objects:
  - a. Load status
  - b. Schedule state, normal or after-hours
  - c. Demand Response enable and disable
  - d. Room occupancy status
  - e. Total room lighting and plug loads watts

- f. Electrical current
  - g. Total watts per controller
  - h. Total room watts/sq ft.
  - i. Force on/off all loads
- B. Digital Sensors:
- 1. BACnet object information shall be available for the following objects:
    - a. Detection state
    - b. Occupancy sensor time delay
    - c. Occupancy sensor sensitivity, PIR and Ultrasonic
- C. Digital Wall Switches:
- 1. BACnet object information shall be available for the following objects:
    - a. Button state
    - b. Switch lock control  
Switch lock status
- D. Digital Photocells:
- 1. BACnet object information shall be available for the following objects:
    - a. Light level
    - b. Day and night setpoints
    - c. Off time delay
    - d. On and off setpoints
    - e. Up to three zone setpoints
    - f. Operating mode - on/off, bi-level, tri-level or dimming
- E. Network Bridge:
- 1. BACnet object information shall be available for the following objects:
    - a. Read/write the normal or after hours schedule state for the room
    - b. Read the detection state of each occupancy sensor
    - c. Read the aggregate occupancy state of the room
    - d. Read/write the On/Off state of loads
    - e. Read/write the dimmed light level of loads
    - f. Read the button states of switches
    - g. Read total current in amps, and total power in watts through the load controller
    - h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
    - i. Activate a preset scene for the room
    - j. Read/write daylight sensor fade time and day and night setpoints
    - k. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells
    - l. Set daylight sensor operating mode
    - m. Read/write wall switch lock status
    - n. Read watts per square foot for the entire controlled room
    - o. Write maximum light level per load for demand response mode
    - p. Read/write activation of demand response mode for the room
    - q. Activate/restore demand response mode for the room

### 2.3 PREPARATION

- A. Do not begin installation until measurements have been verified and work areas have been properly prepared.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that required pre-installation meeting specified in Part 1 of this specification has been

completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

## 2.4 INSTALLATION

- A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
- B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. In room wire substitution is not permitted
  - 1. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty.
  - 2. Low voltage wiring topology must comply with manufacturer's specifications.
  - 3. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.
- C. All line voltage connections shall be tagged to indicate circuit and switched legs.
- D. Test all devices to ensure proper communication.
- E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
- F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
  - 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  - 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
  - 3. Load Parameters (e.g. blink warning, etc.)
- G. Post start-up tuning – Areas connected to a segment manager, adjust lighting control devices for the owner at no additional charge for the first year.
- H. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.
- I. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.
- J. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

## 2.5 START-UP:

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.
- B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
  - 1. Verify Class I and II wiring connections are terminated properly by validating system performance.
  - 2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
  - 3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
  - 4. Verify that the control of each space complies with the Sequence of Operation.
  - 5. Correct any system issues and retest..

## 2.6 DEMONSTRATION AND TRAINING

- A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
  - 1. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

2.7 PRODUCT SUPPORT AND SERVICE

- A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION

## SECTION 26 24 16 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
  - 1. Edit panelboards below to suit Project.
  - 2. Lighting and appliance branch-circuit panelboards.
  - 3. Distribution panelboards.
- B. Related Sections include the following:
  - 1. List below only products, construction, and equipment that the reader might expect to find in this Section but are specified elsewhere.
  - 2. Retain subparagraph below if Project includes fusible panelboards.
  - 3. Section "Fuses."

#### 1.3 DEFINITIONS

- A. Retain abbreviations that remain after this Section has been edited.
- B. EMI: Electromagnetic interference.
- C. GFCI: Ground-fault circuit interrupter.
- D. RFI: Radio-frequency interference.
- E. RMS: Root mean square.
- F. SPDT: Single pole, double throw.
- G. TVSS: Transient voltage surge suppressor.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, 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. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboards and overcurrent protective devices.
    - d. Delete subparagraph below if series rating of overcurrent protective devices is not used.
    - e. UL listing for series rating of installed devices.
    - f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Delete paragraph below if independent testing agency is not used.
- D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- E. Field Test Reports: Submit written test reports and include the following:
  - 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.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Maintenance Data: For panelboards and components to include in maintenance manuals specified in other sections. In addition to requirements specified in Section "Contract Closeout," 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.

#### 1.5 QUALITY ASSURANCE

- A. Retain paragraph and subparagraph below if Contractor or manufacturer selects testing agency.
- 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 NEMA PB 1.
- D. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Edit below to delete or add types of equipment that affect panelboard installation.
- B. 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, and encumbrances to work-space clearance requirements.

#### 1.7 EXTRA MATERIALS

- A. Extra materials may not be allowed for publicly funded projects. Revise quantity below to suit Project.
- B. Keys: [SIX] 6 spares of each type of panelboard cabinet lock.

### PART 2 - PRODUCTS

#### 2.1 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. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Lists below are examples only. Retain or insert only those manufacturers whose products correspond with other requirements and whose availability and suitability for the application have been verified.
  2. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - a. Eaton
    - b. Square D Co.
    - c. General Electric

#### 2.2 FABRICATION AND FEATURES

- A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
  1. Delete items below if not applicable. Add other Project-specific requirements.
  2. Outdoor Locations: NEMA 250, Type 3R.
  3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  4. Enclosures in hazardous locations must be carefully selected to meet the division and group listing of the environment.
  5. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
- B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- C. Retain paragraph above or below.
- D. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- E. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- F. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- G. Bus: Hard-drawn copper, 98 percent conductivity.
- H. Main and Neutral Lugs: Copper mechanical type suitable for use with conductor material.

- I. Ten paragraphs below are special features. Add other required features and coordinate with Drawings.
- J. Equipment Ground Bus: Copper and adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- K. Delete paragraph below except for panelboards incorporating one or more main service disconnect switches. Edit to suit Project.
- L. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- M. Delete paragraph below if future provisions are not required.
- N. Isolated Equipment Ground Bus: Copper and adequate for branch-circuit equipment ground conductors; insulated from box.
- O. Extra-Capacity Neutral Bus: Copper neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
- P. Split Bus: Vertical buses divided into individual vertical sections.
- Q. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
- R. Gutter Barrier: Arrange to isolate individual panel sections.
- S. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.
- T. Feed-through Lugs: Copper mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

### 2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. Select one of two paragraphs below for series-rated system or system that has panelboards and circuit breakers rated for full value of short-circuit current available at location of equipment. Edit to suit Project and coordinate with Drawings.
- B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

### 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Plug-in or bolt on circuit breakers, replaceable without disturbing adjacent units.
- B. Coordinate below with Drawings.
- C. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

### 2.5 DISTRIBUTION PANELBOARDS

- A. Edit three paragraphs and associated subparagraphs below to suit Project. Coordinate with Drawings.
- B. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike.
- C. Main Overcurrent Protective Devices: Circuit breaker.
- D. Branch overcurrent protective devices shall be one of the following:
  - 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in or Bolt-on circuit breakers.
  - 2. 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.

### 2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Edit three paragraphs and associated subparagraphs below to suit Project. Coordinate with schedules and Drawings.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
  - 1. 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.
  - 2. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and I<sup>2</sup>t response.

3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  4. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
  5. GFCI Circuit Breakers: Single- and two-pole configurations with [5] [30]-mA trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
  2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
- D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Revise paragraph below if "Balancing Loads" Paragraph is deleted from "Field Quality Control" Article below.
- E. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- F. Install filler plates in unused spaces.
- G. Revise below if "Balancing Loads" Paragraph is deleted from "Field Quality Control" Article below.
- H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

### 3.2 IDENTIFICATION

- A. Select Division 16 Section "Basic Electrical Materials and Methods" for projects with simple requirements and Division 16 Section "Electrical Identification" for projects with complex requirements.
- B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Basic Electrical Materials and Methods] [Electrical Identification."
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### 3.3 CONNECTIONS

- A. Coordinate paragraphs below with Drawings.
- B. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- C. 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.

### 3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.
- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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.
- C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
  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.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Re-balance and recheck as necessary to meet this minimum requirement.

3.5 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

## SECTION 26 27 26 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes receptacles, connectors, switches, and finish plates.

#### 1.3 DEFINITIONS

- A. Retain abbreviations that remain after this Section has been edited for Project.
- B. GFI: Ground-fault circuit interrupter.
- C. TVSS: Transient voltage surge suppressor.

#### 1.4 SUBMITTALS

- A. Product Data: For each product specified.
- B. Shop Drawings: Legends for receptacles and switch plates.
- C. Include sample review below if products may have critical features needing hands-on appraisal.
- D. Samples: For devices and device plates for color selection and evaluation of technical features.
- E. Maintenance Data: For materials and products to include in maintenance manuals specified in other sections.

#### 1.5 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.
- B. Comply with NEMA WD 1.
- C. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Delete paragraph below unless receptacles for Owner-Furnished equipment with plugs have unknown configurations.
- B. Receptacles for Owner-Furnished Equipment: Match plug configurations.
- C. Coordinate with pool contractor for special receptacles.

### PART 2 - PRODUCTS

#### 2.1 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. Wiring Devices:
    - a. Bryant Electric, Inc.
    - b. Eagle Electric Manufacturing Co., Inc.
    - c. GE Company; GE Wiring Devices.
    - d. Hubbell, Inc.; Wiring Devices Div.
    - e. Killark Electric Manufacturing Co.
    - f. Leviton Manufacturing Co., Inc.
    - g. Pass & Seymour/Legrand; Wiring Devices Div.
    - h. Pyle-National, Inc.; an Amphenol Co.

#### 2.2 RECEPTACLES

- A. Select one of three paragraphs below to specify grade of receptacles. See Editing Instruction No. 3 in the Evaluations for wiring device grades.
- B. Straight-Blade and Locking Receptacles: Heavy-Duty grade. The device shall be 20-ampere, 125-volts, Nema configuration 5-20R, back and side wired.
- C. Special Receptacles for NEMA configuration refer to Manufacturer specs.
- D. Termination-type GFCI unit may be substituted for feed-through type where no protection of downstream receptacles is required.
- E. GFI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter. Device shall have an indicator light.
- F. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap. Device shall be white finish with the orange symbol.

2. Devices: Listed and labeled as solated-ground receptacles.
3. Isolation Method: Integral to receptacle construction and not dependent on removable parts.

### 2.3 SWITCHES

#### A. General

1. Switches shall be toggle rocker type as indicated herein.. The body of the switch shall be made of an arc-resistant thermoset material. All toggle switch handles shall be constructed of a thermoplastic material. All rocker switch handles shall be constructed of a thermoset material. All wall switches shall be of the quiet AC type.
2. Switches shall be SPST, DPST, 3-way or 4-way as indicated on the Drawings.
3. Switch color shall be white unless noted otherwise. Coordinate with Architect.

#### B. Specification Grade

1. Specification Grade switches shall be toggle type. The contact arms shall be made of one-piece copper alloy material. The switch shall include a green ground screw attached to the mounting strap. The switch shall be 20-ampere, 120/277-volts AC, horsepower rated, back and side-wired.

#### C. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters.

1. Modify subparagraph below to suit preference.
2. Control: Continuously adjustable slide, toggle, or rotary knob. Single-pole or three-way switch to suit connections.
3. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable slide with "on/off" switch; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and 5-inch (130-mm) wire connecting leads. Dimmer to be sized per circuit load.

### 2.4 WALL PLATES(All wall plates)

#### A. For all single and combination types match corresponding wiring devices.

4. Plate-Securing Screws: Metal with head color to match plate finish.
5. Select one of five subparagraphs below. Coordinate with Division 9 Section "Painting."
6. Material for Finished Spaces: 0.04-inch- (1-mm-) thick, Type 302, satin-finished stainless steel.
7. Select one of three subparagraphs below or delete all.
8. Material for Unfinished Spaces: stainless steel.

### 2.5 FLOOR SERVICE FITTINGS

- A. Items in this Article are available for telephone and data cable service as well as power. Edit to suit Project.
- B. Select one of three paragraphs below.
- C. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- D. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Coordinate two paragraphs below with Drawings.
- F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- G. Protect devices and assemblies during painting.
- H. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.
- I.

### 3.2 IDENTIFICATION

- A. Comply with Section "Electrical Identification."
- B. Select paragraph above or below.
- C. Comply with Section "Basic Electrical Materials and Methods."
  1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
  2. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.3 CONNECTIONS

- A. Select paragraph above or below. Coordinate with Division 16 Section "Grounding."
- B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- C. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
- D. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Dparagraph below if GFCIs are not in Part 2.
- C. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- D. Replace damaged or defective components.

3.5 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

## SECTION 26 28 13 - FUSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Fuses.

#### 1.3 SUBMITTALS

- A. Use this Article to convey basic design intent. Delete if Drawings show sufficient detail to clarify intent.
- B. General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections.
- C. Product Data for each fuse type specified.
- D. Select above or below. Data listed in paragraph below are appropriate where selective coordination is necessary.
- E. Field test reports indicating and interpreting test results.
- F. Maintenance data for tripping devices to include in the operation and maintenance manual specified in other sections.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from one source and by a single manufacturer.
- B. Comply with NFPA 70 for components and installation.
- C. Listing and Labeling: Provide fuses specified in this Section that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
  - 2. Subparagraph below is required by some Federal agencies.
  - 3. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

#### 1.5 EXTRA MATERIALS

- A. Extra materials may not be allowed for publicly funded projects.
- B. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Spare Fuses: Furnish quantity equal to 20 percent of each fuse type and size installed, but not less than 1 set of 3 of each type and size.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fuses that may be incorporated into the Work include, but are not limited to, the following:
- B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."
- C. Manufacturers: Subject to compliance with requirements, provide fuses by one of the following:
  - 1. See Editing Instruction No. 1 in the Evaluations for cautions about naming products and manufacturers.
  - 2. Cooper Industries, Inc.; Bussmann Div.
  - 3. Eagle Electric Mfg. Co., Inc.
  - 4. Ferraz Corp.
  - 5. General Electric Co.; Wiring Devices Div.
  - 6. Gould Shawmut.

7. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

## 2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class as specified or indicated; current rating as indicated; voltage rating consistent with circuit voltage.

## 2.3 SPARE FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- (1.27-mm-) thick steel unit with full-length, recessed piano-hinged door with key-coded cam lock and pull.

1. Size: Adequate for orderly storage of spare fuses specified with 15 percent spare capacity minimum.

2. Finish: Gray, baked enamel.

3. Identification: Stencil legend "SPARE FUSES" in 1-1/2-inch (40-mm) letters on door.

4. Fuse Pullers: For each size fuse.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 FUSE APPLICATIONS

A. Select and edit paragraphs below. Add paragraphs as Project requires to specify fuse applications rather than show them on Drawings.

B. Motor Branch Circuits: Class RK1, time delay.

C. Other Branch Circuits: Class RK5, non-time delay.

### 3.3 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

B. Install spare fuse cabinet where indicated.

### 3.4 IDENTIFICATION

A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

END OF SECTION

## SECTION 26 28 16.16 - ENCLOSED SWITCHES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

#### 1.2 SCOPE OF WORK

- A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of disconnect switches, including all related systems and accessories.

#### 1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with other Sections for products specified under PART 2 - PRODUCTS.
- B. Provide outline drawings with dimensions, and equipment ratings for voltage, amperage, horsepower and short circuit.
- C. Provide designations for each disconnect. RE: to section 16075.

#### 1.4 REFERENCE STANDARDS

- A. Switches shall be manufactured in accordance with the following standards:
  - 1. UL 98 - Enclosed and Dead Front Switches
  - 2. NEMA KS1 - Enclosed Switches
  - 3. NEMA 250 - Enclosures for Electrical Equipment

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

- A. Eaton
- B. Square D Co.
- C. General Electric

#### 2.2 GENERAL

- A. Switches shall be heavy duty type.

#### 2.3 SWITCH INTERIOR

- A. Switches shall have switch blades which are visible when the switch is OFF and the cover is open.
- D. Lugs shall be copper and front removable and UL listed for 60°C or 75°C conductors 30-100 ampere, 75°C conductors 200 ampere and up.
- E. Current carrying parts shall be plated to resist corrosion.
- F. Switches shall have removable arc suppressor to facilitate easy access to line side lugs.
- G. Switches shall have provisions for a field installable electrical interlock.

#### 2.4 SWITCH MECHANISM

- A. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
- B. The operating handle shall be an integral part of the box, not the cover.
- C. Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.
- D. The handle position shall travel at least 90° between OFF and ON positions to clearly distinguish and indicate handle position.
- E. Switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

#### 2.5 SWITCH ENCLOSURES

- A. Switch covers shall be attached with welded pin-type hinges (Type 1) or top-hinged, attached with removable screws and securable in the open position (Type 3R).
  - B. The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated steel (Type 1) or gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated galvanized steel (Type 3R).
  - C. The enclosure shall have ON and OFF markings stamped into the cover.
  - D. The operating handle shall be provided with a dual colored, red/black position indication.
  - E. Switches shall have provisions to accept up to three 3/8" hasp padlocks to lock the operating handle in the OFF position.
  - H. Tangential knockouts shall be provided to facilitate ease of conduit entry (Type 1).
  - I. Type 3R enclosure shall contain no knockouts. Supply watertight hubs.
  - J. Type 4x shall be stainless steel enclosure with no knockouts. Supply watertight hubs.
- 2.6 SWITCH RATINGS
- A. Switches shall be horsepower rated.
  - B. The UL listed short circuit current rating of the switches shall be: 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses 30-600 ampere employing appropriate fuse rejection schemes.

### PART 3- EXECUTION

#### 3.1 INSTALLATION

- D. Install disconnect switches where indicated shown or not shown.
- E. Install fuses in fusible disconnect switches.

END OF SECTION



## SECTION 26 43 13 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions, apply to work covered by this Section.
- B. Comply with Electrical Sections, as applicable. Refer to other Sections for coordination of work.

#### 1.2 SCOPE OF WORK

- A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of a high-energy power conditioning surge protection device(s) at branch circuit panelboards where indicated on the Drawings. The device shall incorporate transient voltage surge suppression (TVSS) and high-frequency electrical line noise filtering. The device shall provide effective high energy transient voltage suppression, surge current diversion, high-frequency attenuation, and line stabilization in ANSI/IEEE C62.41-2002 environments connected downstream from the facility's main overcurrent protective device. The device shall be connected in parallel with the facility's wiring system.
- B. The device shall be installed as an integral part or external of the panelboard, switchboard.

#### 1.3 SUBMITTALS

- A. Submit product data and shop drawings for products specified under PART 2 - PRODUCTS.
- B. Manufacturers' Product Data: Submit material specifications and installation data for products specified under PART 2 - PRODUCTS.
- C.
- D. Shop Drawings: Submit shop drawings to indicate information not fully described by the product data to indicate compliance with the contract documents.
  - 1 Include electrical characteristics and ratings for the specified equipment.
  - 2 Include wiring diagrams indicating the internal connections of the specified equipment within its enclosure.
  - 3 Drawings shall be provided indicating device dimensions, weights, mounting provisions, connection details and wiring diagrams.
  - 4 Documentation of the specified device UL 1449 3<sup>rd</sup> Edition voltage protection rating (VPR) and per mode surge current rating shall be included. All submittals without this documentation will be rejected.
  - 5 The manufacturer shall make available upon request certified documentation of applicable Location Category Testing in full compliance with ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1987 Guidelines.
- E. Record Drawings
  - 1 A complete set of manufacturers' product data and shop drawings indicating all post bid revisions and field changes.

#### 1.4 QUALITY ASSURANCE

- A. Industry Reference Standards and Publications: The device shall be designed, manufactured, tested and installed in compliance with the latest editions of:
  - 1 American National Standards Institute (ANSI) and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.41-2002 and C62.45-2002)
  - 2 Federal Information Processing Standards Publication 94 (FIPS PUB 94)
  - 3 National Electrical Manufacturers Association (NEMA LS-1)
  - 4 National Fire Protection Association (NFPA 70, National Electrical Code (NEC), 75 and 78)
  - 5 Underwriters Laboratories UL 1449 Standard for Transient Voltage Surge Suppressors Surge Protection Devices and UL 1283 Standard for Electromagnetic Interference Filters.
- B. The device shall be UL listed under UL 1449 and UL 1283 complimentary listed.
- C. The device shall be warranted against defects in material and/or workmanship and any failure or end-of-life event including lighting for a minimum of TEN (10) years from the date of shipment.
- D.
- E. The device shall be thoroughly factory-tested before shipment. Testing of the device shall include but not be limited to quality control checks, maximum continuous operating voltage (MCOV) check, and clamping voltage verification tests. The MCOV check shall consist of a minimum of one (1) hour burn-in at the applicable MCOV.
- F.

1.5 SYSTEM DESCRIPTION

A. Environmental Requirements

- 1 Storage Temperature: Storage temperature range shall be -40° to +85° C (-40° to +185° F).
- 2 Operating Temperature: Operating temperature range shall be -40° to +60° C (-40° to 140° F).
- 3 Relative Humidity: Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.
- 4 Operating Altitude: The device shall be capable of operation in an altitude of 0 - 12,000 feet above sea level.
- 5 Audible Noise: The device shall not generate any audible noise.
- 6 Magnetic Fields: No appreciable magnetic fields shall be generated. The device shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.
- 7 Electrical Requirements
- 8 Device Operating Voltage: The nominal operating voltage and configuration shall be that of the switchgear, distribution panel, sub or branch panelboard. Maximum Continuous Operating Voltage (MCOV): The allowable maximum continuous operating voltage of all suppression components utilized in the unit shall not be less than 115% of the nominal operating voltage.
- 9 Operating Frequency: The operating frequency range of the device shall be 47 to 63 Hertz.
- 10 Protection Modes: The devices primary mode of protection shall be line-to-neutral. The secondary modes of protection shall be line-to-ground and neutral-to-ground.
- 11 Surge Current Capacity and Voltage Protection Rating: Unless specifically noted on the drawings and/or the schedules, the surge current capacity, and the voltage protection rating of the SPD shall be not less than listed on the following table.

The above text gives you the option to request a specific surge current rating on the riser or panel schedules

5. Construction: SPD's with a surge current rating of greater than 155,000 amps per mode shall be field serviceable modular devices. SPD's with a surge current rating of less than 155,000 amps may be non-modular.

Location	Per Mode Surge Current Rating	120/208vac 3 phase VPR	277/480vac 3 phase VPR
Switchgear	200,000 amps	900v	1200v
Distribution Panel	150,000 amps	900v	1200v
Sub or Branch Panel	100,000 amps	900v	1200v

1.6 DOCUMENTATION

- A. Equipment Manual. The manufacturer shall furnish an equipment manual with installation, operation, and maintenance instructions for the system.

PART 2 - PRODUCTS

3.1 MANUFACTURER

- 1 Square D
- 2 Cutler-Hammer
- 3 Current Technology
- 4 THOR SYSTEMS

3.2 TRANSIENT VOLTAGE SURGE SUPPRESSION COMPONENTS

- A. The device shall include a solid-state suppression system which includes arrays of fused non-linear voltage dependent metal oxide varistors (MOV's) with similar operating characteristics. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads. The suppression system shall not incorporate any other components which may degrade performance or reliability of the

3.3 HIGH-FREQUENCY FILTER

- A. The device shall include a UL 1283 high frequency extended range tracking filter. The filter shall reduce fast rise-time, high-frequency, error-producing transients and electrical line noise eliminating disturbances which may lead to system upset. The filter shall provide minimum insertion loss of 45 dB at 100 kHz attenuation frequency utilizing the MIL-STD-E220A 50 ohm insertion loss methodology.

3.4 INTERNAL CONNECTIONS

- a. All internal wiring associated with the suppression/filter device and subject to surge currents shall utilize low-impedance copper bus bar and/or #4 AWG copper conductor or larger. All internal connections associated with the suppression/filter device and subject to surge currents shall be made with compression solderless-type lugs and shall be bolted to the bus bars in order to reduce overall system impedance.

SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

### 3.5 FIELD CONNECTIONS

- A. The device shall include mechanical lugs for each phase, neutral and ground, or permanently connected conductors as applicable. The lugs shall accommodate up to #4 AWG copper conductor.

### 3.6 ENCLOSURE

- A. The device shall be provided in a surface mounted NEMA 1 type hinged enclosure, with a NEMA rating that matches or exceeds that of the switchgear, distribution panel, sub or branch panelboard that is being protected. of minimum 14 gauge steel, painted inside and out. Enclosure width shall not be greater than 24 inches.

### 3.7 MONITORING

- a. The device shall include solid-state, long-life externally mounted LED visual status indicators that indicate the on-line status of each phase of the unit.
- b. Dry Contacts
- c. Audible alarm with silence switch
- d. For Service Entrance or Switchgear SPD's: LED visual status indicators, Audible alarm with silence switch, Dry Contacts plus Surge Event Counter.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The installation and testing of the system shall be in full accordance with the manufacturer's installation, operation and maintenance instructions, and all national and local codes.
- B. The device shall be installed as close as practical to the facility's wiring system in accordance with NEC Article 285, IEEE 1100-2005 section 8.4.2.5, plus applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be from a minimum 40A branch circuit breaker in the switchgear, distribution panel or panelboard with #4 AWG copper conductors not any longer than necessary, avoiding unnecessary bends. Advise the engineer if the installed In no case shall conductors will be longer than 3 feet in length. Verify circuit breaker size with manufacturer.

### 3.2 TESTING

- A. The system shall be field tested in the presence of the Owner. At the same time operational procedures shall be reviewed with the Owner.
- B. If external test equipment is required, two (2) testers shall be furnished to the owner and two (2) training sessions shall be furnished. The first training session shall be with 90 days of occupancy and the second training session shall be not less eight months, but not more than 12 months after the first training session. Training and test equipment shall be furnished at no additional cost to the owner.

END OF SECTION

## SECTION 26 51 00 - INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, emergency lighting units, and accessories.
- B. Related Sections include the following:

#### 1.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
  - 1. Dimensions of fixtures.
  - 2. Select one of two subparagraphs below. With second subparagraph, photometric tests by manufacturer's laboratory are acceptable.
  - 3. Certified results of laboratory tests for fixtures and lamps for photometric performance.
  - 4. Emergency lighting unit battery and charger.
  - 5. LED lights
  - 6. Retain two subparagraphs below for projects with air-handling fixtures.
  - 7. Types of lamps.
- B. Delete paragraph and subparagraph below unless custom fixtures are indicated.
- C. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.
  - 1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
- D. Consider retaining paragraph below for projects with congested ceiling space and where Drawings do not include comprehensive reflected ceiling plans.
- E. Coordination Drawings: Reflected ceiling plans and sections drawn to scale and coordinating fixture installation with ceiling grid, ceiling-mounted items, and other components in the vicinity. Include work of all trades that is to be installed near lighting equipment.
- F. Retain paragraph and subparagraphs below if fixture Samples are required for verification purposes. Edit if sample requirements are indicated in other than interior lighting fixture schedule. As an alternative, list of fixture types for sample submission can be added below.
- G. Delete paragraph below if not required.
- H. Product Certificates: Signed by manufacturers of lighting fixtures certifying that products comply with requirements.
- I. Delete paragraph below except for projects with extensive tests of emergency lighting equipment.
- J. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- K. Maintenance Data: For lighting fixtures to include in maintenance manuals in the close out documents.

#### 1.4 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70.
- C. Delete paragraph below if FM compliance is not required. Coordinate with Drawings.
- D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

#### 1.5 COORDINATION

- A. Retain this Article if Coordination Drawings are not required.

- B. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

#### 1.6 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.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Interior Lighting Fixture Schedule at the end of Part 3.
- B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Interior Lighting Fixture Schedule in the plans. Submit Manufacturers as is in the Lighting Fixture Schedule or Equal. Submit Equal Manufacturers 10 days prior to bidding day for approval. For Equal Manufacturers submit lighting calculation for each equal fixture submitted for approval.

#### 2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp corners, and edges.
- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
- D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
  - 4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
  - 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
  - 2. Lens Thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.

#### 2.3 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] <Insert value> 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.

#### 2.4 LED EXIT SIGNS

- A. Exit light fixtures shall meet applicable requirements of NFPA and UL.
- B. Housing and door shall be die-cast aluminum.
- C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.
- D. Finish shall be satin or fine-grain brushed aluminum.
- E. There shall be no radioactive material used in the fixtures.
- F. Fixtures:
  1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
  2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
  3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.
- G. Voltage: Multi-voltage (120 – 277V).

#### 2.5 EMERGENCY LIGHTING UNITS

- A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:
  1. Battery: Sealed, maintenance-free, lead-acid type with minimum 5-year nominal life and special warranty.
  2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  3. Operation: Relay automatically turns lamp on when 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, and battery is automatically recharged and floated on charger.

#### 2.6 LAMPS

- A. ALL LED – NO LAMPS

#### 2.7 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
  - B. NFPA 70 requires minimum support for fixtures. Retain paragraphs below for more specific support requirements and for requirements exceeding code minimums. Units in seismic zones must have additional supports and restraining devices beyond those specified here. See Editing Instruction No. 3 in the Evaluations.
  - C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Do not use grid for support.
    - 1. Install a minimum of two ceiling support system wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.
    - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
    - 3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
  - D. Suspended Fixture Support: As follows:
    - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
    - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
- 3.2 CONNECTIONS
- A. Ground equipment.
    - 1. 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.
- 3.3 FIELD QUALITY CONTROL
- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
  - B. Advance Notice: Give dates and times for field tests.
  - C. Provide instruments to make and record test results.
  - D. Tests: As follows:
    - 1. Verify normal operation of each fixture after installation.
    - 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
    - 3. Verify normal transfer to battery source and retransfer to normal.
    - 4. Report results in writing.
  - E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
  - F. Corrosive Fixtures: Replace during warranty period.
- 3.4 CLEANING AND ADJUSTING
- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.
  - B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION

## SECTION 26 01 00 - SUMMARY OF ELECTRICAL WORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes exterior lighting units with luminaires and lamps.
- B. Related Sections include the following:
  - 1. Section "Interior Lighting" for interior fixtures, lamps, ballasts, emergency lighting units, and accessories; and for exterior luminaires normally mounted on buildings.

#### 1.3 DEFINITIONS

- A. Lighting Unit: A luminaire or an assembly of luminaires complete with a common support, including pole, post, or other structure, and mounting and support accessories.
- B. Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of lighting unit indicated, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
  - 1. Materials and dimensions of luminaires.
  - 2. Delete "independent" in subparagraph below if certified tests by manufacturer are adequate.
  - 3. Select one of two subparagraphs below. With second subparagraph, photometric tests by manufacturer's laboratory are acceptable.
  - 4. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
  - 5. Certified results of laboratory tests for fixtures and lamps for photometric performance.
  - 6. High-intensity-discharge luminaire ballasts.
- B. Product Certificates: Signed by manufacturers of lighting units certifying that products comply with requirements.
- C. Delete paragraph below except for projects with extensive tests of installations.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Maintenance Data: For lighting units to include in maintenance manuals specified in other sections.

#### 1.5 QUALITY ASSURANCE

- A. Luminaires and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use, location, and installation conditions by acceptable to authorities having jurisdiction
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.

#### 1.6 WARRANTY

- A. General Warranty: LED fixture warranty is a five year limited warranty. Pole standard warranty is one year.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Exterior Lighting Unit Schedule at the end of Part 3.
- B. Retain above for nonproprietary or below for semiproprietary Specification, and name products in schedules or details.
- C. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Interior Lighting Fixture Schedule in the plans. Submit Manufacturers as is in the Lighting Fixture Schedule or Equal. Submit Equal Manufacturers 10 days prior to bidding day for approval. For Equal Manufacturers submit lighting calculation for each equal fixture submitted for approval.



## 2.2 LUMINAIRES

- A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- B. Metal Parts: Free from burrs, sharp corners, and edges.
- C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.
- F. Exposed Hardware Material: Stainless steel.
- G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
- H. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
- I. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.
- J. Photoelectric Relays: As follows:
  - 1. Contact Relays: Single throw, arranged to fail in the on position and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.
  - 2. Relay Mounting: In luminaire housing.
- K. High-Intensity-Discharge Ballasts: Comply with ANSI C82.4. Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.
  - 1. Single-Lamp Ballasts: Minimum starting temperature of minus 40 deg C.
  - 2. Open-circuit operation will not reduce average life.
  - 3. High-Pressure Sodium Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.
  - 4. Noise: Uniformly quiet operation, with a noise rating of B or better.
- L. Lamps: Comply with the standard of the ANSI C78 series that is applicable to each type of lamp. Provide luminaires with indicated lamps of designated type, characteristics, and wattage. Where a lamp is not indicated for a luminaire, provide medium wattage lamp recommended by manufacturer for luminaire.
- M. LED sources shall meet the following requirements:
  - 1. Operating temperature rating shall be between -40 degrees C (-40 degrees F) and 50 degrees C (120 degrees F).
  - 2. Correlated Color Temperature (CCT): 4000K
  - 3. Color Rendering Index (CRI):  $\geq 85$ .
  - 4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating

## LED DRIVERS

- A. LED drivers shall meet the following requirements:
  - 1. Drivers shall have a minimum efficiency of 85%.
  - 2. Starting Temperature: -40 degrees C (-40 degrees F).
  - 3. Input Voltage: 120 to 480 ( $\pm 10\%$ ) volt.
  - 4. Power Supplies: Class I or II output.

5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50  $\mu$ s, 10kA/8 x 20  $\mu$ s) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
6. Power Factor (PF):  $\geq 0.90$ .
7. Total Harmonic Distortion (THD):  $\leq 20\%$ .
8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.//

### PART 3 - EXECUTION

#### 3.1 CONNECTIONS

- A. Ground equipment.
  1. 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.
- B. Ground metal poles/support structures according to Section "Grounding and Bonding."
  1. Nonmetallic Poles: Ground metallic components of lighting units and foundations. Connect luminaires to grounding system with No. 6 AWG conductor.

#### 3.2 FIELD QUALITY CONTROL

- A. Inspect each installed unit for damage. Replace damaged units.
- B. Advance Notice: Give dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests and Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source, and as follows:

#### 3.3 CLEANING AND ADJUSTING

- A. Clean units after installation. Use methods and materials recommended by manufacturer.

END OF SECTION

## SECTION 27 05 33 - CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions apply to work covered by this Section.
- B. Comply with Sections 26 00 00, as applicable. Refer to other Sections for coordination of work.

#### 1.2 SCOPE OF WORK

- A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of a telephone and data communications empty conduit system, including all related systems and accessories.

#### 1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with the Architectural sections.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Conduit, conduit sleeves, outlet boxes, cover plates and pullwire as indicated.
- B. Fireproofing material for telephone and data communication conduit and conduit sleeves through fire rated walls and floors.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install telephone and data communication raceways as indicated.
- B. Install individual raceways from telephone and data communications outlets to above accessible ceiling. In areas without a ceiling, raceways shall be routed to the nearest ceiling space. In building without a ceiling, raceways shall be extended back to the main telephone/ data communication board or to a location indicated on the Drawings.
  - 1 Minimum size conduit: one inch, REFER TO PLANS FOR SIZES.
  - 2 Raceway installation shall be in accordance with Section 26 05 33.
  - 3 Coordinate raceway installations in millwork and other fabricated architectural items with the other portions of the Work.
  - 4 Provide pullwire in each raceway tagged on each end.
  - 5 Raceways shall be terminated with an insulating bushing or a suitable connector with an insulated throat.
- C. Provide telephone and data communications outlet boxes.
  - 6 Provide a one-gang outlet unless noted otherwise.
  - 7 Install outlet box and device ring at each location.
  - 8 Install telephone and data communications outlets at same height specified for convenience outlets unless noted otherwise. Group telephone and data communications outlets with related receptacle outlets unless noted otherwise.
  - 9 Install a blank cover plate on all unused communications outlet boxes.

END OF SECTION

## SECTION 28 31 00 - INTRUSION DETECTION

### PART 1 - GENERAL

#### 1.1 Manufacturer

- A. The manufacturer shall have at least twenty-five (25) years of experience in the role of fire and security control manufacturing, and a proven track record of forward and backward compatibility for a minimum of twenty (20) years for its product's auxiliary devices, including system keypads, annunciation devices, zone expansion modules, and addressable detection devices.
- B. The manufacturer must also manufacture receiving equipment that is compatible with standard dial-up telephone lines and network monitoring equipment that is compatible with a LAN, WAN, and the Internet. The receiving equipment shall be capable of receiving all status and alarm messages generated by the system. The receiving equipment shall be capable of updating the panel operating program and the system date and time.
- C. Intrusion detection/Access control pane(SEC) equipment manufacturer shall be: Digital Monitoring Products, Incorporated (DMP) #XR500N

#### 1.2 Installer

- A. The installing company shall show proof of having regular experience with design, installation, service, and maintenance of manufactured systems for a minimum of the last twelve (12) calendar months from the project start date. Each system installer and service person must provide manufacturer certification of technical training for installation, service, and system maintenance. Certification shall be proven with an official document issued by the manufacturer.
- B. The installing company shall provide a minimum of 8 (eight) verifiable references from its clients where the manufacturer's system has been installed within the last twelve (12) calendar months from the project start date.
- C. The installing company shall furnish and install a complete electrically supervised Command Processor™ Panel, as detailed in this specification. The system shall be inclusive of all necessary function, monitoring, and control capability as detailed herein and on accompanying shop drawings.
- D. The installing company shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Architect of any discrepancy before performing the work. Materials shall be installed in strict compliance with local building codes. All work shall be performed in accordance with Digital Monitoring Products, Inc. instructions.

#### 1.3 Central Reporting Station

- A. The central reporting station contractor must possess an Underwriter's Laboratory (UL) listing as a "Mercantile Police Station" or "Mercantile Burglar Alarm Systems" company. A copy of the listing shall be attached as a part of this bid package.
- B. The actual alarm signal receipt and processing is a significant portion of the scope of work. Third party and/ or contract stations are permitted. UL must list the monitoring station for Protective Signaling Services or Central Reporting Station Signaling Services. A copy of the station UL listing shall be attached as part of this bid package.
- C. The monitoring station must provide openings/ closing activity reports, activity day and time, authorized individual, office name and account number and the system type being monitored. These reports are to be mailed to the user's office at the end of each month. The Office Manager or Contract Administrator may request an additional report if an incident occurs.
- D. The contractor must have a valid Alarm Operator License. A copy of licenses shall be attached as part of this bid package.
- E. The contractor may be required to monitor a portion of the alarm systems by way of the end user data network.
- F. The Contractor shall become familiar with all work details, verify all dimensions in the field, and shall advise the Architect of any discrepancy before performing the work.
- G. The end user shall not incur any central station setup charges by the contractor to receive alarm signals by way of the end user data network.

## **PART2 - SCOPE**

### 2.1 Requirements

- A. Furnish and install a complete Intrusion Detection/ Access Control system (SEC) with the performance criteria detailed in this specification. The system shall be inclusive of all necessary functions, monitoring, and control capability as detailed herein and on accompanying Shop drawings.
- On-site or remote video monitoring
  - Heating, air conditioning, and lighting management
  - Temperature threshold detection and monitoring
  - Humidity threshold detection and monitoring
  - Pressure threshold detection and monitoring
  - Power loss detection and monitoring, generator switching
  - Leak detection and monitoring
  - Carbon Monoxide detection and monitoring
  - Tank level threshold detection and monitoring
- B. This specification document provides the requirements for the installation, programming, and configuration of a complete Command Processor Panel. This system shall include, but not be limited to:
- Control panel
  - System cabinet
  - Power supply
  - Digital Signaling Line Circuits (SLC)
  - Notification Appliance Circuits (NAC)
  - Annunciator/keypad bus
  - Batteries
  - Wiring
  - Conduit
  - Associated peripheral devices
  - Other relevant components and accessories required to furnish and install a complete and operational addressable reporting Life Safety System.

### 2.2 Standards

- A. The system shall be listed as a Power Limited Device and be listed under the standards in the table. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

#### Burglary Listings

- UL 365 Police Connect Burglar
- UL 609 Local Burglar
- UL 1023 Household Burglar Alarm System Units
- UL 1076 Proprietary Burglar
- UL 1610 Central Station Burglar Alarm Units
- UL 1635 Digital Burglar Alarm Communicator System Units

#### Fire Listings

- UL 864 Control Units for Fire Protective Signaling Systems
- UL 985 Household Fire Warning

#### Access Control Listings

- UL 294 Access Control System Units

#### Related Listings

- NFPA 70 National Electric Code (NEC)
- NFPA 72 Local Protective Signaling
- NFPA 72 Remote Station Protective Signaling
- NFPA 72 Proprietary Protective Signaling

- NFPA 72 Household Fire Warning
- U.S. Government Standards/Listings
- Meets DCID 6/9
  - Meets DoD/NIST SCIF Standards

### 2.3 Americans with Disabilities

All indicating and notification appliances shall comply with the Americans with Disabilities Act (ADA) requirements.

## **PART 3 - SUBMITTALS**

### 3.1 General Requirements

The contractor shall submit three (10) complete sets of documentation within thirty (30) calendar days after contract award date. Indicated in the document shall be the manufacturers' names, catalog number, type, size, style, rating, and catalog data sheets for all items proposed to meet these specifications.

### 3.2 Shop Drawings

Shop drawings shall be submitted in accordance with Section 3.0 Submittals and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions.

### 3.3 As-Built Drawings

The contractor shall provide a complete set of as-built drawings for the entire system upon installation completion. These drawings shall include, but not be limited to, the exact locations of all equipment, connections between all equipment, and wiring for all equipment as the system is installed.

### 3.4 Spare Parts Data

After shop drawings are approved, and not later than thirty (30) calendar days prior to the date of beneficial occupancy, a list of spare parts data for each item of specified materials and equipment shall be submitted. The data shall include a complete list of parts and supplies with current unit prices and source of supply. Spare parts shall consist of, but not be limited to, five (5) percent of all initiating and notification appliances with a minimum of one (1) each. All spare parts shall be on site prior to commencement of acceptance testing. Depleted spare parts shall be replaced prior to beneficial occupancy.

### 3.5 Operating Documents

The contractor shall furnish to the architect operating instructions outlining the step-by-step procedures required for system start-up, operation, and shutdown at least thirty (30) calendar days prior to acceptance test. The instructions shall include the manufacturer's name, system model number, service manual, parts list, and a description of all equipment and their basic operating features.

### 3.6 Maintenance Documents

The contractor shall furnish maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides at least 30 calendar days prior to acceptance test.

### 3.7 Performance Test Reports

Upon the installed system completion and testing, test reports shall be submitted in booklet form showing all field tests performed to prove compliance with specified performance criteria.

### 3.8 Warranty

A copy of the manufacturer's warranty for all equipment and materials shall be provided. Warranty shall be for all equipment, materials, installation, and workmanship for a minimum of three (3) years, unless otherwise specified.

## **PART 4 - GENERAL COMPONENT REQUIREMENTS**

### 4.1 Component Enclosure

Housings; power supply enclosures, terminal cabinets, control units, and other component housings, collectively referred to as enclosures shall be so formed and assembled as to be sturdy and rigid. If sheet steel is used in the fabrication of enclosures, it shall be not less than an 18 gauge door with a 20 gauge box frame. Where exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent ready removal. Doors having a latch edge length of less than 24 inches shall be provided with a single lock. Where the hinged door latch edge is 24 inches or more in length, doors shall be provided with three-point latching device with lock; or alternatively with two locks, one located near each end. For SCIF and High Security applications an attack proof enclosure with proper tamper UL listed for use with the XR500/XR500N/XR500E shall be used.

#### 4.2 Electronic Components

- A. All system electronic components shall be solid-state type, mounted on printed circuit boards. Light duty relays and similar switching devices shall be solid-state type or electromechanical.
- B. The panel shall have an over current notification LED that lights when devices connected to the Keypad Bus and LX-Bus(es) draw more current than the panel is rated for. When the over current LED lights, the LX-Bus (es) and Keypad bus are shut down.

#### 4.3 Control Unit

- A. A battery test shall be automatically performed to test the integrity of the standby battery. The test shall disconnect the standby battery from the charging circuit and place a load on the battery. This test shall be performed no more than every 180 seconds.
- B. The control unit shall be capable of operating and supervising notification appliance devices as well as addressable initiating detection devices and an integrated supervised dual line digital communicator.

#### 4.4 Remote Annunciators

- A. The system shall support a maximum of sixteen (16) supervised remote annunciators with the identical capabilities, functions and display layout. Operation of the remote annunciators shall be limited to authorized users by the use of a code or key.
- B. The remote annunciators shall be capable of operating at a maximum wiring distance of 15,000 feet from the control unit on unshielded, non-twisted cable.

#### 4.5 Control Designations

Controls shall be provided to ensure ease of operation of all specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals and indicating devices, input and output connectors, terminals and test points shall be clearly marked or labeled on the hardware to permit quick identification of intended use and location.

#### 4.6 Test Modes

- A. The system shall include a provision that permits testing from any alphanumeric keypad. The test shall include standby battery, alarm bell or siren, and communication to the central station.
- B. The system shall include a provision for an automatic, daily, weekly, thirty (30) day, or up to sixty (60) day communication link test from the control panel installation site to the central station.
- C. The system shall include a provision for displaying the internal system power and wiring conditions. Internal monitors shall include the bell circuit, AC power, battery voltage level, charging voltage, panel box tamper, phone trouble line 1, phone trouble line 2, transmit trouble, and network trouble.

#### 4.7 Serial Interface

The control panel shall be capable of a serial interface to output information to a standard serial printer or serial interface to a communication port on a standard computer. Through control panel programming the system shall include a provision to allow the selection of which reports are to be output.

#### 4.8 Power Supplies

- A. Power supplies for the control unit shall operate from 120 VAC, supplied at the respective protected areas. Standby batteries shall be supplied to power the system in the event of a utility power failure. Batteries shall be sized to provide 105% capacity for eight hours. Standby batteries shall be sealed lead-acid. Power supplies shall be all Solid State.
- B. Controls shall be designed to maintain full battery charge when alternating current is available. Batteries shall be recharged to 85% capacity within 24 hours from battery use. The system shall be automatically transferred to battery power upon loss of alternating current power and return to alternating current power upon restoration. Intrusion alarms shall not be initiated during switch over; a signal shall be initiated upon failure of battery or alternating current power.
- C. Approved power supplies shall meet or exceed the following power supply model specifications:
  - UL Listed DMP 505-12: 12VDC 5 amp with transformer and enclosure.
  - UL Listed DMP 504-24: 24 VDC 4 amps with transformer and enclosure.

#### 4.9 Software

- A. The system shall interface with computer software with the capability to fully program the panel by connecting to the panel through:
  - Direct cable connection interface card
  - Receiver phone line connection
  - Standard phone line connection
  - Ethernet network connection
  - Network connection across the Internet
- B. The system shall interface with computer software capable of locking down all controlled doors.
- C. The system shall interface with computer software capable of monitoring and logging all events.
- D. The system shall interface with computer software capable of exporting reports in the following file formats:
  - Excel spreadsheet (\*.xls)
  - Rich Text (\*.rtf)
  - Windows Metafile (\*.wmf)
  - QuickReport (\*.qrp)
  - Text (\*.txt)
  - Comma-separated (\*.csv)
  - HTML document (\*.htm)
- E. The system shall interface with computer software capable of printing custom, filtered reports including:
  - All Events
  - Zone Action
  - Arming/Disarming
  - Area Late to Close
  - User Code Changes
  - Door Access Granted
  - Door Access Denied
  - Opening/Closing
  - Schedule Changes
  - System Monitors
  - System Events

#### 4.10 Control Panel Capability

The basic control panel shall provide:

- Expansion to a total of at least 10,000 user codes with 99 user profile definitions.
- Sixteen (16) independent door/keypad addresses, each with four zones.
- Twenty (20) Holiday Dates for custom holiday scheduling by area.
- A total door access granted event buffer of at least 10,000 events.
- Anti-passback access control selectable by area and user.
- Four (4) shift schedules per area.
- A total of at least 100 programmable output relay schedules.
- Thirty-two (32) individual reporting areas.
- Built-in bell and telephone line supervision.

The networked control panel shall provide:

- All of the above features.
- Require two-man access code or credentials.
- Support programming to require the same or different access code entered within a programmed delay time of 1 to 15 minutes after disarming before activating a silent ambush alarm.
- Support area programming that disables schedule and time-of-day changes while system is armed so that area can only be disarmed during scheduled times.

The encrypted control panel shall provide:

- All of the basic and network features listed above.
- Built-in Encrypted Alarm Router.
- Certified operation that meets 128 Bit AES Rijndael Encryption communications.
- Certified operation that meets SCIF (Sensitive Compartmented Information Facility) application needs.
- Certified operation that meets NIST (National Institute of Standards and Technology) standards.
- Certification that encrypted panel is capable of meeting DCID 6/9 standards.



- Certification that encrypted panel is capable of meeting UL 2050 standards.

## **PART 5 - FUNCTIONAL DESCRIPTIONS**

### 5.1 System Description

- A. The system areas and zones shall be programmable, and the system shall store, log, display, and transmit specific custom designations for system areas, zones, and user names.
- B. To ensure continued, one-call support, the system shall be constructed of sensing components provided directly by the system manufacturer, such as power supplies, motion detectors, door and window position switches, glass break detectors, or other sensing devices that the manufacturer offers.
- C. The system controller, user interfaces, zone input devices, relay output devices, and the system signal receiving equipment shall be engineered, manufactured, assembled, and must be distributed from a location within the United States of America.
- D. The system shall support user interaction by way of a keypad, web browser, system software, key switch, or radio frequency wireless control, using integrated or auxiliary devices provided by the system manufacturer.
- E. The system shall support controller zone input connections, system keypads, system zone expansion modules, and wireless zone input modules, and must support zone input connections by way of at least two competitive products. The system shall offer a seamless integrated compatibility with hard-wire and/ or wireless zone expansion equipment for at least 200 wireless zones and/ or a maximum of 574 hardwired zones.
- F. The system shall be capable of offering at least five zone expansion buses, each of which can support the connection of up to 15,000 feet of four-wire cable. Zone expansion and keypad data buses that exceed 2,500 feet of cable must include splitter/repeater modules to boost data voltage and maintain data integrity.
- G. The system shall provide a seamless capability to provide a minimum of 500 addressable relays, which can be located at any connection location upon a zone expansion bus.
- H. System relay outputs shall have the capability of being triggered as a result of a command from the user interface, changes in system status, changes in zone status, or by a programmable schedule.
- I. System relay output states shall be programmable for momentary, maintained, pulsed, or must follow the state of an associated system zone input.
- J. The system shall be completely programmable either locally from a keypad or remotely through a standard dial-up, and network connections by way of a LAN, WAN, and/or by way of the Internet.
- K. The control unit shall be completely programmable remotely using remote annunciators, and/ or using upload/download software that communicates using SDLC 300 baud, 2400 baud, or IP Addressed data network. On-site programming from a personal computer shall also be permitted.
- L. The control unit shall be equipped with an anti-reversing circuit breaker to prevent damage due to accidental reversal of battery leads.

### 5.2 Input/Output Capacity

- A. This system shall be capable of monitoring a maximum of 574 individual zones and controlling a maximum of 502 output relays.
- B. The control panel shall have, as an integral part of the assembly, 2 SPDT Form C relays rated at 1 Amp at 30 VDC and four open collector 12 VDC outputs rated at 50mA each. It shall also have the capacity of a maximum of 125 output expander modules with 500 switched ground, open collector outputs, 50mA maximum and 502 auxiliary relays (Form C rated at 1.0 Amp at 30 VDC).
- C. The panel shall also provide 100 programmable output schedules, and include an integral bell alarm circuit providing at least 1.5 Amps of steady, pulsed, or temporal bell output. Output type shall be programmable by zone type. Relays and voltage outputs shall be capable of being independently programmed to turn on and/or off at selected times each day.

### 5.3 User/Authorization Level Capacity

- D. The system shall be capable of operation by 10,000 unique Personal Identification Number (PIN) codes with each code having one (1) of ninety-nine (99) custom user profiles. This allows for limitation of certain functions to authorized users. The operation of all keypads shall be limited to authorized users.

### 5.4 Keypads

- A. The keypads shall be DMP # 7063. The system shall support a maximum of sixteen (16) keypads with alphanumeric display. Each keypad shall be capable of arming and disarming any system area based on a pass code and Proximity key authorization. The keypad alphanumeric display shall provide complete prompt messages during all stages of operation and system programming and display all relevant operating and test data.
- B. Communication between the control panel and all keypads and zone expanders shall be multiplexed over a non-shielded multi-conductor cable, as recommended by the manufacturer. This cable shall also provide the power to all keypads, zone expanders, output expanders, and other power consuming detection devices.
- C. If at any time a keypad does not detect polling, the alphanumeric display shall indicate "SYSTEM TROUBLE". If at any time two devices are programmed for the same address, the alphanumeric keypad shall display "4 WIRE BUS TROUBLE". If at any time a keypad detects polling but not for its particular address, the alphanumeric display shall indicate "NON POLLED ADDR". The system shall display all system troubles at selected keypads with distinct alphanumeric messages.
- D. The keypad shall include self-test diagnostics enabling the installer to test all keypad functions: display test, key test, zone test, LED test, relay test, tone test, and address test.
- E. The keypad shall provide an easy-to-read English text display. The text shall exactly match the text seen in all software reports, keypad displays, and central station reports.
- F. The keypad user interface shall be a simple-to-use, menu-driven help system that is completely user friendly.
- G. The control panel shall support a keypad interface accessible on the World Wide Web in a browser window. The web-accessible keypad interface shall provide at least five (5) programmable hyperlinks for camera access or other use.
- H. The system shall support sub-control keypads with four (4) built-in zones and capable of functioning in the following modes:
  - Panel monitors all four (4) keypad zones independently with a maximum of 125 keypads attached to the control panel
  - Panel assigns one (1) zone to each keypad and monitors all keypad zones as a single zone with a maximum of 500 keypads attached to the control panel
  - Stand-alone mode allowing keypad to operate as a self-contained security system independent of the control panel

5.5 Zone Configuration

- A. A minimum of 4 Class B ungrounded zones shall be available at each keypad or zone expander on the system. The system shall have the capacity for a maximum of sixteen (16) keypads and a maximum of 125 four (4) zone expanders or 500 single zone expanders. It shall also have the capacity of a maximum of 125 supervised relay output expanders. All Class B zones shall be 2-wire, 22 AWG minimum, supervised by an end-of-line (EOL) device and shall be able to detect open and short conditions in excess of 500ms duration.
- B. Each zone shall function in any of the following configurations: Night, Day, Exit, Fire, Supervisory, Emergency, Panic, Auxiliary 1, Auxiliary 2, Fire Verification, Cross Zone, Priority, and Key Switch Arming.
- C. The digital SLCs and the annunciator/keypad bus shall be able to operate at a maximum wiring distance of 2500 feet from the control panel on unshielded, non-twisted cable. This distance may be extended to a total of 15,000 feet when bus repeater modules are installed.
- D. The system shall have the capability to incorporate up to 200 zone expander POPIT™ points.
- E. Each zone shall function in any of the following configurations:

5.6 Communication

- A. The system shall be capable of signaling to two remote monitoring station receivers, four telephone numbers of 32 digits each using two separate switched telephone network lines such that if two unsuccessful attempts are made on the first line to the first number, the system shall make two attempts on first line to the second number. If these two attempts are unsuccessful, the system shall make two further attempts on the first line of the first number. After the tenth unsuccessful attempt, dialing shall stop and the alphanumeric keypad shall display trouble. Should another event occur that requires a report to be transmitted, the dialing process shall be repeated. The system shall have a programmable option to dial a second set of telephone numbers after the first ten attempts using the same sequence.
 

• Night	• Supervisory	• Auxiliary 1	• Cross-
• Day	• Emergency	• Auxiliary 2	Zone
• Exit	• Panic	• Fire	• Priority
• Fire		Verification	Arming

- B. The system shall be capable of communication using the IBM Synchronous Data Link Control format, and at least two other standard industry formats.
- C. The system shall be capable of supporting Network communication with digital dialer backup, existing Ethernet or token ring data networks, satellite communication, fiber optic networks, local area networks, wide area networks, cellular communication, and retail data networks.

#### 5.7 Network Communication

- A. The control panel shall be capable of asynchronous network communication with a retry time between 3 and 15 seconds for a total of one (1) minute. If communication is unsuccessful the control panel shall be capable of attempting backup communication through any of the available communication methods to the same receiver or a backup receiver.
- B. Network communication between the control panel and the receiver shall be in a proprietary communication format.
- C. The control panel shall be capable of supporting Dynamic Host Communication Protocol (DHCP) Internet Protocol (IP) addressing.
- D. Underwriters Laboratories (UL) shall list network communication by the control panel for Grade AA High-Line Security.
- E. The control panel shall be capable of two-way network communication using standard Ethernet 10BaseT in a LAN, WAN, or Internet configuration.
- F. The control panel shall be capable of communication by means of a 128 Bit AES Rijndael Encryption process certified by NIST (National Institute of Standards and Technology) to an SCS-1R receiver with a built-in Encryption Alarm Router.
- G. The control panel shall be capable of meeting DCID 6/9 and UL 2050 standards.

#### 5.8 TCP/IP Network Trapping

- A. The control panel shall be capable of having communication set to Network operation. When a trap is set in Remote Link, the software shall be capable of sending a panel trap message with the panel account number to the iCOM or iCOM-E installed in an SCS-1R receiver.
- B. The receiver iCOM or iCOM-E shall store the trap and monitor the panel for the next message. When the panel sends its next message, the receiver iCOM or iCOM-E shall then send a message to the panel to contact Remote Link at the IP address contained in the original trap message.
- C. The trap message shall be stored in the receiver iCOM or iCOM-E for up to four hours. If the trap message is not sent to the panel within the four-hour window, the panel trap message shall be discarded and a new trap message must be sent from Remote Link.
- D. The user shall be able to view the trap status in the receiver iCOM or iCOM-E in Remote Link using the Trap Query function.

#### 5.9 NAC Circuit Configuration

- A. The system shall be capable of additional Class B NAC circuits utilizing the Model 867 Notification Module. Each module shall be controlled and supervised via the SLC loop and monitor for short circuits, open circuits, and ground faults. The NAC circuits shall monitor for external NAC trouble conditions.
- B. The system shall be capable of providing Class A NAC circuits utilizing the Model 865 Notification Module. Each module shall monitor for short circuits, open circuits, and ground faults. The NAC circuits shall monitor for external NAC trouble conditions and have a manual bell silence switch.

### **PART6- INTEGRATED INTRUSION ALARM AND ACCESS CONTROL OPERATION**

#### 6.1 Access Authority Levels

The system shall be capable of programming access credentials authority levels to check whether the user has access to a specific area and also has the authority to disarm or arm the area. If the user access credential has access and disarm/arm authority the system shall provide the user the option to disarm the area simultaneously upon opening the door, or to open the door and begin an entry delay timer. With the timer option the user then disarms the area using an intrusion control keypad inside the area. If the user only has access authority to the area and the area is in an armed condition, the user is denied access to the area.

#### 6.2 Door Open Schedule Override

The system shall be capable of programming certain area doors to be scheduled to unlock and lock at specific times of the day or night. The lock/unlock function shall be capable of an override option depending upon the area armed/disarmed status. If the area remains in an armed status at the scheduled unlock time the armed status overrides the unlock schedule ensuring the doors remain locked and armed in situations where the business might open late, close early, is affected by inclement weather, or another emergency.

### 6.3 Common Area

The system shall be capable of programming a common area to be armed when the last area in the system is armed and disarmed when the first area in the system is disarmed. To ensure the common area works properly it shall not have any user codes assigned to the common area. The system shall also be capable of programming multiple common areas.

### 6.4 Early Morning Ambush (XR500N and XR500E only)

- A. The system shall be capable of programming an area to require two user codes be entered within a programmed number of minutes to prevent an ambush message from being sent to the Central Station Receiver. If both user codes are not entered within the time an ambush message is sent to the central station receiver.
- B. Both user codes shall have the authority to disarm the specific area and must be entered at the same keypad or reader. The keypad shall not display any indication that the ambush timer is running.
- C. The system shall be capable of programming an output to provide an external indicator that an ambush situation is taking place.

### 6.5 Two-Man Rule (XR500N and XR500E only)

The system shall be capable of programming an area to require two separate user codes be entered in order to disarm and/or allow access to a specific area. Both required codes shall have at least the same or greater authority level. Both required codes shall be entered within 30 seconds or an alarm shall activate.

### 6.6 UL Bank Safe & Vault Operation (XR500N and XR500E only)

The system shall be capable of being programmed to only be disarmed during scheduled times regardless of the authority level of any user code or user profile in the system. The schedule and time and date set for this area shall not be capable of being changed while the area is armed. Zones assigned to Bank Safe & Vault areas shall not be able to be bypassed or force armed.

### 6.7 Panic Button Summary Test (XR500N and XR500E only)

- A. The system shall have the ability to test panic buttons without sending a panic alarm to the Central Station Receiver.
- B. The system shall also have the ability to send panic zone test verification and failure results to the Central Station Receiver.
- C. During the test, each time a panic zone trips, the display number shall increment and the keypad buzzer sound for two seconds.
- D. The number of panic zones tripped shall constantly display until the test ends or no panic zone activity has occurred for 20 minutes.
- E. When the Panic Zone Test ends and a zone failed (did not trip) during the test, the keypad shall be able to display the zone name and number and have the buzzer sounds for one second. Additional zone failed zones shall display when a button is pressed.

## **PART7- FALSE ALARM REDUCTION FEATURES**

The system shall be capable of providing false alarm reduction features, functions, capabilities, or processes that either require alarms be verified or potential alarms be corrected before a system or zone can be placed into an armed state.

### 7.1 Exit Error Alert and Reporting

The panel shall be able to provide an automatic function to prevent a false alarm from occurring if an exit door does not properly close after the system is armed.

### 7.2 Entry and Exit Delay Annunciation

- A. When arming, the system shall provide clear annunciation indicators to the user about the need to exit the premises prior to the exit delay time expiring.
- B. When disarming, the system shall notify the user the need to disarm the system prior to the entry delay time expiring.

### 7.3 Remote Annunciation

The system shall be able to provide entry and exit delay time period notification. This notification can be from DMP keypads, remote annunciators, or bell tests.

#### 7.4 Abort Reporting

The system shall be capable of sending an Abort report to the central station if the system is disarmed while the alarm is still sounding. The Abort report shall be sent *after* the alarm report to notify the central station that an authorized user has cancelled the alarm.

#### 7.5 System Testing

The system shall offer testing features that are simple, quick, and complete and provide the highest measure of safety by ensuring that alarm conditions are detected and communicated to the proper authorities in a timely manner and on a regularly scheduled basis.

#### 7.6 Ambush Code

The system shall offer ambush codes for those dangerous encounters where the user is instructed to either arm or disarm the system under threat of harm. The duress code shall disarm the system without giving local indication of an alarm that might put the user well-being in jeopardy.

#### 7.7 Two-Button Panic Feature

The system shall support DMP keypads that provide the option to use only two-button panic codes. The user shall be required to press and hold two designated keys for approximately two seconds before the system generates a panic alarm.

#### 7.8 Fire Verify Zones

The system shall support Fire Verify zones to help the panel verify the existence of an actual fire condition before it sends an alarm report to the central station. The Fire Verify zone shall require the panel to perform a Sensor Reset whenever a device connected to a Fire Verify zone initiates an alarm. This shall begin a verification period during which the panel waits for a second alarm initiation. If the original zone or any other Fire Verify zone on the panel initiates an alarm within the next 120 seconds, the panel shall recognize this as an actual alarm and send an alarm report to the central station.

#### 7.9 Cross-Zoning Protection

The system shall support cross-zoning as a means of requiring two device trips to occur within a short period of time before sounding an alarm and sending an alarm report to the central station. Supported device trips shall be from one device that trips two times, or from two devices that each trip once.

#### 7.10 Swinger Zone Bypassing

The system shall be capable of automatically bypassing a zone if it goes into an alarm or trouble condition a specified number of times within a one-hour period. The panel shall be able to track the number of times the zone trips while armed and compare that against a programmed number. When that number is reached, the panel shall be able to automatically bypass the zone. The panel shall be capable of resetting the zone when the area to which it is assigned disarms, is manually reset from the keypad or remotely, or remains normal for one hour.

#### 7.11 Recently Armed Report

The system shall be capable sending a System Recently Armed report, along with a zone alarm report, to the central station any time an alarm occurs within five minutes of the system arming. The System Recently Armed report allows the central station operator to follow a "call the subscriber first" procedure instead of immediately dispatching the police to what could be a false alarm.

#### 7.12 Transmit Delay

The system shall be capable of programming the panel to wait up to 60 seconds before sending burglary alarm reports to the central station. If an alarm is accidental, the user shall be able to disarm the system within the programmed Transmit Delay time. An Abort report shall be sent in place of an alarm report after the system disarms. During the alarm, sirens and panel relay outputs shall not be delayed and shall still provide local condition annunciation.

#### 7.13 Call Waiting Cancel

The system shall be capable of being programmed to cancel call waiting any time the panel dials the receiver number to send a report.

### **PART8- PRODUCTS (NOT USED)**

### **PART9- BURGLARY CONTROL SPECIFICATIONS**

#### 9.1 Burglary Standards

The Burglary system shall be listed as a Power Limited Device and be listed under the standards in the table below.

Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

## 9.2 Area System

- A. The system user shall be capable of selectively arming and disarming any one or more of 32 areas within the intrusion detection system based on the user PIN code and/or keypad used. Each of the 574 zones shall be able to be assigned to any of the 32 available areas. The system shall be capable of having up to a sixteen (16) character length name programmed for each area.
- B. The system user shall be capable of assigning an opening and closing schedule to all areas or to each of the 32 areas separately. Each area shall be able to arm or disarm automatically by a schedule. The system shall have the capacity for common areas that automatically disarm when any other area disarms and that automatically arm when all others areas arm.
- C. The networked system shall have the ability to comply with Bank Safe & Vault application. The networked system shall also have the ability to use a two-man rule for disarming or allowing door access to an area. The system shall have the ability to operate a Common Area application.

## 9.3 Zones

The system shall have a minimum of eight (8) grounded burglary zones available from the control panel.

## 9.4 Burglary Equipment

Burglary detection equipment shall communicate to the system by way of the control panel loop expansion bus or 900MHz receiver. The detection equipment shall have a three (3) year warranty and meet or exceed features offered in the products listed in Section 9.0 of this document.

### Burglary Listings

- UL 365 Police Connect Burglar
- UL 609 Local Burglar
- UL 1023 Household Burglar Alarm System Units
- UL 1076 Proprietary Burglar
- UL 1610 Central Station Burglar Alarm Units
- UL 1635 Digital Burglar Alarm Communicator System Units

### F. Additional Listings

- NFPA 72 Local Protective Signaling
- NFPA 72 Remote Station Protective Signaling
- NFPA 72 Proprietary Protective Signaling
- A. U.S. Government Standards
  - Meets DCID 6/9
  - Meets DoD/NIST SCIF Standards
    - Output Expansion Module - DMP Models 710, 716
    - Graphic Annunciator Module - DMP Model 717

### **PART10- ACCESS CONTROL SPECIFICATIONS – N/A**

### **PART11-COMPILED DETECTION EQUIPMENT LISTING**

#### 11.1 Hard-wired

Hard-wired detection equipment shall communicate to the system by way of the control panel loop expansion bus. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:

- Motion Detector – equal to #C&K 907(hallways) and #C&K 706(classrooms)
- Door Contact – DMP Model SD70 (concealed applications – requires DMP zone expander)
- Bus Splitter/Repeater Module – DMP Model 710
- Door Contact – DMP Model SM20WG (surface applications – requires DMP zone expander)

## 11.3 Power Supplies and Transformers

Power supply, transformer, and battery devices shall maintain system operation. The batteries shall be checked and replaced every three to five years. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:

- Power Supply – DMP Model 504-24LX, 115 VAC, 24 VDC
- Power Supply – DMP Model 505-12, 115 VAC, 12 VDC
- Power Supply – DMP Model 505-12LX, 115 VAC, 12 VDC
- Power Supply – DMP Model 508, 115 VAC, 12 or 24 VDC

- Transformer - DMP Model 326, 16 VAC 50 VA, Wire-in
- Transformer - DMP Model 327, 16.5 VAC 50 VA, Plug-in
- Transformer - DMP Model 322, 16.5 VAC 56 VA, Wire-in

## **PART12- INSTALLATION**

### 12.1 System Component Installation

- A. When used in NFPA 72 compliant installations, the Intrusion Detection/ Access Control shall be on an electrical circuit dedicated branch in accordance with the National Electrical Code (NEC) and the local authority having jurisdiction (AHJ). This circuit shall be available only to authorized personnel and shall be clearly labeled "Security Alarm CIRCUIT CONTROL".
- B. Materials shall be installed in strict compliance with all local, state, county, province, district, federal and other applicable building, safety, and fire standards, laws, codes, regulations, and guidelines including, but not limited to, all appendices and amendments and the requirements of the local authority having jurisdiction (AHJ).
- C. All wiring from all devices shall be non-spliced home runs.
- D. All cables shall be plenum rated.
- E. All conductors from expanders shall be home runs to control panel separately and shall be non spliced.
- F. All conductors terminating at zone splice box shall be identified as per detail device labeling.
- G. All zone splice boxes shall be located per owner's preference.
- H. All 120vac shall be provided by contractor to all power supply and panel locations shown or not shown on plans.
- I. Install siren in each inside hallway and one outdoor (weather proof).
- J. Zone expanders and power supplies shall be installed in each electrical room.

END OF SECTION

## SECTION 28 46 21.11- ADDRESSABLE FIRE ALARM SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification Sections apply to Work covered by this Section.
- B. Comply with applicable sections in division 26. Refer to other Sections for coordination of the Work.

#### 1.2 SCOPE OF WORK

- A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing additional and new devices for new building.
  - 1. Fire alarm control panel
  - 2. Remote Annunciator
  - 3. Addressable or conventional manual fire alarm stations.
  - 4. Addressable analog and conventional area smoke detectors.
  - 5. Conventional beam detectors.
  - 6. Addressable analog and conventional duct smoke detectors.
  - 7. Addressable analog and conventional heat detectors.
  - 8. Sprinkler water flow alarm switches.
  - 9. Audible notification appliances; bells, horns, chimes.
  - 10. Visual notification appliances; strobes.
  - 11. Central station alarm connection control.
  - 12. Air handling systems shutdown control.
  - 13. Magnetic door holder release.
  - 14. Dry pipe sprinkler release valve/deluge valve control.
  - 15. Sprinkler supervisory switches and tamper switch supervision.
  - 16. Dry pipe sprinkler release valve/deluge valve supervision.
  - 17. Battery standby.
  - 18. System shall activate the overhead gates. Provide all accessories for an active system.

#### 1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with other Sections for products specified under PART 2 - PRODUCTS. Shop drawings shall be generated by the Fire Alarm Contractor without the Engineers plans.
- B. The submittal data shall include, but not necessarily be limited to, the following:
  - 1. Complete bill of material indicating quantity, part numbers and brief description.
  - 2. Data sheets for all products. If multiple models are shown on the same data sheet, highlight the specific model used.
  - 3. Provide drawing with all devices.

#### 1.4 REFERENCE STANDARDS

- A. The fire alarm system devices specified herein shall be designed, manufactured, installed and tested according to the latest version of the following standards:

##### 1 National Fire Protection Association Standards

- 1. NFPA 70 - National Electric Code (NEC), Articles 725 & 760.
- 2. NFPA 71 - Central Station Signaling Systems
- 3. NFPA 72 - National Fire Alarm Code (NFAC)
- 4. NFPA 92A - Smoke Control Systems
- 5. NFPA 101 - Life Safety Code
- 6. Underwriters Laboratories, Inc.
- 7. UL 38 - Manually Activated Signaling Boxes
- 8. UL 228 - Door Holders for Fire Protective Signaling Systems
- 9. UL 268 - Smoke Detectors for Fire Protective Signaling Systems
- 10. UL268A - Smoke Detectors for Duct Applications
- 11. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems
- 12. UL 464 - Audible Signaling Appliances
- 13. UL 864/UOJZ/APOU - Control Units for Fire Protective Signaling Systems
- 14. UL 1481 - Power Supplies for Fire Protective Signaling Systems
- 15. UL 1638 - Visual Signaling Appliances



16. UL 1711 - Amplifiers for Fire Protective Signaling Systems
17. UL 1971 - Standard for Fire Protective Signaling Systems
18. Americans with Disabilities Act (ADA)
19. Local and State Building Codes
20. Local Authorities Having Jurisdiction (LAHJ)

#### 1.5 QUALITY ASSURANCE

- A. The fire alarm system devices shall be listed and labeled by Underwriters Laboratories, Inc. for use in fire protective signaling system.
- B. The Installing Contractor shall be factory authorized and trained and shall be NICET certified in the sub-field of Fire Alarm Systems, for the engineering and technical installation and supervision of the system. This certification shall be Level III for engineering and Level II for technical installation and supervision. Proof of certification shall be provided. All work shall be performed by skilled technicians, under the supervision and direction of the designated NICET engineering technician, all of whom shall be properly trained and qualified for the work.
- C. The fire alarm contractor shall not sub out portion of the work. The fire alarm shall be responsible to complete the job.
- D. Submission to Authority Having Jurisdiction: Submit copies of State Certificate as required by State Fire Marshall. Provide copy with operating and maintenance manual.

#### 1.6 QUALIFICATIONS

1. The fire alarm contractor, as a business entity, shall be an authorized and designated representative of the equipment manufacturer and shall have been actively engaged in the business of selling, installation and servicing fire alarm systems for a period of at least (5) years prior to the bid date.
2. The fire alarm contractor shall have an office within the Rio Grande Valley with trained technicians who are qualified to manage the installation, to be responsible that the system is installed as submitted, to conduct system start-up, to instruct the project coordinators representatives and local authorities in the proper operation of the system, and to provide service throughout the warranty period. 3. The fire alarm contractor SHALL NOT HAVE any grievances or complaints on record regarding workmanship, code compliance, or service response with either the project coordinator, Architect, Engineer, Owner or the State Fire Marshals office. A contractor that has any prior finding(s) of a Fire Alarm license violation or has any litigation in process with the State Fire Marshal is unacceptable.
3. The fire alarm contractor shall be an active installer on the approved manufacturer for a minimum of 5 years.

#### 1.7 WARRANTY

1. Warranty of all control equipment, sensors, I/O modules and all other peripherals and of materials, installation and workmanship shall be for one (1) year from date of acceptance.
2. The Contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

- A. Silent Knight

#### 2.2 CIRCUITING GUIDELINES

- B. Each addressable analog loop shall be circuited as shown on the drawings but device loading in not to exceed 80% of loop capacity in order to leave for space for future devices. The loop shall have Class A operation. When it is necessary to interface conventional initiating devices provide intelligent input modules to supervise Class A zone wiring. The audio system components shall be an integral part of the fire alarm system control panel.
- C. Audio Amplifiers
  1. Each audio power amplifier shall have integral audio signal de-multiplexers, allowing the amplifier to select any digitized audio channels. The channel selection shall be directed by the system software. Multiple and different audio signals shall be able to be broadcast simultaneously from the same system network node.
  2. Each amplifier output shall include a dedicated, supervised speaker circuit which is suitable for connection of emergency speaker appliances. Each amplifier shall also include a notification appliance circuit for connection of visual (strobe) appliances. This circuit shall be fully programmable and it shall be possible to define the circuit for the support of audible, visible, or ancillary devices.
  3. Standby audio amplifiers shall be provided that automatically sense the failure of a primary amplifier, and automatically program themselves to select and de-multiplex the same audio information channel of the failed primary amplifier, and fully replace the function of the failed amplifier.
  4. In the event of a total loss of audio data communications, all amplifiers will default to the local "EVAC" tone generator channel. If the local panel has an alarm condition, then all amplifiers will sound the EVAC signal on their connected speaker circuits.

5. In the event of a loss of the fully digitized, multiplexed audio riser, the audio amplifiers shall automatically default to an internally generated alarm tone.
6. Audio amplifiers shall automatically detect a short circuit condition on the connected speaker circuit wiring, and shall inhibit itself from driving into that short circuit condition.

### 2.3 DETECTORS

#### D. General

1. Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters.
2. Detectors shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total loop response time for detectors shall be 0.5 seconds.
3. Detectors shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. Both LEDs on steady shall indicate alarm-standalone mode status. Both LEDs shall be visible through a full 360 degree viewing angle.
4. Detectors shall be capable of identifying diagnostic codes to be used for system maintenance. The diagnostic codes shall be stored at the detector.
5. Detectors shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each detector shall be individually programmable to operate at various sensibility settings.
6. The detector microprocessor shall contain an environmental compensation algorithm which identifies and sets ambient "environmental thresholds." The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminants as well as detector aging. The process shall employ digital compensation to adapt the detector to both long term and short term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the "learned" base line sensitivity. The base line sensitivity information shall be permanently stored at the detector.
7. The detector and loop controller shall provide increased reliability and inherent survivability through intelligent conventional operation. The device shall automatically change to stand alone, conventional device operation in the event of a loop controller polling communications failure. In the standalone detector mode, the detector shall continue to operate using sensitivity and environmental compensation information, stored in its microprocessor at the time of communications failure. The loop controller shall monitor the loop and activate a loop alarm if a detector reaches its alarm sensitivity threshold.
8. Detectors shall be capable of automatic electronic addressing and/or custom addressing. Devices using DIP or rotary switches for addressing, either in the base or on the detector shall not be acceptable.
9. Detectors shall be suitable for operation in the following environment:
  1. Temperature: 32°F to 120°F
  2. Humidity: 0-93% RH, non-condensing
  3. Elevation: Up to 6,000 ft.
10. Photoelectric Smoke Detectors
  - ii. Addressable intelligent photoelectric smoke detectors shall be provided as indicated on the Drawings. The detector shall use a light scattering type photo electric smoke sensor to sense changes in air samples from its surroundings. An integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. The detector shall utilize digital filters to remove signal patterns that are not typical of fires. Each detector shall have twin red/green status LEDs. The red LED shall indicate alarm condition and green LED shall indicate normal.
  - iii. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature and humidity. The information shall be stored in the integral processor and transferred to the loop controller.
  - iv. Detector shall be programmable for different sensitivity during day and night periods.
  - v. The detector shall be suitable for direct insertion into air ducts up to 3 ft. high and 3 ft. wide with air velocities up to 5,000 ft/min.
  - vi. The detector shall be rated for ceiling installation at a minimum of 30 foot centers.

- vii. The percent smoke obscuration per foot alarm setpoint for the detector shall be field selectable to various sensitive settings ranging from 1.0% to 3.5%.
  - b. Detector Mounting Bases
    - i. Detector mounting bases shall be suitable for mounting on a standard 4" square electrical outlet box. The base shall contain no electronics, support all detector types and have the following minimum requirements:
      - 1. Removal of the respective detector shall not affect communications with other detectors.
      - 2. Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.
      - 3. Capable of supporting a remote LED indicator and test station. Provide remote LED indicators and test stations as indicated on the Drawings.
    - c. Detector Mounting Plates
      - i. Provide detector mounting plate assemblies to facilitate mounting detectors for direct insertion into low velocity ductwork. The mounting plate shall be code gauge steel with corrosion resistant red enamel finish.
    - d. Duct Smoke Detectors
      - i. Air duct mounted smoke detectors shall be provided in the air supply stream of all central air handling equipment above 2000 cfm, i.e. Provide all necessary interface wiring for proper system operation.
      - ii. The duct smoke detector shall be UL listed per UL 268A specifically for use in air handling systems. The detector shall operate at velocities of 300-4000 ft./min. The detector housing shall be equipped with an integral mounting base. It shall be capable of local testing via magnetic switch or remote testing using a remote test station. The duct detector housing shall incorporate an airtight smoke chamber in compliance with UL 268A. The housing shall be capable of mounting to either rectangular or round ducts without adaptor brackets. An integral filter system shall be included to reduce dust and residue effects on detector housing, thereby reducing maintenance and servicing. Sampling tubes shall be easily installed after the housing is mounted to the duct by passing through the duct housing. The housing shall have a red enamel finish.
      - iii. For each duct smoke detector provide a remote LED indicator and test station to be mounted in a location indicated on the Drawings and approved by the local authority having jurisdiction.
      - iv. F. Beam Type Smoke Detectors
        - 1. Provide projected beam type smoke detectors. Then beam detectors shall be four wire 24 Vdc and powered from the control panel 4 wire smoke power source. This unit shall consist of a separate transmitter and receiver capable of being powered separately or together. This unit shall operate in either a short range of 30 to 100 ft. (9.14 to 30.4m) or a long range of 100 to 300 ft. (30.4 to 91.4m). The detector shall feature a bank of four alignment LEDs on both the receiver and transmitter that are used to ensure proper alignment without the use of special tools. The beam detector shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on lenses. Ceiling or mount as shown on the plans. Testing shall be carried out using calibrated test filters. Provide an activated remote test station>.
- b) SYSTEM MODULES
  - a. Addressable intelligent modules shall support supervised Class A circuits. The modules shall be multi-function capable of field programming. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
    - i. Temperature: 32°F to 120°F (0°C to 49°C)
    - ii. Humidity: 0-93% RH, non-condensing
  - b. Single Input Module
    - i. Addressable intelligent single input modules shall be provided as required for the system configuration. The single input module shall provide one (1) supervised Class A input circuit. The module shall be suitable for mounting on 4" square electrical box. The single input module shall support the following input circuit types:
      - 1. Normally-Open Alarm Latching (Manual Stations, Smoke Detectors, etc.)
      - 2. Normally-Open Alarm Delayed Latching (Waterflow Switches)
      - 3. Normally-Open Active Non-Latching (Monitors, Fans, Dampers, Doors, etc.)
      - 4. Normally-Open Active Latching (Supervisory, Tamper Switches)
  - c. Dual Input Module
    - 1. Addressable intelligent dual input modules shall be provided as required for the system configuration. The dual input module shall provide two (2) supervised CLASS A input circuits. The module shall be suitable for mounting on a standard 4" square electrical box. The dual input module shall support the following input circuit types:
      - 2. Normally-Open Alarm Latching (Manual Stations, Smoke Detectors, etc.)

3. Normally-Open Alarm Delayed Latching (Waterflow Switches)
  4. Normally-Open Active Non-Latching (Monitors, Fans, Dampers, Doors, etc.)
  5. Normally-Open Active Latching (Supervisory, Tamper Switches)
- d. Monitor Module
1. Addressable intelligent monitor modules shall be provided as required for the system configuration. The monitor module shall support one (1) supervised Class A normally-open active non-latching monitor circuit. The monitor module shall be suitable for mounting on a standard 4" square electrical box.
- e. Waterflow/Tamper Module
1. Addressable intelligent waterflow/tamper modules shall be provided as required for the system configuration. The waterflow/tamper module shall support two (2) supervised Class A input circuits. Channel A shall support a normally-open alarm delayed latching waterflow switch circuit. Channel B shall support a normally-open active latching tamper switch. The waterflow/tamper module shall be suitable for mounting on a standard 4" square electrical box.
- f. Single Input Signal Module
1. Addressable intelligent single input signal modules shall be provided as required for the system configuration. The single input signal module shall provide one (1) supervised Class A output circuit capable of supporting the operation of an audible/ visual signal power selector and a telephone power selector with ring tone for fire fighter's telephone. The module shall be suitable for mounting on a standard 4" square electrical box.
- g. Dual Input Signal Module
1. Addressable intelligent dual input signal modules shall be provided as required for the system configuration. The dual input signal module shall provide a means to selectively connect one of two (2) signaling circuits to one (1) supervised output circuit. The dual input signal modules shall be capable of supporting the operation of an audible/visual signal power selector. The module shall be suitable for mounting on a standard 4" square electrical box.
- h. Control Relay Module
1. Addressable intelligent control relay modules shall be provided as required for the system configuration. The control relay module shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on a standard 4" square electrical box.
- i. Universal Class A Module
- i. Addressable intelligent class A modules shall be provided as required for the system configuration. The universal class A module shall be capable of numerous operations. The module shall be suitable for mounting on a standard 4" square electrical box. The universal class A module shall support the following circuit types:
1. Two (2) supervised Class A Normally-Open Alarm Latching.
  2. Two (2) supervised Class A Normally-Open Alarm Delayed Latching.
  3. Two (2) supervised Class A Normally-Open Active Non-Latching.
  4. Two (2) supervised Class A Normally-Open Active Latching.
  5. One (1) form "C" dry relay contact rated at 2 amps @ 24 Vdc.
  6. One (1) supervised Class A Normally-Open Alarm Latching.
  7. One (1) supervised Class A Normally-Open Alarm Delayed Latching.
  8. One (1) supervised Class A Normally-Open Active Non-Latching.
  9. One (1) supervised Class A Normally-Open Active Latching.
  10. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.
  11. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.
  12. One (1) supervised Class A 2-wire Smoke Alarm Verified
  13. One (1) supervised Class A 2-wire Smoke Alarm Verified
  14. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.
  15. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.
- c) MANUAL PULL STATIONS
- a. Addressable intelligent dual action, non-break glass type, key reset, semi-flush mounted manual pull stations shall be provided as indicated on the Drawings. The stations shall be of Lexan construction, finished in red with white molded raised letters "PULL IN CASE OF FIRE". The station shall be suitable for mounting on a standard 4" square electrical box. The station shall have a minimum of 2 diagnostic LEDs mounted on their integral, factory assembled single or two stage input module. A green LED shall flash to confirm

communication with the loop controller. A red LED shall flash to display alarm status. The station shall be capable of storing diagnostic codes which can be retrieved for troubleshooting assistance. Input circuit wiring shall be supervised for open and ground faults. The fire alarm pull station shall be suitable for operation in the following environment:

- i. Temperature: 32°F to 120°F (0°C to 49°C)
- ii. Humidity: 0-93% RH, non-condensing

d) NOTIFICATION APPLIANCES

a. General

- i. All appliances shall be UL listed for Fire Protective Service. All audible appliances, visual appliances and combination audible/visual appliances shall be capable of providing the equivalent facilitation which is allowed under the Americans with Disabilities Act Accesabilities Guidelines (ADA/AG), and shall be UL 1971, and ULC S526 listed.
- b. Audible Only Notification Appliances
  - i. Audible appliances shall be a mylar cone type speaker. Paper type cones are not acceptable. The rear of the speaker shall be completely sealed protecting the cone during and after installation. Speakers shall provide power taps at 1/4w, 1/2w, 1w, and 2w. Speakers shall provide UL confirmed 90 dBA sound output at 2w.
  - ii. Audible appliances shall be provided with in/out wiring terminals.
  - iii. Audible appliances shall be flush for ceiling mounted and flush/semi-flush for wall mounted as indicated on the Drawings. They shall have a white faceplate for ceiling mounting and red faceplate for wall mounting. They shall mount to a standard 4" square electrical box.
- c. Visual Only Notification Appliances
  - i. Visual appliances shall be a self-synchronized strobe. The strobe flashtube shall be enclosed in a rugged lexan lens with solid state circuitry. The strobe shall provide 15, 15/75, 30, 60 and 110 candela synchronized flash outputs. The strobe intensity selection shall be based on the installed location within the building.
  - ii. Visual appliances shall be provided with in/out field wiring terminals.
  - iii. Visual appliances shall have lens markings oriented for wall mounting where indicated on the Drawings. They shall have a red faceplate for flush/semi-flush wall mounting. They shall mount to a standard 4" square electrical outlet box.
- d. Combination Audible/Visual Notification Appliances
  - i. Combination appliances shall be a combination of the audible and visual appliances specified previously. They shall have a red faceplate for flush/semi-flush wall mounting.
  - ii. The majority, if not all, of the notification appliances shall be combination devices such that the visual and audible requirements of ADA shall be complied with. Visual notification appliances shall be located in all areas of common use, i.e. lobbies, hallways, restrooms, meeting/conference/assembly areas, break rooms, copy/fax/mail rooms, etc. Audible notification appliances shall produce a sound that exceeds the prevailing equivalent sound level in the room or space by at least 15dba or exceeds any maximum sound level with a duration of 60 seconds by 5dba, whichever is louder. Sound levels for alarm signals shall not exceed 120 dbA. It is the intent of the Drawings to show all devices that are required. The fire alarm system vendor/bidder shall provide all appliances shown and/or required by these specifications but it others are anticipated to be required the vendor/bidder shall qualify the provisions for the system making note of the additional cost for the anticipated additional requirements.

e) ANCILLARY DEVICES

a. Remote Relays

i. Multi-Voltage Control Relays

- 1. Remote control relays shall be provided as required for the system configuration for connection to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT or DPDT, as required, and rated for 10 amperes at 115 Vac. A single relay may be energized from a voltage source of 12 Vdc, 12 Vac, 24 Vdc, 24 Vac, 115 Vac, or 230 Vac, as required. A red LED shall indicate the relay is energized. A metal enclosure shall be provided.

ii. Manual Override Control Relays

- 1. Remote control relays with a manual override shall be provided as required for the system configuration for connection to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amperes at 115 Vac or 24 Vdc. A single relay may be energized from a voltage source of 24 Vdc or 24 Vac. A red LED shall indicate the relay is energized.

iii. Heavy Duty Power Relays

- 1. Remote control relays shall be provided as required for the system configuration for connection to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be DPDT and rated for 30 amperes at 300 Vac or 2 HP motor load. A single relay may be energized

- from a voltage source of 24 Vac, 115 Vac, as required. A metal enclosure shall be provided.
- f) **ELECTROMAGNETIC DOOR HOLDERS**
- a. Provide single or double door, floor or wall mounted electromagnetic door holder/release devices as indicated on the Drawings. The devices shall be rated for 24V ac/dc input. The devices shall be brushed zinc finished.
- g) **FIRE ALARM CABLE**
- a. The fire alarm cable shall plenum rated and be UL listed and suitable for use as power limited fire protective signaling circuit cable in accordance with National Electric Code Article 760 (Fire Alarm Systems) and Article 725 (Class 1, Class 2 and Class 3 - Remote Control, Signaling and Power-Limited Circuits).
  - b. Cable Construction
    - i. Conductors shall be solid, soft annealed, uncoated copper.
    - ii. Insulation shall be 300 volt, 105°C polyvinylchloride.
    - iii. Two conductor, non-shielded cables shall be parallel; shielded and three or more conductors shall be cabled round.
    - iv. Shielding shall be mylar backed aluminum foil, helically wrapped to provide 100% coverage. A suitable copper drain wire shall be provided with shielded cables.
    - v. Jacket shall be red, 105°C polyvinylchloride, rated 300 volt.
    - vi. Cable shall be plenum rated when installed in air handling plenums.
  - c. In general, non-shielded cable is acceptable for use throughout except on voice circuits. All voice circuits shall utilize shielded, twisted pair cable.

### PART 3 - EXECUTION

#### 3.1 APPROVALS

- A. Complete fire alarm system drawings shall be issued to the Local Authority Having Jurisdiction for approval prior to the installation of the fire alarm system.

#### 3.2 INSTALLATION

- A. Installation of the Fire Alarm System shall be in strict compliance with manufacturers recommendations. The entire system shall be installed in accordance with approved manufacturers manuals and wiring diagrams and as approved by the Local Authority Having Jurisdiction.
- B. Fire alarm cable shall be installed in conduit in areas of exposed structure and within inaccessible ceilings. Conduit shall also be provided from outlet boxes within walls stubbed up to accessible ceilings. Provide end bushings on conduit stub-ups. Cable only is acceptable in accessible ceilings.
- C. All conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation shall be included as part of the system. All junction box blank coverplates shall be labeled with a red "F.A." for identification purposes.
- D. All wiring shall be color coded throughout.
- E. The system shall be installed and fully tested under the supervision of trained manufacturer's representatives. The system shall be demonstrated to perform all the functions as specified.

END OF SECTION

## SECTION 31 10 00 — SITE CLEARING, GRADING AND FILLING

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. Clearing, filling and grading of the affected areas of the site.
- B. Top Soil removal and reuse.
- C. Disposal of debris and surplus materials.
- D. Protection of trees and vegetation to remain, coordinate with the Architect.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS:

- A. Excavation and backfilling for underground site utilities.
- B. Paving and sidewalks.
- C. Site drainage systems.

#### 1.4 QUALITY ASSURANCE

- A. Testing Laboratory Services: Installed materials shall meet specified requirements as determined by the Owner's Testing Laboratory.
- B. Proposed sitework contractor shall be able to provide documentation that he has a minimum of three years of satisfactory experience in the performance of similar operations.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Existing top soil to be stockpiled and reused.
- B. Existing and off-site earth fill as required.
- C. TOPSOIL:
  - 1. Rich sandy loam, low in silt, free of trash, rocks, debris and other foreign materials.
  - 2. Topsoil stripped at the site and stockpiled may be used if material meets the above requirements and quantities are sufficient to meet all topsoil needs of the site. Otherwise topsoil meeting specified requirements and approved by the testing laboratory shall be provided from an approved off site source.
- D. FERTILIZER AND GRASSING: Provide grass to replace any disturbed areas during regarding.

### PART 3 - EXECUTION

#### 3.1 PROTECTION OF EXISTING TREES AND VEGETATION

- A. GENERAL: In addition to any temporary construction fencing provided under Section 01 50 00 Temporary Facilities, provide temporary chain link fencing around existing shrubs, grasses, ground cover and trees indicated to remain. Locate fencing around drip lines of individual trees or groups of trees.
- B. REPLACEMENT: Replace damaged existing trees and vegetation indicated to remain with materials of like kind, size and maturity as approved by the architect. Follow supplier's recommended procedures of planting.

#### 3.2 TOPSOIL REMOVAL AND EXCAVATION

- A. Strip topsoil to a depth of 4" to 6" under all new site paving, sidewalks, within new building lines and at all site areas which will receive earth fill for grading adjustments.
- B. Temporarily store removed topsoil at an on-site location designated by the Architect. Stored topsoil shall be kept free of trash and construction debris.
- C. Remove additional existing soil as required to achieve any finish paving grades which may be at or near natural grade elevation.

#### 3.3 EXCAVATING, GRADING AND FILLING

- A. GRADE ELEVATIONS: Establish finish grades as indicated on the drawings. Set and maintain grade stakes.
- B. ROUGH GRADING:
  - 1. Provide clean earth fill meeting specified requirements from off-site should additional earth fill be required.
  - 2. Provide temporary and permanent drainage swales, pumps, gutters and trenches necessary to dry existing soil and carry off water during construction. As indicated on drawings shape the site around structures to drain away from the building(s) at all times. Do not allow water to stand around trees scheduled to remain.



3. All site fill at unpaved and typical sidewalks areas shall be thoroughly compacted in lifts as specified below. Each layer and subgrade shall be wetted or dried as required to achieve optimum moisture content and then compacted to minimum ninety (90%) percent Proctor density per ASTM D1557. The subgrade shall be thoroughly and completely scarified before wetting and rolling.

C. COMPACTION: Compaction may be obtained by any of the following methods:

1. By sheepsfoot rollers having a unit weight on the contact feet of not less than 300 pounds per square inch with the soil being compacted in layers not exceeding 8" in depth (loose measurement).
2. By pneumatic tired rollers having a minimum compression of 325 pounds per inch of width of tire tread, with the soil being compacted in layers not exceeding 8" in depth (loose measurement).
3. For those portions of fill which cannot be reached with the sheepsfoot roller, such as corners and areas adjacent to columns, beams, etc., mechanical tampers shall be employed to obtain specified compaction.

D. EXISTING UTILITIES:

1. Arrange with utility companies for removal or relocation of any existing utilities.
2. Remove abandoned utilities up to the property line and provide permanent watertight cap.
3. If unknown or uncharted utilities are encountered during excavation, promptly notify the Architect before proceeding. Damage to existing utilities by continuing work without notifying the Architect shall be repaired by the Contractor at no additional cost to the Owner.

E. FINISH GRADING;

1. After rough grading and proof rolling operations are complete, install 2" of topsoil over unpaved open area (within the limits of grading) and fine grade to finish contours and make ready to receive grass planting (whether or not grass planting is required under this contract).
2. Open areas shall be raked smooth and left free of clumps, trash, debris and vegetation. Finish grading shall be uniform in planarity, meeting elevations and slopes as indicated on the drawings, and as required to ensure proper drainage.

3.4 DISPOSAL:

1. Adhere to Federal, State, County and local regulations regarding disposal of removed trees, shrubs, vegetation, soil, and rubble. It is the sole responsibility of the Contractor to determine the regulations regarding on-site burning of removed trees and vegetation.
2. Upon completion of fine grading operations, any excess soil shall be removed from the site, stockpiled at the site, or relocated to any property controlled by the Owner within five miles of the site. The above options shall be as determined by the Owner at no additional cost to the Owner.

END OF SECTION

## SECTION 31 31 16 - TERMITE CONTROL

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

#### 1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data and product certificates signed by manufacturer certifying that products used comply with U.S. EPA regulations for termiticides. Include application instructions and EPA-Registered Label.
- B. Engage a licensed professional pest control operator to apply termite control solution.

### PART 2 - PRODUCTS

#### 2.1 TERMITICIDES

- A. Provide an EPA-registered termiticide (5 year) complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Prepare surfaces and apply treatment at rates and concentrations recommended in manufacturer's written instructions.
- B. Apply termite control to the following:
  - 1. At foundations. (Piers, mid-span supports)
  - 2. Under sub-floors and flooring materials.

3. Under basement floor slabs.
  4. At hollow masonry.
  5. At expansion and control joints and slab penetrations.
  6. At crawlspaces; treat soil under and adjacent to foundation supports. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment.
- C. Post warning signs in areas of application.
- D. Reapply soil termiticide treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

END OF SECTION

## SECTION 32 13 13 — CONCRETE PAVING, CURBS AND SIDEWALK

### PART 1 - GENERAL

#### 1.1 COORDINATION

- A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

#### 1.2 WORK INCLUDED

- A. All site concrete work, including sidewalks, paving, equipment slabs, ramps, and other miscellaneous concrete.
- B. All form work.
- C. Reinforcing steel.
- D. Installation of sleeves provided by plumbing, heating, and electrical contractors for work under site concrete. Sleeves for irrigation system.

#### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Testing Laboratory services.
- B. Excavation and fill.
- C. Soil stabilization.

#### 1.4 DRAWING REFERENCES: See drawings for reinforcing sizes and placement.

#### 1.5 SUBMITTALS

- A. DESIGN MIX: Submit six (6) copies directly to the Owners Testing Laboratory the proposed concrete mix for concrete paving and sidewalks. Include cement brand and type, aggregate identification, admixtures, proportions and anticipated strengths.

- B. PLASTIC CHAIR SUPPORT: Submit manufacturer's literature indicating dimensions, configuration, and performance data. Submit sample for approval by the Architect.
- C. JOINT FORMS: Submit manufacturer's literature indicating dimensions, configuration, reinforcing and accessories related to load transfer units.
- D. ADMIXTURES: Submit manufacturer's literature indicating composition and mix proportions.
- E. CURING COMPOUND: Submit manufacturer's literature indicating composition and recommended application procedures.
- F. JOINT SEALANT: Submit manufacturer's literature indicating sealant type(s), performance, recommended application procedures, and recommending open or closed cell backer material for the application.
- G. DELIVERY TICKETS: Furnish copies of delivery tickets for each load of concrete delivered to the site. Provide items of information as follows:
  - 1. Ambient temperature.
  - 2. Any modifications and dispositions of the load.
  - 3. Driver's identification.
  - 4. Identification of placement location at jobsite.
  - 5. Ingredients by weight.
  - 6. Number of cubic yards.
  - 7. Time emptied.
  - 8. Time loaded.
- H. TEST REPORTS: Arrange for the Owner's Testing Laboratory to submit reports to the Owner, Architect and Contractor indicating compressive strength, aggregate type and slump for samples taken at the site.

#### 1.6 SAMPLES

- A. Plastic chair support.
- B. Minimum 36" x 36" finish samples at the job site for Architects approval. Provide sample for each type of finish (smooth, light broom, medium broom, etc.) and each type of joint.

#### 1.7 WARRANTY

- A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

#### 1.8 QUALITY ASSURANCE

- A. Cast-in-place concrete shall be installed by technicians specially trained in the proper handling, placing and protection of concrete and reinforcing steel. If required by the Architect, installer shall submit for approval a list of similar installations successfully completed.
- B. Cast-in-place concrete shall be mixed and installed in strict accordance with applicable written recommendations and requirements of the Texas State Department of Highways and Public Transportation (TSDHPT) and the American Concrete Association (ACI) including but not necessarily

limited to the following where documents conflict, the most stringent of the requirements as determined by the Architect shall apply:

1. TSDHPT, item 360.
2. ACI 302.
3. Building Code Requirements for Reinforced Concrete, ACI 318.
4. Recommended Practice for Hot Weather Concreting, ACI 305.
5. Recommended Practice for Cold Weather Concreting, ACI 306

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. GENERAL: All materials used in the Work shall be stored or handled in a manner which will prevent deteriorations; any materials that have been damaged shall be immediately and completely removed from the Work. All manufactured materials, such as cement, shall be delivered and stored in their original packages, plainly marked with the brand and manufacturer's name. Broken packages or packages that show marks or other evidence of damage shall be wholly rejected.
- B. CEMENT: Portland cement shall conform to standard specifications of ASTM,C-150, Type 1, latest edition. The brand shall be one approved by the Architect, and this one brand shall be used throughout the project.
- C. AGGREGATES: Aggregates for concrete of normal weight shall be clean, hard, strong, uncoated, free of loam, fine sand, clay dust, organic or other deleterious matter and shall conform to ASTM C-33.

FINE AGGREGATE			COARSE AGGREGATE		
Sieve Size	Percent Passing	Sieve Size Passing	1-1/2	Percent	3/4
4	95-100	1-1/2	95-100	-	-
16	50- 88	1"	-	90-100	-
50	10-30	3/4"	40-70	-	90-100
100	0- 5	1/2"	-	25- 60	
		3/8"	10-30	-	20-55
		#4	0- 5	0- 10	0- 10

- D. Clay - 3% Maximum Clay - 1 % Maximum
- E. WATER: Water shall be clean and potable, free from injurious amounts of oil, acid, Alkali, organic matter or other deleterious substances.
- F. REINFORCING STEEL: All reinforcing steel shall be high bond, new billet stock, and shall conform with ASTM A-615, except that mesh shall conform with ASTM A-1 85. All materials must be free from seams, flaws, scale or an excessive amount of rust. The supplier shall furnish Architect with a certificate certifying the reinforcing steel is domestic, or supply laboratory tests acceptable to the Architect, that foreign steel meets these tests. Laboratory tests shall be made on each size of steel. Samples for testing shall be taken from jobsite. The samples shall be replaced with bar of like size and length, plus 40 diameter.
- G. ANCHORS: Install all necessary anchors, wire loops or other miscellaneous fasteners to be installed in concrete for anchoring masonry or other work.
- H. WOOD JOINT FORMS:
  - 1. Sidewalk Joints: Expansion joints at concrete walks shall be 1X Redwood.
  - 2. Paving Joints: 3/4" thick redwood form with minimum 1" deep removable top strip, 3/4" x 1 0" steel reinforcing bars at 24" o.c. with bond-breaker sleeve on one side, and 3/16" thick steel rebar support plates each side. Provide custom size as required for full depth of paving as manufactured by Shepler Equipment Co., or equivalent by Commercial Lumber Supply, Marine Lumber Co., or Southern States Lumber.
- I. TRANSIT MIX CONCRETE: Contractor shall provide concrete meeting the specifications with regard to compressive strength, method of handling, and controlled by testing lab at batch plant. Concrete shall meet ASTM C-94; Certificate from supplier shall be furnished to Architect.
- J. CURING COMPOUND: Shall be Southform 4-way (cures, seals, dustproofs, and hardens), or equivalent product by Gifford-Hill, Nox-Chem, Sonneborn, or W.R. Grace.
- K. ADMIXTURES:

1. General: All admixtures shall be added at the plant during mixing and must be prior approved by the Testing Laboratory. Admixtures shall comply with requirements of ASTM C-260 and C-494. Admixtures containing calcium chloride are not acceptable. **Do not use admixtures in footings or seal slabs.**
  2. Water Reducing Agents: All design mixes must test with the required slumps prior to the addition of a water reducing agent. Each specified maximum slump may be increased by a maximum of 2" at the plant by the addition of a maximum of 3 ounces of water reducing agent per 94 pound bag of cement. Meet requirements of ASTM C494, Type F.
    - a. "PSI Super" as manufactured by Cormix Construction Chemicals.
    - b. "WRDA-1 9" as manufactured by W.R. Grace.
    - c. "Sikament" as manufactured by Sika Chemical Corp.
  3. Set-Controlling Agents: Under 40 degrees F., add accelerating agent Over 80 degrees F., add retarding agent.
    - a. Cormix Construction Chemicals.
    - b. Master Builders
    - c. Protex Industries
    - d. Sika Chemical Corp.
  4. Air Entrainment: All structural concrete shall contain an air entraining agent compatible with other approved admixtures. Agent added at the plant shall produce 4-5% air entrainment - not required at drilled footings.
- L. REINFORCING BAR SUPPORTS: Heavy-duty type four-legged plastic chair supports with sand plate. Series "G" or "B" (as determined by job conditions) as manufactured by W.H.C. Products, Inc. or approved equivalent by Aztec Concrete Accessories. Provide sand plate for slab on grade. Space at a maximum of 45" centers each way. Provide closer spacing where required to prevent excessive sag, or to support the weight of concrete pump hose.
- M. METAL REINFORCEMENT:
1. Bars
    - a. General: Detailing conform to ACI detailing manual.
    - b. Grade 60: Comply with ASTM A 615.
    - c. Grade 40 (#3 bars): Comply with ASTM A 615.
  2. Mesh
    - a. Comply with ASTM A 185.
    - b. Mesh shall be type which is fabricated and delivered in flat sheets.
    - c. Use mesh only where specifically indicated in the drawings for sidewalks or equipment pads.
- N. PAVING JOINT SEALANT: Polyurethane base, multi-component, chemical curing, self-leveling Type 1, conforming to requirements of FS TT-S-00227E, Class A (provide equivalent non-sagging Type 2 at vertical joints in curbs), as manufactured by Tremco or equivalent by Sonneborn, Sheplers, or Pecora. Use with flat strip, non-absorbent polyethylene joint backer-open or closed cell type as recommended by the sealant manufacturer.

## 2.2 MIX DESIGNS



- A. The concrete mix shall be designed by the concrete supplier and approved by the Owner's Testing Laboratory. Contractor shall furnish to the laboratory samples of the aggregate he proposes to use in the concrete work. Concrete mixes shall achieve twenty eight (28) day compressive strengths indicated below, and shall be so proportioned as to obtain a workable mix in accordance with the following limits:
- |    |                       |                   |                               |
|----|-----------------------|-------------------|-------------------------------|
| B. | Compressive Strength  | Minimum Cement    | Maximum Total                 |
| C. | at 28 days            | Content 94#       | SacksWater Per Sack of Cement |
| D. | <u>Minimum P.S.I.</u> | <u>Cubic Yard</u> | <u>Gallons</u>                |
| E. | Paving 3,500          | 5.5               | 7.0                           |
- F. SLUMPS: Slumps greater than specified can adversely affect concrete performance due to excessive shrinkage. Slumps specified below are based upon concrete design mix prior to addition of any approved water reducing agent.
1. 5" +/- 1": Sidewalks
  2. 3" +/- 1": Paving, curbs
- G. The use of fly ash in the concrete mix is not acceptable.
- H. MIXING
1. Comply with ASTM C 94.
  2. Mix concrete to a uniform distribution of materials. Mix at least two minutes after materials are in mixer. Discharge concrete completely before mixer is recharged.
  3. Mix each batch not less than 70 or more than 100 revolutions of the drum at mixing speed. Additional mixing is to be done at agitating speed.
- I. ADJUSTMENTS TO MIX DESIGN: Submit for approval by the Owner's Testing Laboratory any proposed adjustments to the approved mix design due to job conditions, weather or testing results. Necessary adjustments to the mix design shall be at the Contractor's expense.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Any portions of the subgrade or fill that are below optimum moisture content shall be wetted at least one (1) week prior to placing concrete in order to achieve a proper uniform distribution of moisture.
- B. All preliminary work shall be carefully checked, all trash and debris removed, and the approval of the Architect obtained before any concrete is placed. The Architect shall be notified twenty-four (24) hours before any concrete is scheduled to be placed.
- C. SUBGRADE APPROVAL- The bearing grade of slab-on-grade concrete shall require approval of the Owner's testing laboratory immediately prior to the placement of concrete regardless of any previous test results. Bearing grade which is overly dry, saturated, exhibits standing water, contaminants, irregularities or other properties which may tend to be deleterious to the performance of the cast-in-place concrete will not be approved by the Owner's testing laboratory as suitable for concrete placement.

- D. Coordinate and provide for plumbing, electrical, carpentry, masonry, miscellaneous metals and other installation requirements, which must be completed prior to concrete work or which may require special forming or block-outs.
- E. CLEANING: Clean all forms of debris and thoroughly wet wood forms before placing concrete.
- F. Inspect subgrade to determine that uniform thickness of concrete paving and walks will result in proper drainage and no standing water. Notify Architect prior to beginning work of any no slope areas or potential standing water conditions.
- G. HOT WEATHER CONDITIONS: Where ambient temperature exceeds 95 degrees F. with a wind velocity exceeding 5 MPH or temperature exceeds 90 degrees F. with a wind velocity exceeding 15 MPH, follow recommendations in ACI publication "SLABS ON GRADE" to protect against rapid drying.
- H. Do not place concrete when air temperature is 40 degrees F. or below or when the air temperature is expected to go below 30 degrees F. in the following 48 hours after placing of concrete unless the concrete is protected from such temperature.
- I. Install all anchors, fasteners, junction boxes, curb dowels collection boxes or other construction to be installed within concrete paving.

### 3.2 INSTALLATION

- A. TRANSIT: Concrete shall be agitated continuously with slow revolutions of the drum while in transit. No concrete shall be deposited after being in the mixer more than 90 minutes. Testing laboratory shall check each delivery ticket and notify Contractor immediately of any concrete arriving more than 90 minutes after plant loading.
- B. HANDLING: Concrete shall be deposited in the forms as rapidly as practicable by methods which will prevent loss or separation. It shall be deposited as nearly as practicable in its final position to avoid rehandling. Provide runways, or other means for wheeled equipment to carry concrete to points of deposit.
- C. PLACING REINFORCEMENT:
  - 1. A thin film of rust will not be considered objectional, but no loose or scaly rust, dirt, mud or cement will be allowed. Steel must be cleaned with wire brushes or replaced if pitted from rust.
  - 2. Accurately position, secure against displacement with #18 gauge wire ties or suitable clips, support by heavy duty plastic chairs with sand plates. Do not use "brick batts" or rubble for support.
  - 3. Follow recommendations of Concrete Reinforcing Steel Institute as to type of steel, splicing, location and placement.
- D. PLACING CONCRETE:
  - 1. Deposit and consolidate concrete in a continuous operation, within the limits of joint forms, until the placing of a panel or section is completed.
  - 2. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement, other embedded items, and into corners.
  - 3. Maintain reinforcing steel in the proper position continuously during concrete placement operations.
  - 4. Bring slab surfaces to the correct plane with a straight edge or vibrating screed and strike off. Use bull floats or derbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle

water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Concrete surface shall be true to plane within 1/4" against a 10' straight edge.

### 3.3 JOINTS

#### A. LOAD TRANSFER UNITS:

1. Install wood joint form in accordance with manufacturer's printed directions prior to concrete pour. All plastic sleeves at reinforcing bars shall be placed running in same direction.
2. Install manufacturers stakes at 48" o.c. maximum where concrete is to be placed on both sides of form simultaneously. Install at 36" o.c. maximum at cold joints.
3. Longitudinal joint forms shall be continuous through transverse joint forms.
4. Pre-wet form boards prior to placement to ensure against dry wood forms removing water at edges of concrete.
5. Leave removable top strip in place and protect until sealant operations begin.

#### B. WOOD FORMS:

1. Install similar to load transfer units. Use at radiused areas and sidewalks.
2. Kerf where required for radius.
3. Leave removable top strip in place at paving and protect until sealant operations begin. Top strip and sealant not required at sidewalks.

#### C. KEYED JOINTS:

1. Align metal joint forms and install manufacturer's splice clip at ends to keep joints in alignment during concrete placement.
2. Set all stakes securely to keep joint form from moving during concrete placement.
3. Do not remove forms until concrete has obtained sufficient strength. When removing forms, apply no vertical uplift which may damage or weaken concrete key.

### 3.4 CURBS

- A. Provide machine laid (extruded) reinforced concrete curbs unless monolithic or formed curbs are indicated in the drawings.
- B. Apply epoxy to cured concrete paving and continuously lay curb over installed dowels.

### 3.5 FINISHING

- A. GENERAL: Concrete finishes shall match approved jobsite samples approved by the Architect. Spreading of dry cement for finishing is not acceptable. Begin finishing operations as soon as water sheen has disappeared from surface.
- B. PAVING FINISHES: Slabs shall be true to plane within 1/4" in a length of 10' machine finish and provide light to medium broom finish (across the direction of traffic) at all paving as approved by the Architect.
- C. SIDEWALKS: Provide light broom finish perpendicular to walk. Provide Architect with sample panel of proposed finish for approval prior to beginning work.

- D. STEPS AND RAMPS: Shall be constructed as detailed. Exterior steps, landings, and ramps shall be medium broom finished.
- E. PAVING JOINTS: Provide tooled eased edges along both sides of redwood joint form to ensure neat appearance, sealant adhesion, and to facilitate removal of top strip. Use 1/8" radius jointing tool.
- F. OPEN TOOLED JOINT: Provide scored lines on concrete sidewalks 5'-0" o.c. unless spaced otherwise on the drawings. Joint size shall be 1/4" wide x 1/4 depth of concrete.
- G. All concrete paving and walks shall be uniform in color and consistent in finish. Remove and replace any areas dimpled by rain or discolored (concrete mix).

### 3.6 CURING

- A. Apply complete covering of curing compound as soon as concrete is finished and in accordance with manufacturer's instructions. Curing compound shall be applied as it comes from the can, at the rate of 200 to 300 square feet per gallon.
- B. To avoid sealant adhesion problems ensure that curing compound does not seep into paving joints that receive sealant.

### 3.7 CAP SEALANT

- A. Remove redwood top strip from joint forms. Take care to avoid damaging concrete edges. Clean sealant cavity and inspect for proper depth as recommended by sealant manufacturer.
- B. Ensure that sealant cavity is clean, dry, and free of dust, dirt, and small stones. Ensure that edges are not contaminated with curing compound, oil or other agents, which might cause adhesion failure. Prime side walls in accordance with sealant manufacturer's recommendations.
- C. Install flat ethafoam strip in bottom of sealant cavity to provide bond-breaker at bottom of sealant and to ensure against sealant loss past the joint form. Install strip in thickness required to provide sealant cavity size as recommended by sealant manufacturer. Use no sand or other loose material in joint cavity.
- D. Mix sealant thoroughly in accordance with manufacturer's recommendations and pour to within 1/8" of top of paving. Where sealant must be repoured due to run off or improper level, remove completely all traces of sealant on side walls before next application.
- E. At concrete curbs rake joint filler to minimum 1" depth and install sealant manufacturer's vertical joint grade sealant.

### 3.8 CLEANING AND PROTECTION

- A. Paving is to be kept free of any foreign substances (wax, oil, paint, etc.) or surface irregularities, which may affect the final appearance of the completed installation.
- B. Unless otherwise approved by the Architect, no vehicular traffic will be allowed on any concrete slab, paving or drive until after the 7 day concrete tests have been made by the laboratory indicating that the concrete has attained 3,000 psi compressive strength.
- C. Contractor shall coordinate with Architect and Owner to determine a suitable on-site "wash-out" area for concrete trucks. Contractor shall be responsible for clean up of the designated area.

- D. Contractor shall keep clean all adjacent public streets and rights of way. Wash down daily or more often as needed to maintain a safe condition at entrances/exits to site.

3.9 TESTING LABORATORY CONTROL

- A. Contractor shall contact Owner's Testing Laboratory at least 24 hours prior to time of anticipated concrete placement.
- B. Contractor shall require the manufacturers of the cement and metal reinforcement to be used in the work to furnish mill certificates showing that such materials meet ASTM standards as specified.
- C. Contractor shall follow all requirements of ASTM C 31 concerning the proper handling and protection of concrete test cylinders. Contractor shall provide locked storage facilities for test cylinders with all heat, insulation and protection as required by ASTM C 31.

END OF SECTION

SECTION 33 05 00 — SITE DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.
- B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.
- C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.
- D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

- A. Provide and install storm sewer piping, collection boxes, grates, manholes, culverts, inlets and headwalls as indicated in the Architectural drawings and specified herein.
- B. Related trenching, pipe bedding, backfill, and compaction as indicated in the Civil and MEP documents drawings and specified herein.
- C. Trench safety in accordance with OSHA requirements and as specified **under Trench Safety Section.**

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Piping indicated on plumbing drawings.
- B. Site clearing, grading and filling.

1.4 SUBMITTALS

- A. **PRODUCT DATA:** Submit manufacturer's literature for piping precast drainage structures and grates illustrating performance, fabrication procedures, materials and sizes.
- B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **CONCRETE SEWER PIPING:** Extra strength tongue and groove pipe conforming to ASTM C-76, Class III for reinforced pipe.

- B. JOINT SEALS:
1. Under 42" diameter: Provide Talcote Asphalt Primer No. 041 and Talcote Cold Plastic No. 052 joint compound.
  2. 42" diameter and larger: Bell and rubber gasketed joints.
- C. CONCRETE: Minimum compressive strength of 3,000 psi. Conform to requirements of Cast in Place Concrete Section 3.
- D. POLYVINYL CHLORIDE (PVC) SDR 26 PIPING: Provide PVC piping where indicated on the drawings. Jointing shall be solvent weld or bell and gasket meeting requirements of A.S.T.M. 3212. Piping shall meet requirements of A.S.T.M. D-3034.
- E. INLETS:
1. Precast concrete, cast in place concrete or brick collection boxes as indicated in the drawings. Brooks Products, or equivalent. Form both inner and outer walls for cast-in-place items.
  2. Brick: ASTM C-32 sewer brick, Grade SS, 2-1/4" x 3-3/4" x 8".
  3. Gratings, Covers and Frames: Cast iron, McKinley, Neenah or approved equal. Heavy duty in paving. Medium duty in walks. Light duty in grass or planting areas.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. INLETS:
1. All storm sewer inlets shall be constructed to the line and grade and at location shown on the drawings. Inlets shall be constructed in strict accordance with details as indicated in the drawings.
  2. When the box section of the inlet has been completed, the floor of the inlet shall be shaped by filling with one-two mortar to conform to the section shown on the detail drawings.
  3. Cast iron inlet frames and grates shall be accurately adjusted to line, grade and slope and grouted in place with mortar consisting of one part Portland Cement to two parts sand.
- B. PIPING:
1. Inspection: Review drawings and job conditions and verify all inverts before trenching to avoid conflict with other below grade utilities either planned or existing. Immediately notify Architect of any apparent conflicts before beginning work.
  2. Trenching: Provide trenching in strict compliance with current OSHA regulations and in accordance with **Trench Safety Section. Do not trench ahead of pipe laying unless trench is protected.**
  3. Begin excavation work at the lower end of flow line and proceed to higher flow line. Avoid over-excavating; return over-excavated bed to grade and thoroughly compact. Remove large rocks, foreign or organic material; return bed to grade and thoroughly compact.
  4. Lay all pipe on required bedding to a true line slope as indicated in the drawings. Hand excavate at joints to ensure that full length of pipe lays on a solid bed. Install tongue end of pipes facing direction of drainage flow.
  5. Bedding and backfilling of pipe:
    - a. Bed and backfill all piping in accordance with the details indicated on the drawings. Where local or other applicable codes require more stringent specifications, those codes shall govern.

- b. All piping located in County Flood Control District right of way shall be bedded and backfilled with cement stabilized sand in accordance with Flood control District requirements.
- c. Cement stabilized sand shall be a homogeneous mixture of 1-1/2 sacks Portland Cement per cu. yd. of mixed material. Provide greater cement content where required by City or County Requirements.

END OF SECTION