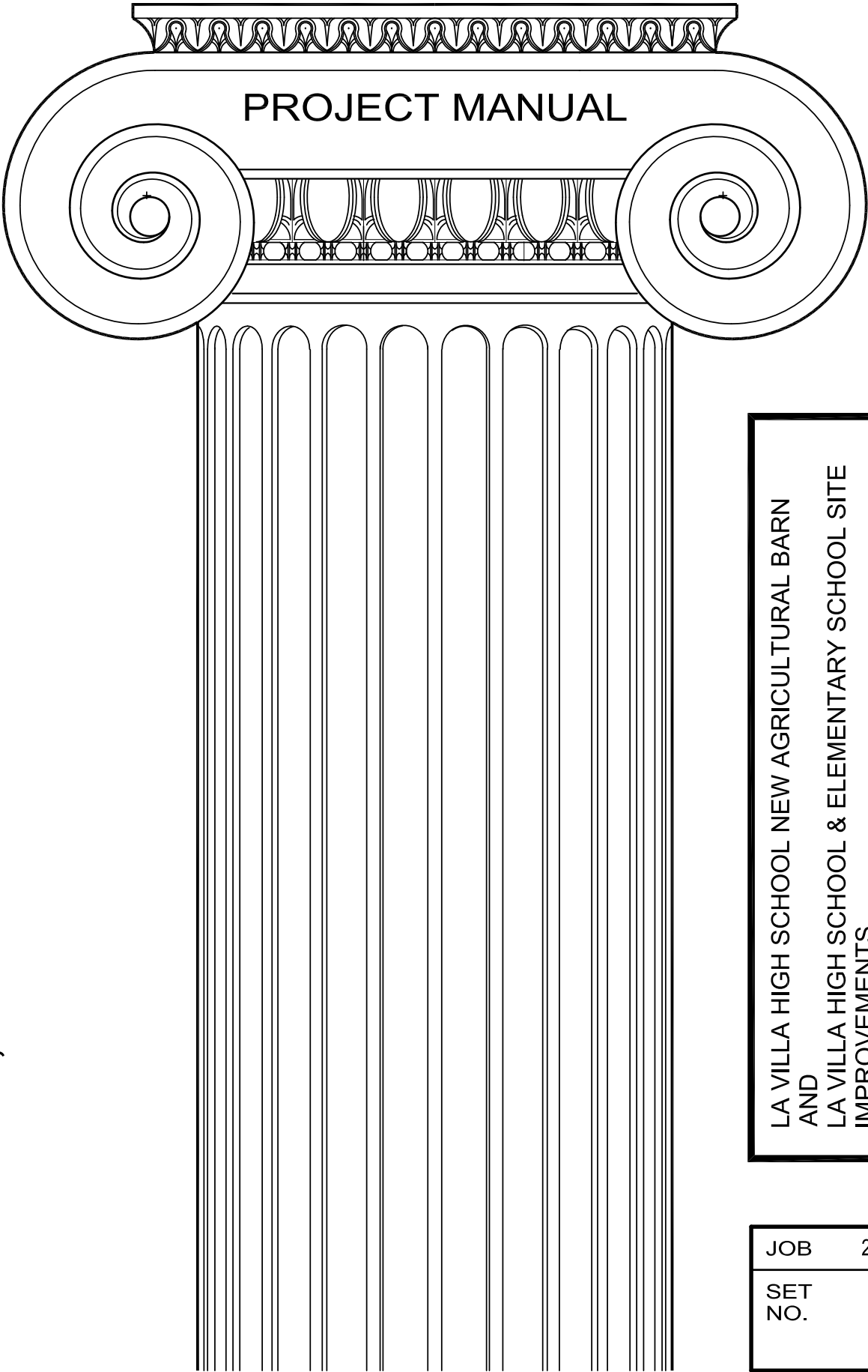


RIKE - OGDEN - FIGUEROA - ALLEX
ARCHITECTS, INC.



JOB	2018.07R
SET NO.	

LA VILLA HIGH SCHOOL NEW AGRICULTURAL BARN AND LA VILLA HIGH SCHOOL & ELEMENTARY SCHOOL SITE IMPROVEMENTS FOR LA VILLA INDEPENDENT SCHOOL DISTRICT LA VILLA, TEXAS

PROJECT MANUAL

***LA VILLA HIGH SCHOOL NEW
AGRICULTURAL BARN
&
LA VILLA HIGH SCHOOL AND ELEMENTARY SCHOOL
SITE IMPROVEMENTS
FOR
LA VILLA INDEPENDENT SCHOOL DISTRICT
LA VILLA, TEXAS***

PROJECT NO. 2018.07R



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".

ROFA ARCHITECTS INC.

1007 WALNUT AVENUE

McAllen, TEXAS 78501

{956}686-7771 - FAX: {956}687-3433

PROJECT MANUAL

**LA VILLA HIGH SCHOOL
NEW AGRICULTURAL BARN
AND
LA VILLA HIGH SCHOOL & ELEMENTARY SCHOOL
SITE IMPROVEMENTS
FOR
LA VILLA INDEPENDENT SCHOOL DISTRICT
LA VILLA, TEXAS 78562**

Project No. 2018.07R

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LA VILLA ISD HIGH SCHOOL AGRICULTURAL BARN AND HIGH SCHOOL SITE IMPROVEMENTS AND

ELEMENTARY SCHOOL SITE IMPROVEMENTS INDEX

Date: FEBRUARY 27, 2019

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LA VILLA ISD HS AND ELEM SITE IMPROVEMENTS
LA VILLA ISD

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A handwritten signature in blue ink, appearing to read "M. Garcia", located below the professional seal.

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END OF SECTION



02-27-19

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2/27/2019

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SECTION 00020
INVITATION FOR COMPETITIVE SEALED PROPOSALS

PART 1: GENERAL:

1.01 PROJECT DESCRIPTION:

- A. This project consists of the construction of *La Villa High School New Agricultural Barn and La Villa High School & Elementary School Site Improvements for La Villa Independent School District La Villa, Texas 78562.*

1.02 INSTRUCTIONS TO OFFERORS:

- A. Refer to SECTION 00100 – Instructions to Offerors

1.03 PRE-PROPOSAL CONFERENCE:

- A. The purpose of the Pre-Proposal Conference is to answer any questions that any offerors may have.
- B. Date and Time: Thursday, March 14, 2019
- C. Location: Business Office (500 East 9th Street)
P. O. Box 9 La Villa, Texas, 78562

1.04 OPENING OF PROPOSALS:

- A. Place:
1. *Competitive sealed Proposals* will be received at the office of:
- Owner:* La Villa Independent School District
- Address:* Business Office (500 East 9th Street)
- ATTENTION:* Mr. Alejos Salazar, Superintendent
- B. Date: Thursday, March 21, 2019
- C. Hour: 4:00 P.M.

1.05 REJECTION:

- A. The Owner reserves the right to reject any or all Proposal, and to waive any irregularities or formalities.

END OF SECTION

SECTION 00100
PROPOSAL INSTRUCTIONS

PART 1: GENERAL:

1.01 SECURITY BOND:

- A. Security bond in the amount of five percent (5%) of the Proposal must accompany each Proposal. Security bond shall be issued by an insurance company authorized to provide bonds on work in the State of Texas and shall be made payable to the Owner.

1.02 DOCUMENTS:

- A. Qualified offerors may obtain two (2) sets of Drawings and Project Manuals from: ***RGV REPROGRAPHICS 519 S. Broadway, McAllen, Texas 78501 (956) 686-1525.***
- B. Subcontractors may obtain one (1) set of Drawings and Project Manuals from the office: ***RGV REPROGRAPHICS 519 S. Broadway, McAllen, Texas 78501(956) 686-1525.***
- C. A deposit of ***\$ 100.00*** will be required for each set of Drawings and Project Manuals issued. Partial sets will not be issued. Make checks payable to ROFA ARCHITECTS INC.
- D. Deposits will be refunded to offerors and subcontractors provided that all sets along with addendums are returned within ten {10} days after date of opening of Proposals. The offeror awarded the Project may retain the Construction Documents, and request refund of deposit.
- E. Deposit amount will be refunded as soon as practical, provided sets are in good condition. Costs of reproducing missing or damaged sheets or pages will be deducted from the deposit amount.
- F. Offerors may obtain additional sets by paying the cost of reproduction, which will not be refunded, and complete sets shall be returned to the Architects.
- G. Complete sets of Construction Documents shall be used in preparing proposals; neither the Owner nor the Architect assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Construction Documents.
- H. The Owner or Architect in making copies of the Construction Documents available on the above terms, does so only for the purpose of obtaining proposals on the work and does not confer a license or grant for any other use.
- I. Complete sets of Drawings and Project Manuals are on file at the following locations and subcontractors may examine them there:

ROFA Architects Inc.
1007 Walnut Avenue McAllen, Texas 78501
(956) 686-7771
McGraw-Hill Construction Dodge
<http://www.dodgeplans.construction.com>

A.G.C. PLAN ROOMS
Pharr, Harlingen, Brownsville

VIRTUAL BUILDERS EXCHANGE
San Antonio, Texas 78217
askme@virtualbxb.com

1.03 EXAMINATION:

- A. Offerors and sub contractors shall carefully examine the Construction Documents and the construction site to familiarize themselves with existing local conditions under which the Work is to be performed.
- B. Extra payments will not be authorized for work that could have been foreseen by careful examination of the site. Submission of a proposal shall constitute acceptance, by the offeror, of existing site conditions as a part of

the requirements for this work.

- C. Offerors shall carefully examine the Construction Documents to verify that they agree with the Table of Contents in the Project Manual, the Index of Drawings Sheet on the Drawings, and the Cover Page of all Addenda. Offerors shall be responsible for obtaining any pages or sheets which have been inadvertently left out during the printing process.
1. All entities providing proposals on any portion of the work contained in the Construction Documents shall ascertain the completeness of the set of documents.
 2. The Construction Documents are printed by an independent vendor and, although the Architect endeavors to check the documents for completeness, the Architect has, in the past, discovered missing or misplaced sheets in the Drawings and the Specifications.
 3. Each entity receiving a set of Construction Documents shall check the indexes against the sheets or pages contained in the sets.
 4. Should pages or sheets be found to be misplaced or missing, immediately notify the Architect who will give direction as to placement or provide the sheets or pages that are missing.
 5. Failure to notify the Architect means the offeror is providing a proposal based on a complete set of Construction Documents.

1.04 INTERPRETATION OF CONSTRUCTION DOCUMENTS:

- A. Offerors shall promptly notify the Architect of any ambiguity, inconsistency or error which they may discover upon examination of the Construction Documents or of the site and local conditions.
- B. Submit all questions regarding clarification or interpretation of Construction Documents to the Office of the Architects: ROFA ARCHITECTS INC., 1007 Walnut Avenue, McAllen, TX 78501.
Attn: Humberto Rodriguez, AIA – (956)686-7771; email: humbertor@rofainc.com
- C. Submit all questions in writing. In the interest of time, requests may be made by telephone, but they must be submitted in writing the same day. Replies to questions will be issued to all Offerors in the form of an Addenda. **General contractor and subcontractors shall submit questions in writing seventy-two (72) hours prior to opening of proposals.**
- D. Make requests for interpretations as early as possible so as to allow adequate time to prepare and issue Addenda.
- E. All Offerors shall check with the Architect within **six (6) hours** prior to Opening of proposals to secure all Addenda. The Architect will not be responsible for oral clarification.

1.05 BASIS OF PROPOSALS:

- A. Proposals shall be on a lump sum basis for each and or combined proposal packages and shall include all costs for these projects as described and indicated by the Construction Documents. Basis for proposals shall be on brands, materials, processes, products, persons or organizations, etc., indicated in the Construction Documents.
- B. Proposals shall include all unit price costs and all Alternate costs as indicated by the Construction Documents and Proposal Form.

1.06 ALTERNATES:

- A. The Owner may, at his option, elect to proceed with any or all Alternates as set forth in the Contract Requirements.
- B. Amount shown in proposal for each Alternate shall include profit, insurance, contingencies and other costs

incidental to performance under such Alternative.

- C. Amount shown in Proposal for each Alternate shall include the making of all changes and the installation of all materials and equipment necessary to the accomplishment of the Alternate requirements.

1.07 SUBSTITUTIONS:

A. Approval Required:

1. The Contract is based on the standards of quality established in the Contract Documents.
2. All products proposed for use, including those specified by required attributes and performance, shall require approval by the Architect before being incorporated into the work.
3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Architect.
4. ***Product substitution requests shall be submitted no later than 7 days prior to Opening of Bids (Proposals) as noted in Section 00020.***

1.08 PROPOSALS:

- A. Proposals shall be made on unaltered Proposal Forms furnished by the Architect. No oral, telephone or personal Proposals will be considered. All blank spaces shall be properly filled in by typewriter or manually in ink.
- B. Where so indicated by the makeup of the Proposal Form, sums shall be expressed in both words and figures, and in case of discrepancy between the two, the written amount shall govern.
- C. Any alteration or erasure to information entered in the blank spaces must be initialed by the signer of the proposal.
- D. Original sheets shall be submitted, signed in longhand below the printed name of the person authorized to bind the offeror to a Contract.
- E. Where offeror is a corporation, Proposal must be signed with the legal name of the corporation followed by the name of the State of Incorporation and the legal signature of a person authorized to bind the corporation to a Contract.
- F. Failure to submit a proposal on the form requested, or the inclusion of conditions, limitations or provisions distorting the intent of the Construction Documents, will render the proposal irregular and subject to rejection.

1.09 SUBMITTALS:

- A. ***Submit One Original and 2 copies of Proposal, Security Bond and other required data in an opaque, sealed envelope. Submit proposal at the time and place shown in the Invitation for Competitive Sealed Proposals***
- B. Envelope shall be addressed to the Owner and identified with the Project Name and the name and address of the offeror.
- C. If the Proposal is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "PROPOSAL ENCLOSED" on the face thereof. No envelopes shall be opened until the date and time proposals are to be received.

1.10 MODIFICATION OR WITHDRAWAL OF PROPOSAL:

- A. A proposal may not be withdrawn or canceled by the offeror during the stipulated time period following the time and date designated for the receipt of Proposals, unless the award of Contract has been delayed more than sixty (60) calendar days.
- B. Prior to the time and date designated for receipt of Proposals, Proposals submitted early may be modified or withdrawn only by notice to the party receiving Proposals at the place and prior to the time designated for receipt of Proposals.
- C. Modification of Proposals shall be in writing over the signature of the offeror or be by telegram; if by telegram, written confirmation over the signature of offeror must have been mailed and postmarked on or before the date and time set for receipt of proposals; it shall be so worded as not to reveal the amount of the original Proposal.
- D. Withdrawn Proposal may be resubmitted up to the time designated for the receipt of proposals provided that they are then fully in conformance with these Proposal Instructions.
- E. Security bond shall be in an amount sufficient for the proposal as modified or resubmitted.

1.11 CONSIDERATION OF PROPOSAL:

- A. Properly identified Proposals received on time will be considered.
- B. The Owner shall have the right to reject any or all Proposal and in particular to reject a Proposal not accompanied by any required security bond or data required by the Contract Documents or a Proposal in any way incomplete or irregular.
- C. The Owner shall have the right to waive any formality or irregularity in any proposal received.
- D. If the Owner accepts any Alternates, the Owner shall have the right to accept them in any order or combination.
- E. It is the intent of the Owner to award a contract to the offeror submitting the proposal providing the “best value” to ***the Owner*** provided the Proposal has been submitted in accordance with the requirements of the Contract Documents and selection criteria adopted by the Owner.
- G. ***Contractor shall provide supplemental information to address selection criteria noted in Section 00320 Ranking/Selection Criteria. The support information will not be disclosed to other offerors.***
- H. ***The estimated budget is as follows: \$820,000.00.***

1.12 LOCATION TO ACCESS AND PREMISES:

- A. The project site location: ***Refer to vicinity map on drawings.***
- B. The offeror shall have free access to the premises for the purpose of acquainting himself with the conditions, delivering equipment, and performing the work necessary to fulfill the contract. Offeror shall cooperate with the other contractors who may concurrently be working on the premises, integrating his work with that of others, all to the best interest of the total work and its orderly completion.

1.13 STATE SALES TAX:

- A. ***This project is exempt from state taxes. A sales tax exemption certificate may be obtained from the State Comptroller.***

END OF SECTION

SECTION 00220

SOIL INVESTIGATION DATA

PART 1: GENERAL:

1.01 SUBSURFACE SOIL INVESTIGATION:

- A. Subsurface borings have been taken at the Project Site and a Final Report on Foundation Soil investigation has been prepared.
- B. The information was obtained for use in preparing the foundation design, but is indicative only of the soil conditions where the boring is taken.
- C. Bidders are expected to examine the site and the record of investigation to determine character of materials to be encountered.
- D. If soil conditions other than those indicated are encountered during construction, notify the Architect before work continues.
- E. Complete reports are available at the office of the Architect and may be examined there.

END OF SECTION

SECTION 00310
PROPOSAL FORM FOR COMPETITIVE SEALED PROPOSALS

PROPOSAL FROM: _____

ATTN: Alejos Salazar, Superintendent

RE: La Villa High School New Agricultural Barn and La Villa High School & Elementary School Site Improvements for La Villa Independent School District, La Villa, Texas

The Undersigned proposes to furnish all labor, services, materials, tools, and necessary equipment for the construction of the **La Villa High School New Agricultural Barn and La Villa High School & Elementary School Site Improvements**, and to perform the work required for the construction of said project at the location set out by the Drawings, Project Manual and Specifications, in strict accordance with the Contract Documents for the completed work.

In submitting this Proposal, it is understood that this Proposal may not be altered or withdrawn for sixty (60) calendar days and that the Owner has reserved the right to reject any and all Proposals.

Offerors shall submit a schedule of values with-in 24 hours of proposal opening.

The Undersigned certifies that this Proposal is made in good faith, without collusion or connection with any other person, persons, partnership, company, firm, association, or corporation offering on this work, for the following sum or prices to wit:

BASE BID HIGH SCHOOL NEW AGRUCULTURAL BARN:

_____ (\$ _____) DOLLARS

ADD ALTERNATE NO. 1 High School Fencing Work: That amount to add materials and labor to provide high school fencing and related work as indicated on drawings and specifications:

_____ (\$ _____) DOLLARS

ADD ALTERNATE NO. 1A High School Fencing Work Wrought Iron Fence In lieu of Chainlink Fence: That amount to add materials and labor to provide Wrought Iron Fence in lieu of chainlink fence and related work as indicated on drawings and specifications:

_____ (\$ _____) DOLLARS

ADD ALTERNATE NO. 2 High School Parking Lot Repaving Work: That amount to add materials and labor to provide the High School parking lot repaving and related work as indicated on drawings and specifications:

_____ (\$ _____) DOLLARS

ADD ALTERNATE NO. 3 Elementary School Parking Lot Repaving and addition to parking lot Work: That amount to add materials and labor to provide the Elementary School parking lot repaving and addition to parking lot and related work as indicated on drawings and specifications:

_____ (\$ _____) DOLLARS

SECTION 00310
PROPOSAL FORM

The Undersigned further agrees that in case of authorized variations of quantities from those shown or specified, the attached ***UNIT PRICE SCHEDULE*** will be used in adjusting the Contract Price.

The Undersigned hereby declares that he/she has visited the site and has carefully examined the Drawings, Specifications, Contract Documents and Proposal Documents related to the Work covered by this proposal.

Upon receipt of "*NOTICE TO PROCEED*", the Undersigned will immediately execute the formal contract (Agreement).

The Undersigned agrees to commence work within ten (10) days of Notice to Proceed and to substantially complete the work on or before _____.

The Contract required will be that Standard Form of the American Institute of Architects or an owner modified form and shall provide for payment on accounts of ***ninety-five (95%)*** percent of the value monthly.

The Proposal, the Agreement, the Drawings, the General Conditions, Supplementary General Conditions, the Specifications and any Addenda shall all become a part of the Contract.

I HEREBY ACKNOWLEDGE RECEIPT OF THE FOLLOWING ADDENDUM:

BONDING COMPANY(IES):

(Name and address)

Respectfully Submitted:

BY: _____

FIRM: _____ If corporation affix seal here

TITLE: _____

DATE: _____

SECTION 00310
BID PROPOSAL FORM (UNIT PRICES)

- A. In case of additions or deletions to the Work from the Work shown in the Contract Documents, the following Unit Prices shall be used in adjusting the Contract Price. All Unit Prices shall remain in effect until completion of the Project. All Unit Prices shall be the total cost for material, labor, tax if applicable insurance mark-ups, overhead and profit.

ITEM	ADD	DEDUCT
1. 4" Concrete sidewalk	\$ /S.F.	\$ /S.F.
2. Multi-purpose wall outlet – empty box, blank cover plate. Include 10 ft. ¾" conduit, empty.	\$ /each	\$ /each
3. Light Switch, in wall -Empty wall box, cover plate. Include 10 ft of ½" C and No. 12 wires.(assume new circuit is not required).	\$ /each	\$ /each
4. Water hose bib (exterior) with 50 ft. of 3" copper line including tee and 2 els. 24" deep trench.	\$ /each	\$ /each
5. Masonry walls, materials and labor: a) 8"x 8" x 16" CMU installed with mortar, reinforcement & grouting as noted on drawings and specifications.	\$ /S.F.	\$ /S.F.
6. Metal wall panels "PBR" with R-19 insulation liner system as noted on drawings and specified. materials and labor:	\$ /S.F.	\$ /S.F.
7. Hollow metal door, frame and hardware 3'-0"x 7'-0" material and labor:	\$ /each	\$ /each
8. Hollow metal door, frame and hardware pair of 3'-0"x 7'-0" material and labor. :	\$ /each	\$ /each
9. Overhead rolling door 10' x 10' as noted on drawings and specified material and labor:	\$ /each	\$ /each
10. Screen door pair of 5'-0"x 10'-0" as noted on drawings material and labor:	\$ /each	\$ /each

Respectfully Submitted:

By:

Date:

Business Address Complete:

Seal, If Bid is by a Corporation.

SECTION 00320
RANKING / SELECTION CRITERIA

Ranking/Selection Criteria, as authorized by: (La Villa Independent School District)

- A. *The selection of offeror will be based on the following: Ranking/Selection Criteria The district retains the right to apply the selection criteria as allowed in Educational Code 44.031 section (B)(shall be taken into account to determine best value of the District).*

RANKING / SELECTION CRITERIA POINTS

	CRITERIA	POINTS
1	Project Cost	35
2	Number of similar Agricultural Barn & Site Improvements Projects completed by the Contractor during any of the last five (5) years. (<u>The number of projects is not limited to the references submitted.</u>)	10
3	Timeline for (earliest) completion of the project. Contractor must submit a timeline for the completion of this project together with the proposal response.	10
4	Favorable & unfavorable references of contractor for similar Agricultural Barn & Site Improvements Projects.	15
5	<u>Contractor's</u> proposed personnel for the project. Contractor must submit a list of proposed personnel and their experience with similar Agricultural Barn & Site Improvements Projects.	5
6	Agricultural Barn & Site Improvements Projects contractor's safety record. (Submit information that confirms your safety record)	5
7	Warranties (Materials & Labor)	10
8	Agricultural Barn & Site Improvements Projects <u>Subcontractors</u> to be used for this project. Contractor must submit a list of proposed subcontractors (if any) together with this proposal. Information must include company name, address, phone number, email address, and references on those subcontractors.	10
	Total Points	100

END OF SECTION

SECTION 00410
SECURITY BOND

PART 1: GENERAL:

1.01 SECURITY BOND FORM:

- A. The "Security Bond", AIA Document A310, February **2010 Edition**, will be the form used as a Bid Bond for this Project. Amount of the Security Bond shall be set forth in the Proposal Instructions.
- B. A copy of the Standard AIA Document may be examined at the office of the Architect. To purchase original blank forms, visit www.aia.org. Copies may be purchased from the American institute of Architects, 1735 New York Avenue, N.W., Washington, D.C., 20006.
- C. Each proposal shall be accompanied by a Security Bond pledging that the Offeror will enter into contract with the Owner on the terms stated in his Proposal and will furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder.
- D. Should the offeror refuse to enter into such a Contract or fail to furnish such bonds, the amount of the security bond shall be forfeited to the Owner as liquidated damages, not as a penalty.
- E. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified or current copy of his power of attorney.
- F. The Owner will have the right to retain the security bond of Offerors to whom an award is being considered until the Contract has been executed and the bonds have been furnished, or the specified time has elapsed so that Proposals may be withdrawn, or all Proposals have been rejected.
- G. A cashiers check payable to owner in the amount of five percent (5%) of the greatest amount bid is acceptable.

END OF SECTION

SECTION 00510
AGREEMENT (STIPULATED SUM)

PART 1: GENERAL:

1.01 AGREEMENT FORM:

- A. The "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. A copy of the Standard AIA Document may be examined at the office of the Architect. To purchase original blank forms, visit www.aia.org. 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 or an Owner provided agreement may be utilized. Either of which will be provided to contractor for review upon award of project, for final execution of the contract.

END OF SECTION

SECTION 00615

**PERFORMANCE BOND AND
LABOR AND MATERIAL PAYMENT BOND**

PART 1: GENERAL:

1.01 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND:

- A. The Contractor shall, prior to the execution of the Contract, furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in the amount of 100% of the Contract Price covering 100% performance and 100% payment, and with such sureties secured through the contractor's usual sources as may be agreeable to the parties.
- B. The Contractor shall deliver the required bonds to the Owner not later than the date of execution of the Contract, or if the work is commenced prior thereto in response to a letter of intent, the Contractor shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.
- C. The Contractor shall require the Attorney-In-Fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his Power of Attorney.
- D. Any Payment Bond and Performance Bond furnished pursuant to the provisions of Art. 5160, Vernon's Texas Civil Statutes, connected with this project, shall be furnished by a corporate surety or corporate or corporate sureties in accordance with Article 7.19-1, Vernon's Texas Insurance Code, that has a stated capital and surplus (as reported by it to the Texas Insurance Commission in its most recent report) that is in excess of ten times the stated amount of the Payment bond or the Performance Bond. Provided however, that if any Payment Bond or any Performance Bond is in an amount in excess of ten percent (10%) of the surety company's capital and surplus (as reported to the Texas Insurance Commission in its most recent report), as a condition to accepting the bond, the Owner must receive written certification and information, satisfactory in form and substance to the Owner, that the surety company has reinsured the portion of the risk that exceeds ten percent (10%) of the surety company's capital and surplus, with one or more reinsurers who are duly authorized, accredited or trusted to do business in the State of Texas. For the purpose of this requirement, any amount reinsured by any reinsurer may not exceed ten percent (10%) of the reinsurer's capital and surplus (as reported to the Texas Insurance Commission by the reinsurer in its most recent report). In the event there is one or more reinsurer, the surety company must provide all necessary information and certification related to the current financial condition of the surety company and any and all reinsurers required by the Owner, together with copies of all reinsurance contracts with the surety company, before any such Payment Bond and Performance Bond is eligible to be considered acceptable by the Owner.
- E. ALL CONTRACTORS SHALL SUBMIT THE NAME, ADDRESS AND TELEPHONE NUMBER OF THE CORPORATE SURETIES PROVIDING THE PAYMENT BOND AND PERFORMANCE BOND AND THE LOCAL AGENT.

END OF SECTION

SECTION 00710
GENERAL CONDITIONS OF THE CONTRACT

PART 1: GENERAL:

1.01 GENERAL CONDITIONS:

- A. The General Conditions of this Contract is the American Institute of Architects Document A201, "General Conditions of the Contract for Construction", **2007, Fourteenth Edition**, hereinafter referred to as the "General Conditions".
- B. A copy of the Document is available at the Architect's office, and shall apply to each and every Section of the Work as though written in full therein. To purchase original forms, visit www.aia.org.
- C. Modifications may be made to the above General Conditions or Owner provided General Conditions may be utilized. Either of which will be provided contractor for review upon award of project, for final execution of the contract.
- D. *See Section 00811 Supplementary Conditions.*

END OF SECTION

SECTION 00811
SUPPLEMENTARY CONDITIONS

PART 1: GENERAL:

1.01 SUPPLEMENTARY CONDITIONS:

- A. The Supplementary Conditions modify, change, delete from or add to the General Conditions and shall apply to each and every Section of the Work as though written in full therein.
- B. The following paragraphs and subparagraphs take precedence over the General Conditions. Where any part of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered provisions remain in effect.
- C. Paragraph numbers and titles refer to like numbers and titles in the General Conditions.

1.2 EXECUTION, CORRELATION AND INTENT

Add the following subparagraphs.

- 1.2.4 Scope paragraphs placed at the beginning of the SECTIONS present a brief indication of the principal Work included in that SECTION, but do not limit Work to subject mentioned nor purport to itemize Work that may be included.
- 1.2.5 The Relation of Specifications and Drawings shall be equal in authority and priority. Should they disagree in themselves, or with each other, bids shall be based on the most expensive combination of quality and quantity of work indicated. The appropriate Work, in the event of the above mentioned disagreements, shall be determined by the Architect, at no additional cost to the Owner.
- 1.2.6 Failure to report a conflict in the Contract Documents, prior to opening of Proposal, shall be deemed evidence that the Contractor has elected to proceed in the more expensive manner, at no additional cost to the Owner.
- 1.2.7 The Specifications have been partially "streamlined" and some words and phrases have been intentionally omitted. Missing portions shall be supplied by inference as with notes on drawings.
- 1.2.8 The words "approved", "inspected", "directed", "selected", and similar words and phrases shall be presumed be followed by "Architect". The words "satisfactory", "submitted", "reported", and similar words and phrases shall be presumed to be followed by "to Architect". Words like "install", "provide", "locate", "furnish", and "supply" shall be construed to include complete furnishing and installing of construction. Words like "Bids", "Bidders", may be construed to be "Proposals", "Proposers" or "offers", "offerors", respectively.

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Delete 2.2.5 and replace with the following subparagraph.

- 2.2.5 The General Contractor will be furnished, free of charge, *fifteen (15)* sets of Drawings and Specifications for use in construction of this Project. Additional Drawings and Specifications will be furnished the General Contractor at the Contractor's expense, but shall remain the property of the Architect. Cost of additional sets will be the cost of reproduction. General Contractor shall use one set to be submitted with closing documents as "as-built" set. This set shall reflect as-built conditions as noted in Section 01720 Paragraph 1.01

3.4 LABOR AND MATERIALS

SECTION 00811
SUPPLEMENTARY CONDITIONS

Add the following subparagraphs 3.4.4 and 3.4.5 to 3.4:

- 3.4.4 After the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications), *unless noted otherwise in Section 00100*.
- 3.4.5 By making requests for substitutions based on subparagraph 3.4.4 above, the Contractor:
1. Represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified; Including cost and quality.
 2. Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
 3. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work , and related work, to be complete in all respects at no additional cost to the Owner.

7.3 CONSTRUCTION CHANGE DIRECTIVES /CHANGE ORDERS

7.3.3.1 CHANGE TO READ:

Mutual acceptance of a lump sum properly itemized in accordance with 7.3.6.1, 7.3.6.2 and 7.3.6.3. Items listed in 7.3.6.4 and 7.3.6.5 shall be a part of the overhead scheduled in 7.3.10 following. Items shall be supported by sufficient substantiating data to permit evaluation;

7.3.6 In the first sentence, delete the words "a reasonable allowance for overhead and profit" and substitute "an allowance for overhead and profit in accordance with Clauses 7.3.10.1 through 7.3.10.6 following:

7.3.6.4 DELETE the final "and" then add the following to the sentence: "are a part of overhead scheduled in 7.3.10 following".

7.3.6.5 ADD the following to the sentence: "are a part of overhead scheduled in 7.3.10 following".

ADD the following subparagraph 7.3.10 to 7.3:

- 7.3.10 In subparagraph 7.3.6, the allowance for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:
1. For the Contractor, for Work performed by the Contractor's own forces, 10 percent of the cost.
 2. For the Contractor, for Work performed by the subcontractor, 6 percent of the amount due the Subcontractor.
 3. For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor's or Sub-subcontractor's own forces, 10 percent of the cost.
 4. For each Subcontractor, for Work performed by the Subcontractor's, Sub-subcontractor's, 6 percent of the amount due the Sub-subcontractor.
 5. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.
 6. **In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over \$500.00 be approved without such itemization.**

8.1 DEFINITIONS

Add the following subparagraph.

8.1.5 The term working Day as used in the Contract Documents for extensions of time shall mean normal working day excluding weekends and legal holidays.

8.3 DELAYS AND EXTENSIONS OF TIME

Delete paragraph 8.3.2 and replace with the following subparagraph.

8.3.2 Any claim for extension of time shall be made in writing to the Architect not more than ten (10) days after the commencement of the delay; otherwise, it shall be waived. In case of a continuing delay only one claim is necessary. In case of claims for extensions of time because of adverse weather, such extensions of time shall be granted only when such adverse weather prevented the execution of major items of Work on normal working days and exceeds the number of days included in the Contract time. Claim shall include respective daily construction progress report and construction photographs to support cost of claim. The Contractor shall provide an estimate of the probable effect of such delay on the progress of the Work. In the event an extension of time is granted such extension shall be the complete claim allowed. Contractor shall not be entitled to additional compensation such as, but not limited to, compensable extended overhead or lost profit.

9.6 PROGRESS PAYMENTS

Add the following subparagraph to 9.6.1

.1 Unless otherwise indicated in the Agreement, the Owner will pay ninety-five (95%) percent of the amount due the Contractor on account of progress payments until final payment.

Add the following paragraphs 9.11 to Article 9:

9.11 LIQUIDATED DAMAGES:

9.11.1 If the Contractor neglects, fails or refuses to complete the Work within the time specified in the Contract, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration of the awarding of this Contract, to pay the Owner the amount of **FIVE HUNDRED DOLLARS (\$500.00)** not as a penalty but as liquidated damages for such breach of Contract as hereinafter setforth, for each and every **calendar day** that the Contractor shall be in default after the time stipulated in the Contractor for completing the Work.

9.11.2 The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would, in such event, sustain.

11.1 Article 11.1 Modify to include the following: The last sentence of paragraph 11.1.3

The Contractor shall furnish three (3) copies of insurance certificates to the Architect's office two (2) days after award of the project and before signing of the contract. The Certificate of Insurance shall include thirty (30) Day Notice of Cancellation; Architect and Owner shall receive the same notice in regard to any policy changes.

Owner and Architect shall be named as additional insured by the Contractor but not with respect to payment of premiums due under Contractor's policies. Coverage shall include any off-site work on adjacent public or private property.

Insurance Company/Carrier issuing the certificates must be listed by A.M. Best and have an "A" rating or better and based in the United States Mainland.

The insurance as required in Article 11.1 shall have "Minimum Limits" as follows:

- A. **WORKER'S COMPENSATION INSURANCE:** Statutory Requirements -
 - 1. All States Endorsements (Broad)
 - 2. Voluntary Compensation
 - 3. Waiver of Subrogation Endorsement
- B. **MINIMUM EMPLOYER'S LIABILITY:** \$100,000/\$100,000/\$500,000

C. COMPREHENSIVE GENERAL LIABILITY INSURANCE MINIMUM LIABILITY AND COVERAGE:

1. Bodily Injury \$500,000 each person/\$500,000 each occurrence
2. Property Damage \$100,000 each occurrence/\$100,000 aggregate
- OR - \$500,000 Combined Single Limit Per Occurrence Bodily Injury and Property Damage.
- a. Premises and operations coverage
- b. Explosion and collapse hazard coverage
- c. Underground hazard coverage
- d. Products/completed operation hazard coverage with limits and coverage continuing one(1)year after job completion.
- e. Broad Form property damage coverage
- f. Personal injury coverage
- g. Waiver of subrogation endorsement
- h. Contractual liability (Broad Form) coverage
- i. Independent contractors coverage (Owners, Architects, and Contractors protective)

NOTE: If General Liability coverage is written on a "Claims Made" basis, the Certificate of Insurance should so indicate. If so written, Contractor agrees that coverage so certified beyond job completion and that coverage written will apply to claims made DURING CONSTRUCTION AND FOR ONE (1) YEAR THEREAFTER.

D. AUTOMOBILE LIABILITY INSURANCE with minimum limits of:

1. Bodily Injury: \$250,000 each person/\$500,000 each occurrence
2. Property Damage: \$250,000 each occurrence/\$500,000 Combined Single Limit per Occurrence Bodily Injury and Property Damage.
3. Automobile Liability Insurance shall include coverage for owned, non-owned, and hired vehicles with limits not less than shown above.

E. OWNER'S AND CONTRACTOR'S PROTECTIVE LIABILITY:

1. Bodily Injury \$500,000 Single limit each occurrence
2. Property Damage \$250,000 each occurrence/\$250,000 aggregate

F. UMBRELLA LIABILITY:

Minimum combined single limits **\$2,000,000** with same inception and expiration dates as underlying liability policies and with coverage no less broad than in primary program.

G. BUILDER'S RISK INSURANCE:

The Contractor shall FURNISH, PAY FOR and issue a Certificate of Builder's Risk Coverage to the Owner/Architect in accordance with the General Conditions and Conditions of the Contract.

H. ARTICLE 11.4: PERFORMANCE BOND AND PAYMENT BOND:

Delete in its entirety and substitute the following:

- 11.4.1: Prior to signing of the Contract, the CONTRACTOR, at HIS/HER OWN EXPENSE, shall furnish a Performance Bond, and a Labor and Materials Payment Bond for one hundred (100%) percent of the Contract price on such form and with such sureties as the Owner may approve. **Surety company furnishing the Bond must be listed by A.M. BEST and have an "A" rating or better and be based in the United States Mainland and authorized to provide such bonds on public work in the State of Texas.**

Any Payment Bond and Performance Bond furnished pursuant to the provisions of Art. 5160, Vernon's Texas Civil Statutes, connected with this project, shall be furnished by a corporate surety or corporate or corporate sureties in accordance with Article 7.19-1, Vernon's Texas Insurance Code, that has a stated capital and surplus (as reported by it to the Texas Insurance Commission in its most recent report) that is in excess of ten times the stated amount of the Payment bond or the Performance Bond. Provided however, that if any Payment Bond or any Performance Bond is in an amount in excess of ten percent (10%) of the surety company's capital and

SECTION 00811
SUPPLEMENTARY CONDITIONS

surplus (as reported to the Texas Insurance Commission in its most recent report), as a condition to accepting the bond, the Owner must receive written certification and information, satisfactory in form and substance to the Owner, that the surety company has reinsured the portion of the risk that exceeds ten percent (10%) of the surety company's capital and surplus, with one or more reinsurers who are duly authorized, accredited or trusted to do business in the State of Texas. For the purpose of this requirement, any amount reinsured by any reinsurer may not exceed ten percent (10%) of the reinsurer's capital and surplus (as reported to the Texas Insurance Commission by the reinsurer in its most recent report). In the event there is one or more reinsurer, the surety company must provide all necessary information and certification related to the current financial condition of the surety company and any and all reinsurers required by the Owner, together with copies of all reinsurance contracts with the surety company, before any such Payment Bond and Performance Bond is eligible to be considered acceptable by the Owner.

END OF SECTION

SECTION 00900

ADDENDUM AND MODIFICATIONS

PART 1: GENERAL:

1.01 All issued Addenda and Modifications to the Contract Documents shall be inserted immediately following this page.

1.02 INDEX OF ADDENDA:

No.	Issue Date	General Description
1		
2		
3		
4		
5		
6		

1.03 INDEX OF MODIFICATIONS:

No.	Issue Date	General Description
1		
2		
3		
4		
5		
6		

END OF SECTION

SECTION 01010
SUMMARY OF WORK

PART 1: GENERAL

1.01 GENERAL:

- A. The Work for this Contract comprises of the general construction of **LA VILLA HIGH SCHOOL NEW AGRICULTURAL BARN AND LA VILLA HIGH SCHOOL & ELEMENTARY SCHOOL SITE IMPROVEMENTS FOR LA VILLA INDEPENDENTS SCHOOL DISTRICT** located at *La Villa, Texas*.

1.02 ASSIGNED CONTRACTS:

- A. Relations and responsibilities between Contractor and assigned subcontractors shall be identical to that between Contractor and subcontractors he has selected.
- B. Assigned subcontractors shall furnish to Contractor bonds covering faithful performance of the subcontract work and payment of all obligations thereunder, when Contractor is required to furnish such bonds to Owner.
- C. Employ subcontractors assigned by the Owner for:
1. None

1.03 WORK BY OTHERS:

- A. Work on the Project will be executed concurrent with the Work of this Contract, and which is excluded from this Contract, are as follows:
1. *Utilities and Drainage Contract, beyond project site boundaries, unless otherwise indicated on Drawings.*
 2. *Owner provided and installed F.F.E.*
 3. *Certain alternates, if not accepted, may be bid separately at a later date.*

1.04 CONTRACTOR'S USE OF PREMISES:

- A. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.
- B. Move any stored Products, under Contractor's control, which interfere with operations of the Owner and separate contractor.

1.05 PRE-ORDERED PRODUCTS:

- A. None

1.06 OWNER-FURNISHED PRODUCTS:

- A. Products furnished and paid for by the Owner, described in specification sections:
1. Furniture, Fixtures, and Equipment (FFE): Owner furnished; Owner installed.
- B. Owner's Responsibilities:
1. Arrange and pay for products delivery to the site and installation thereof, in accordance with the construction schedule.
 2. Inspect deliveries.
 3. Submit claims for transportation damage.
 4. Arrange for manufacturer's warranties, bonds, services, inspections, as required.
- C. Contractor's Responsibilities:
1. Protect products from exposure to elements and from damage until Substantial Completion.

END OF SECTION

SECTION 01020
ALLOWANCES

PART 1: GENERAL:

1.01 GENERAL:

- A. Include in the Contract Sum the following allowances and cause the work so covered to be performed in accordance with the Contract Documents.
- B. Refer to Conditions of the Contract for general requirements with regard to allowances. Allowance sum covers materials delivered to the job site only, unless otherwise indicated.
- C. Allowance money may, if required, be returned to the Owner by Change Order for purpose of payment for materials or services specified.
- D. Where allowance is indicated as a cost, this is to establish the quality of material, and Contractor shall be responsible for ascertaining the total quantity required, including waste, necessary to complete the installation.
- E. The amount of each allowance includes:
 - 1. The cost of the Contractor of materials and equipment delivered to the site.
 - 2. All required taxes, unless exempt from State sales tax.
 - 3. Labor required under the allowance, only when labor is specified to be included in the allowance.
 - 4. Respective overhead and profit per Section 00811, Paragraph 7.3.10.
- F. In addition to the amount of each allowance, include in the Contract sum an amount of 6% of the Allowance as Contractor's cost for:
 - 1. Handling at the Site; including unloading, uncrating, and storage.
 - 2. Labor for installation and finishing, except where labor is specified to be a part of the Allowance.
 - 3. Protection from the elements and from damage.
 - 4. Other expenses contemplated or required for stated allowance.
 - 5. Contractor's overhead and profit per Section 00811 paragraph 7.3.10.2.

1.01 CONTINGENCY ALLOWANCE:

- A. Include in the Contract Sum a lump sum CONTINGENCY ALLOWANCE of **SIXTY-FIVE THOUSAND (\$65,000.00) DOLLARS** including respective labor.
- B. At the closeout of Contract, balance of monies remaining in the CONTINGENCY ALLOWANCE and applicable contractor's cost of 6% of the Contingency Allowance balance will be credited to the Owner by Change Order.

1.02 SITE WORK ALLOWANCE:

- A. Include in the Contract Sum a lump sum SITE WORK ALLOWANCE of **TEN THOUSAND (\$10,000.00) DOLLARS** including respective labor.
- B. At the closeout of Contract, balance of monies remaining in the CONTINGENCY ALLOWANCE and applicable contractor's cost of 6% of the Contingency Allowance balance will be credited to the Owner by Change Order.

1.03 STRUCTURAL ALLOWANCE:

- A. Include in the Contract Sum a lump sum STRUCTURAL ALLOWANCE of **FOURTEEN THOUSAND (\$14,000.00) DOLLARS** including respective labor.
- B. At the closeout of Contract, balance of monies remaining in the STRUCTURAL ALLOWANCE and applicable contractor's cost of 6% of the Contingency Allowance balance will be credited to the Owner by Change Order.

END OF SECTION

SECTION 01025 SPECIAL PROVISIONS

IN ALL CASES WHERE THESE SPECIAL PROVISIONS CONFLICT WITH THE TECHNICAL SPECIFICATION SECTIONS OR ANY OTHER DOCUMENT CONTAINED HEREIN, THESE SPECIAL PROVISIONS SHALL GOVERN.

1. The CONTRACTOR shall do all necessary excavation, trenching, demolition, grading, backfill, etc., to complete the project. All excavation is unclassified. All material removed such as concrete, broken pipe, excess backfill, etc., shall become the property of the CONTRACTOR and he shall be responsible for removing it from the site at not extra expense to the OWNER. Existing material, fencing or fixtures deemed salvageable by the ENGINEER or the OWNER shall be carefully removed and hauled to a designated location as directed by the OWNER or ENGINEER at no extra expense to the OWNER.
2. All trees, plants, grass and shrubs, except those which will be affected by construction shall be protected at all times. The areas in and adjacent to the construction site shall be restored to their original conditions after necessary fine grading is completed. The CONTRACTOR shall provide new grass of the same type removed to restore damaged areas. Only quality sandy loam topsoil shall be used for filling the top four inches of those areas damaged or filled.
3. Damages done to existing utilities, power poles, fences, signs, mailboxes, driveways, culverts, pavement, drainage systems, etc. shall be repaired by the CONTRACTOR at no cost to the OWNER, and such costs shall be subsidiary to the various unit items in the Proposal.
4. Existing lawns are to remain intact as far as practical. The CONTRACTOR shall duly restore such areas disturbed as good as or better than original condition using the same type of grass, shrubs, or cover as the original. The CONTRACTOR shall be responsible for correcting any erosion that occurs at his cost without claim for extra compensation.
5. The CONTRACTOR shall be limited only to existing property for operations and/or easements provided by the Owner. The CONTRACTOR at no extra cost to the OWNER will correct any damages done to property outside these designated work areas to its original or better conditions. It is important that the CONTRACTOR be aware of the work limits so that no damage can result to those areas outside these limits.

6. The CONTRACTOR shall submit to the ENGINEER a proposed sequence of work outline with approximate completion dates to be reviewed at the pre-construction conference. It is important that traffic be interrupted at a minimum during construction. If roadways are to be closed or detoured, the CONTRACTOR shall notify the POLICE DEPARTMENT, FIRE DEPARTMENT, EMERGENCY SERVICES, and other interested entities at least 48 hours in advance.
7. The CONTRACTOR shall be responsible for construction staking for the entire project and shall be done in accordance with the Specifications. The OWNER shall provide horizontal and vertical control.
8. The Plans show approximate locations of existing utilities including gas lines, telephone lines, power lines, water lines, sewer lines, storm sewers and irrigation lines within the vicinity. The CONTRACTOR is responsible for locating all existing utilities and shall exercise extreme care in working in the vicinity of these lines. All existing lines, whether belonging to **McAllen PUB** or Private shall remain in operation at all times. Switchover time, re-connecting new service from existing lines or services (if any) shall be kept to a minimum. Contractor shall be responsible for any re-connects, temporary or otherwise, of all water and sanitary sewer lines required to complete the project. Unless otherwise specified, payment for such items shall be subsidiary to all the various items of the bid.
9. The Contractor shall notify the Utility Companies while working in the vicinity of the corresponding private or public utility.
10. The OWNER reserves the right to add or delete quantities of items in the Proposal at the Unit Prices given.
11. The CONTRACTOR is expected to conduct his work in such a manner as to minimize any soil erosion or sediment runoff from the construction site. Earth cuts and fills shall have smooth, flat side slopes, as generally indicated on the Plans, to preclude erosion of the soil. Such operations should be, at all times, consistent with the actual need for doing the work and only to leave raw, unprotected surfaces for a minimum of time.
12. Until acceptance by the ENGINEER of any part of all of the material, as provided for in these

specifications, it shall be under the charge and care of the CONTRACTOR, and he shall take every necessary precaution against injury or damage to any part of the material by action of the elements of from the non-execution of the work. The CONTRACTOR shall rebuild, repair, restore and make good, at his own expense, all injuries or damage to any portion off the material occasioned by any of the above causes before its completion and acceptance.

13. In cases where the CONTRACTOR deems extra compensation is due him for materials not clearly covered in the contract, or not ordered by the ENGINEER as an extra item, the CONTRACTOR shall notify the ENGINEER in writing of his intention to make claim for such extra compensation before he begins the work. The CONTRACTOR shall not proceed until the OWNER, ENGINEER, and CONTRACTOR approves a written CHANGE ORDER. Failure on the part of the CONTRACTOR to give such notification or to afford the ENGINEER proper facilities for keeping strict account of actual cost shall constitute a waiver of the claim for such extra compensation. The filing of such notice by the CONTRACTOR and the keeping of costs by the ENGINEER shall not in any way be construed to prove the validity of the claim. When the work has been completed, the CONTRACTOR shall, within 10 days, file his claim for extra compensation with the ENGINEER.
14. Upon the failure of the CONTRACTOR to repair satisfactorily or to remove and replace, if so directed, rejected, unauthorized, or condemned materials immediately after receiving formal notice from the ENGINEER, the OWNER may recover for such defective materials on the CONTRACTOR'S bond, or by action in a court having proper jurisdiction over such matters, or may employ labor and equipment and satisfactorily repair or remove and replace such work and charge the cost of the same to the CONTRACTOR, which cost will be deducted from any money due him.
15. Contractor is responsible for all traffic control. All proposed routing of traffic must be approved in writing prior to implementation. All traffic control devices shall be in accordance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD), latest edition. Unless specifically indicated in the bid proposal form, cost shall be subsidiary to the various items of the bid.
16. Saw cutting of existing asphalt or concrete for construction joints will be the only accepted method.
17. Mechanical tamping of all backfilling shall be the only accepted method as shown in the typical trench backfill details of the plans.

18. The CONTRACTOR shall warrant all work for a period of not less than one (1) year from the date of final acceptance of the work by the Owner. CONTRACTOR is responsible for scheduling a final inspection in the presence of the OWNER, ENGINEER, and CONTRACTOR, whereupon all items must be in accordance with plans and specifications prior to final acceptance.
19. The CONTRACTOR is responsible for familiarizing himself and following all **City of McAllen** Standard Specifications for those items not specifically shown on the project plans or project specifications.
20. All asphalt pavement repairs shall be completed as per the construction plans and specifications. The CONTRACTOR shall not leave an area requiring repairs in excess of 1,300 square yards or in excess of 30 days, whichever is less. Owner can require immediate asphalt pavement repair should traffic conditions warrant in the opinion of the Engineer or his agent.

SECTION 01045

CUTTING AND PATCHING

PART 1: GENERAL:

1.01 DESCRIPTION:

- A. Contractor shall be responsible for all cutting, fitting and patching, including attendant excavation and backfill, required to complete the Work and to make its several parts fit together properly.

1.02 SUBMITTALS:

- A. Submit a written request to Architect well in advance of executing any cutting or alteration which affects the structural value or integrity of any structural element of the Project. Obtain Architect's approval prior to executing any of the foregoing.

PART 2: PRODUCTS:

2.01 MATERIALS:

- A. Comply with applicable specifications section for each specific product involved.

PART 3: EXECUTION:

3.01 INSPECTION:

- A. Report unsatisfactory or questionable conditions to the Architect in writing; do not proceed with the work until the Architect has provided further instructions.

3.02 PREPARATION:

- A. Provide adequate temporary support as necessary to assure the structural value or integrity of the affected portion of the Work.
- B. Provide devices and methods to protect other portions of the Project from damage.
- C. Provide protection from the elements for that portion of the Project which may be exposed by cutting and patching work, and maintain excavations free from water.

3.03 PERFORMANCE:

- A. Execute cutting by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs.
- B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.
- C. After installation of the Work, carefully fit around, close up, repair, patch and/or point up all such work to match adjoining surface by use of proper tools and materials and by skilled workmen to which the work belongs.
- D. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.
- E. Restore work which has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.
- F. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes. For continuous surfaces, refinish to nearest intersection. For an assembly, refinish the entire unit.

END OF SECTION

SECTION 01050

FIELD ENGINEERING

PART 1: GENERAL:

1.01 GENERAL:

- A. The Contractor shall, at his expense, engage a Texas licensed Surveyor, to locate all surveyor marks, including bench marks in order that the exact lines of the property, building and grades will be determined and verified.
- B. Surveyor shall layout out entire Project prior to start of construction.
- C. On completion of foundation walls and major site improvements, the Surveyor shall furnish a certified plat verifying property lines and building lines in accordance with the plot plan.
- D. Any discrepancies arising in locating the work in respect to property and building lines shall be reported immediately to the Owner and the Architect.
- E. Locate and protect control points prior to starting work, and preserve all permanent reference points during construction. Replace project control points which may be lost or destroyed.
- F. Establish a minimum of two permanent bench marks on the site, referenced to data established by survey control points. Record locations, with horizontal and vertical data, on Project Record Documents.
- G. Establish all construction lines and levels, by instrumentation and similar appropriate means.

END OF SECTION

SECTION 01085

APPLICABLE STANDARDS

PART 1: GENERAL:

1.01 DESCRIPTION:

A. Work Included:

1. Throughout the Contract Documents, reference is made to codes and standards which establish qualities and types of workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics.
2. Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is the Contractor's responsibility to provide materials and workmanship which meet or exceed the specifically named code or standard.
3. It is also the Contractor's responsibility, when so required by the Contract Documents or by written request from the Architect, to deliver to the Architect all required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested in writing by the Architect, and generally will be required to be copies of a certified report of tests conducted by a testing agency approved for that purpose by the Architect.

B. Related Work Described Elsewhere:

Specific naming of codes or standards occurs on the Drawings and in other Sections of these specifications.

1.02 QUALITY ASSURANCE:

A. Familiarity with pertinent codes and standards: In procuring all items used in this work, it is the Contractor's responsibility to verify the detailed requirements of the specifically named codes and standards and to verify that the items procured for use in this work meet or exceed the specified requirements.

B. Rejection of non-complying items: The Architect reserves the right to reject items incorporated into the work which fail to meet the specified minimum requirements. The Architect further reserves the right, and without prejudice to other recourse the Architect may take, to accept non-complying items subject to an adjustment in the Contract Amount as approved by the Architect and the Owner.

C. Applicable standards listed in these specifications include, but are not necessarily limited to, standards promulgated by the following agencies and organizations:

1. AASHTO = American Association of State Highway and Transportation Officials, 341 National Press, Washington, D.C. 20004
2. ACI = American Concrete Institute, Box 19150, Redford Station, Detroit, Michigan 48129
3. AISC = American Institute of Steel Construction, Inc., 1221 Avenue of the American, New York, New York 10020.
4. ANSI = American National Standards Institute (successor to USASI and ASA), 1430 Broadway, New York, New York 10018.
5. ASTM = American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
6. AWS = American Welding Society, Inc., 2501 N.W. 7th Street, Miami, Florida 33125.
7. AWWA = American Water Works Association, Inc., 6666 West Quincy Avenue, Denver, Colorado 80235.
8. CRSI = Concrete Reinforcing Steel Institute, 228 North LaSalle Street, Chicago, Illinois 60610.
9. CS = Commercial Standard of NBS, U.S. Department of Commerce, Government Printing Office, Washington, D.C. 20402.

SECTION 01085
APPLICABLE STANDARDS

10. FGMA = Flat Glass Marketing Association, 3310 Harrison, Topeka, Kansas 66611
11. NAAMM = National Association of Architectural Metal Manufacturers, 1033 South Boulevard, Oak Park, Illinois 60403.
12. NEC = National Electrical Code (see NFPA).
13. NEMA = National Electrical Manufacturers Association, 155 East 44th Street, New York, New York 10017.
14. NFPA = National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210.
15. SDI = Steel Deck Institute, 135 Addison Avenue, Elmhurst, Illinois 60125.
16. SSPC = Steel Structures Painting Council, 4400 5th Avenue, Pittsburgh, Pennsylvania 15213.
17. TCA = Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540.
18. UL = Underwriter's Laboratories, Inc., 207 East Ohio Street, Chicago, Illinois 60611.
19. FED SPECS and FED STANDARDS:
Specifications Sales (3FRI), Bldg. 197, Washington Navy Yard, General Services Administration, Washington, D.C. 20407.
20. INTERNATIONAL BUILDING CODE 2012 or latest edition. 2009 Energy Conservation Code.
21. NATIONAL FIRE PROTECTION ASSOCIATION STANDARDS:/CURRENT EDITION
22. INTERNATIONAL PLUMBING CODE – 2012 or latest edition.
23. ANSI A 17.1, -Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks; and Supplement ANSI A17.1a, current edition.
24. American Society of Heating, Refrigerating and Air Conditionings Engineers ANSI/ASHREA/IES Standard 90.1-2010- Energy Conservation in New Building Design, current edition.
25. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHREA)-Standard No.52- - Methods of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter , current edition.
26. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHREA)-Handbook of Applications, current edition.
27. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHREA)-Handbook of Fundamentals, current edition.
28. American Society for Testing and Materials (ASTM)-Standard No.E 84- Method of Test for Surface Burning Characteristic of Building Materials, current edition.
29. INTERNATIONAL MECHANICAL CODE – 2012 or latest edition.
30. National Bureau of Standards (NBS) (available through GPO - Technical No.#708 - Appendix II, GPO SD Catalog No. C13.45, 708, NTIS COM:72:50062-Inner Laboratory Evaluation of Smoke Density Chamber. Appendix II-Test Method for Measuring the Smoke Generation Characteristics of Solid Materials.
31. Underwriter's Laboratories, Inc. (UL) - Standard No.181, - Factory Made Air Duct Material and Air Duct Connectors.
32. State Purchasing and General Services Commission-Commission's Rules and Regulations for the Elimination of Architectural Barriers.
33. Texas Department of Licensing and Regulation, Texas Architectural Barriers Act.

END OF SECTION

SECTION 01100
ALTERNATES

PART 1 - GENERAL:

1.01 SCOPE:

- A. Quote as additions or deductions to the Base Proposal, Alternates to the various sections of the Work, which may be included in the Contract Price.
- B. Price all Alternates complete, furnished and installed, including taxes, insurance, overhead and profit. Alternates shall be listed in the order shown on Proposal Form and shall be shown as one figure only; that is, the credit and/or extra involved for any one alternate shall have been reconciled into one figure, which can at Owner's option be added to (or deducted from - as the case may be) the Base Proposal, thus deleting or adding the applicable work in Proposal.
- C. Include in the price quoted for each Alternate, any changes required in other Sections as a result of the Alternate.
- D. Refer to the respective Section for complete Specifications of each Alternate.
- E. If an Alternate is accepted, it shall be included as a part of the Contract Documents.

ADD ALTERNATE NO. 1 High School Fencing Work: That amount to add materials and labor to provide high school fencing and related work as indicated on drawings and specifications:

ADD ALTERNATE NO. 1A High School Fencing Work Wrought Iron Fence In lieu of Chainlink Fence: That amount to add materials and labor to provide Wrought Iron Fence in lieu of chainlink fence and related work as indicated on drawings and specifications:

ADD ALTERNATE NO. 2 High School Parking Lot Repaving Work: That amount to add materials and labor to provide the High School parking lot repaving and related work as indicated on drawings and specifications:

ADD ALTERNATE NO. 3 Elementary School Parking Lot Repaving and addition to parking lot Work: That amount to add materials and labor to provide the Elementary School parking lot repaving and addition to parking lot and related work as indicated on drawings and specifications:

END OF SECTION

SECTION 01152
APPLICATIONS FOR PAYMENT

PART 1: GENERAL:

1.01 GENERAL:

- A. Submit Applications for Payment to Architect for each site in accordance with the schedule established by Conditions of the Contract and Agreement Between Owner and Contractor.
- B. Submit applications on original AIA DOCUMENT G702 - Application and Certificate for Payment. Use AIA DOCUMENT G703 for Architect approval of itemized schedule of values. Forms can be downloaded via www.lrgv.org/documents/.
- C. *Application for payment shall also be accompanied by a written notarized statement from the surety confirming that the surety has reviewed the application for payment and approves, without reservation, of its payment by the Owner.*

1.02 PREPARATION OF APPLICATION:

- A. Application Form:
 - 1. Fill in required information, including that for Change Orders executed prior to the date of submittal of application.
 - 2. Fill in summary of dollar values to agree with the respective totals indicated on the continuation sheets.
 - 3. Indicate percentage of retainage for completed work and for stored materials as agreed upon in the Owner-Contractor Agreement.
 - 4. Execute notarized certification with the signature of a responsible officer of the Contract firm.
- B. Continuation Sheets:
 - 1. Fill in total list of all scheduled component items of Work, with item number and the scheduled dollar value for each item.
 - 2. Fill in the dollar value in each column for each scheduled line item when work has been performed or products presently stored.
 - a. Round off values to nearest dollar, or as specified for the Schedule of Values.
 - 3. List any change to Contract Sum or Allowance and description, executed prior to the date of submission, at the end of the continuation sheets unless otherwise agreed upon.
- C. Construction Schedule:
 - 1. **Provide original construction schedule with first application for payment.**
 - 2. **With subsequent applications provide updated construction schedule indicating deviations from original construction schedule.**

1.03 SUBMITTAL PROCEDURE:

- A. Submit three (3) notarized, original AIA – G702 Application and Certificate for Payment to Architect at the times agreed upon in Pre-Construction meeting.
- B. When Architect finds the Application properly completed and correct, he will transmit a certificate of payment to Owner. If an adjustment in the requested amount is made, he will advise the Contractor in writing.

END OF SECTION

SECTION 01153

CHANGE ORDER PROCEDURES

PART 1: GENERAL:

1.01 PROPOSED CHANGES:

- A. Upon discovery of circumstances or conditions leading to the conclusion that a construction change should be made, the Architect will issue a Request for Change Order Proposal (R.F.P.) form.
- B. Any work done by Contractor not authorized by the Owner shall be subject to removal at the Contractor's expense.
- C. Upon determination that a proposed change appears feasible, the Architect will assign a R.F.P. number and log the information. The Architect will then prepare necessary drawings, specifications or descriptions as required for pricing.
- D. The Architect will forward the package to the Contractor for pricing. Typically, ten (10) working days will be allowed for pricing; however, additional time will be allowed for more extensive changes.
- E. **The Contractor shall submit his price proposal along with all required back-up information to the Architect. The submittal shall include separate breakdowns for general contract and subcontract work.**
- F. **The breakdowns shall show materials by quantities and unit prices. Cost including labor, tax, insurance mark-ups, and equipment costs. Overhead and profit shall be shown separately. Quotation shall include all costs. No additional costs will be allowed for a proposed change.**
- G. The Contractor's proposed change quotations will be reviewed by the Architect within a reasonable amount of time, usually not more than ten (10) working days. Conformance with the contract and the proposed change documents, as well as material, labor and equipment quantities and costs, and allowed mark-up percentages will be verified. Requests for additional time will also be evaluated based on the contractor's written evidence submitted along with a revised construction schedule proving impact on final completion date. Lack of such written evidence shall cause the request for time extension to be rejected. In case of differences, discrepancies, errors, etc. the Contractor will take action to obtain necessary revisions or corrections to the quotation.
- H. "Cost of Doing business" items such as, but not limited to, supervision, field and home office expenses, warranty reserve, clean-up, and expendable supplies are a part of the overhead expense and as such shall not be included as a part of the change order proposal.
- I. Bond premiums may be included as an expense item in an additive R.F.P. if also included in a deductive R.F.P. Percentage allowed shall be limited to actual percentage paid by General Contractor to bonding agent. Premiums for subcontractor bonds, if required by General Contractor, shall not be passed on the Owner.
- J. When a price quotation has been considered acceptable, the Architect will forward his recommendations and all back-up information to the Owner. A recommendation either for or against the proposed change will accompany this submittal from the Architect.

1.02 AUTHORIZATION FOR CONSTRUCTION TO PROCEED:

- A. Within a reasonable time, the Owner will notify the Architect whether the change will be implemented. If the change is approved, the Architect will issue a Change Order. The Change Order may be issued, at the Architect's discretion, immediately or in conjunction with several other approved RFP's if considered appropriate.

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL:

1.01 DESCRIPTION:

- A. Contractor shall schedule and administrate monthly or bi-weekly Architect Owner Contractor (AOC) meetings, and special called meeting throughout the progress of the project.
 - 1. Prepare agenda for meetings.
 - 2. Distribute written notice of each meeting and the agenda four (4) working days in advance of meeting date.
 - 3. Make physical arrangements for meetings.
 - 4. Preside at meetings.
 - 5. Record the minutes; include all significant proceedings and decisions.
 - 6. Reproduce and distribute copies of minutes within three (3) working days after each meeting.
- B. Representative of contractors, subcontractors and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.
- C. Architect's and Owner's Representative may attend meetings.

1.02 PRE-CONSTRUCTION MEETING:

- A. Architect shall schedule a Pre-Construction meeting within fifteen (15) days after date of Notice to Proceed.
- B. Location: RIKE-OGDEN-FIGUEROA-ALLEX ARCHITECTS INC.
1007 Walnut Avenue, McAllen, Texas 78501
- C. Attendance:
 - 1. Owner's Representative.
 - 2. Architect and his professional consultants.
 - 3. Contractor's project manager and superintendent.
 - 4. Major Subcontractors.
 - 5. Others as appropriate.

1.03 PROGRESS MEETINGS:

- A. Schedule regular bi-weekly or monthly meetings at a **scheduled time** on an agreed upon date.
- B. Hold called meetings as required by progress of the Work.
- C. Location of the meetings: on site or designated meeting place.
- D. Attendance:
 - 1. Owner representative.
 - 2. Architect and his professional consultants needed.
 - 3. Contractor's project manager and superintendent.
 - 4. Subcontractors and suppliers as appropriate to agenda.
 - 5. Others as appropriate.

END OF SECTION

SECTION 01300
SUBMITTALS AND SUBSTITUTIONS

PART 1: GENERAL:

1.01 DESCRIPTION:

A. Work Included:

1. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by manufacturer's name and catalog numbers, reference to recognized industry and government standards, or description of required attributes and performance.
2. To ensure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data and for their review by the Architect.
3. Make all submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements. Submittals should include cut sheets of original specified items.
4. ***Product substitutions request shall be submitted no later than 7 days prior to opening of Bids (Proposals) as noted in Section 00020.***

B. Related Work Described Elsewhere: Individual requirements for submittals are described in pertinent other Sections of these Specifications.

1.02 QUALITY ASSURANCE:

A. Coordination of Submittals: Prior to each submittal, carefully review and coordinate all aspects of each item being submitted and verify that each item and the submittal for it conforms in all respects with the requirements of the Contract Documents. By affixing the Contractor's signature to each submittal, Contractor certifies that this coordination has been performed. Contractor shall approve all submittals prior to submission to Architect. Contractor shall verify all dimensions and conditions on the job.

B. Certificate of Compliance:

1. Certify that all materials used in the work comply with all specified provisions thereof. Certification shall not be construed as relieving the Contractor from furnishing satisfactory materials if, after tests are performed on selected samples, the material is found to not meet specified requirements.
2. Show on each certification the name and location of the work, name and address of Contractor, quantity and date or dates of shipment or delivery to which the certificate applies, and name of the manufacturing or fabricating company. Certification shall be in the form of letter or company-standard forms containing all required data. Certificates shall be signed by an officer of the manufacturing or fabricating company.
3. In addition to the above information, all laboratory test reports submitted with Certificates of Compliance shall show the date or dates of testing, the specified requirements for which testing was performed, and results of the test or tests.

1.03 SUBMITTALS:

A. Submittals Schedule: Provide submittal schedule with first Application for Payment, and before any items are submitted for approval, submit to the Architect two copies of the schedule described in Article 2.01 of this Section.

SECTION 01300
SUBMITTALS/SUBSTITUTIONS

- B. Certification of Compliance: Upon completion of the Work, and as a condition of its acceptance, submit to the Architect all Certificates of Compliance.
- C. Procedures: Make submittals in strict accordance with the provisions of this Section.

PART 2: PRODUCTS:

2.01 SUBMITTAL SCHEDULE:

- A. General: Compile a complete and comprehensive schedule of all submittals anticipated to be made during progress of the work. Include a list of each type of item for which Contractor's drawings, shop drawings, Certificates of Compliance, material samples, guarantees, or other types of submittals are required. Upon approval by the Architect this schedule will become part of the Contract and the Contractor will be required to adhere to the schedule except when specifically, otherwise permitted. **Submittals will not be processed & reviewed until schedule is received.**
- B. Coordination: Coordinate the schedule with all subcontractors and materials suppliers to ensure their understanding of the importance of adhering to the approved schedule. Coordinate as required to ensure the grouping of submittals as described in Paragraph 3.02 below.
- C. Revisions: Revise and update the schedule on a monthly basis as necessary to reflect conditions and sequences. Promptly submit revised schedule to the Architect for review and comment with each application for payment.
- D. It is the Contractor's responsibility to notify the Architect in writing if and when the submittal not returned from review are going to impact the construction schedule.

2.02 SHOP DRAWINGS AND COORDINATION DRAWINGS:

- A. Shop Drawings:
 - 1. Scale and Measurements: Make all shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the items and its method of connection to the work (construction document drawings shall not be traced, copied or reproduced).
 - 2. Type of Prints Required: Submit two printed copies and one reproducible (vellum) of each submittal.
 - 3. Review of Shop Drawings: All review comments of the Architect will be shown on the reproducible drawings when it is returned to the Contractor. The Contractor shall be responsible for making all copies required for his purpose and distributing them to the subcontractors & suppliers.
 - 4. Failure to submit one printed & one reproducible copy will cause the submittal to be returned unchecked.

2.03 MANUFACTURERS' LITERATURE:

- A. General: Where contents of submitted literature from manufacturers includes data not pertinent to the submittal, **clearly indicate which portion of the contents is being submitted for review. Highlight pertinent information with green highlighter.**
- B. Number of Copies Required: ***Submit number required by the general contractor for construction plus one copy for architect, one copy for consultants, one copy for owner.*** General contractor's copies will be returned to the contractor with all review comments of the architect and respective consultant.

2.04 SAMPLES:

- A. Accuracy of Samples: Samples shall be of the precise article proposed to be furnished.
- B. Number of Samples Required: Unless otherwise specified, submit all samples in the quantity which is required to be returned plus two (2) which will be retained by the Architect.
- C. Reuse of Samples: In situations specifically so approved by the Architect, the Architect's retained sample may be used in the construction as one of the installed items.

2.05 COLORS AND PATTERNS:

- A. Unless the precise color and pattern is specifically described in the Contract Documents, and whenever a choice of color pattern is available in a specified product, submit accurate color and pattern charts to the Architect for review and selection.

2.06 SUBSTITUTIONS:

- A. Approval Required:
 - 1. The Contract is based on the standards of quality established in the Contract Documents.
 - 2. All products proposed for use, including those specified by required attributes and performance, shall require approval by the Architect before being incorporated into the work.
 - 3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Architect.
 - 4. ***Product substitution requests shall be submitted no later than 7 days prior to Opening of Bids (Proposals) as noted in Section 00020.***
- B. "Or Equal":
 - 1. Where the phrase "or equal" or "or equal as approved by the Architect" occurs in the Contract Documents, do not assume that materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this work by the Architect.
 - 2. The decision of the Architect will be final.
 - 3. It is the Contractor's responsibility to compare all aspects of the substitute and prove the substitute is equal.
 - 4. Coordinate submission of submittals with the different submittals related to the parts of Work so that the submittal will proceed according to the submittal schedule.
 - 5. Processing of submittal which contain finishes for selection will not begin until all related submittals are received.

2.07 DEVIATIONS:

- A. Clearly note, in written form, any deviations from the contract documents.

2.08 COMPLIANCE:

- A. Clearly mark specific items which are submitted in compliance with the contract documents.

PART 3: EXECUTION:

3.01 IDENTIFICATION OF SUBMITTALS:

- A. General: Identify each submittal with specification section number and project name. Accompany each submittal with a letter of transmittal containing all pertinent information required for identification and check of submittals.
- B. Internal Identification: On at least the first page of each copy of each submittal, and elsewhere as required for positive identification, clearly indicate the submittal specification section number in which the item was included.
- C. Resubmittals: When material is resubmitted for any reason, transmit under a "REVISED" letter of transmittal and with a "REVISED" submittal specification section number. (e.g.: 03100 becomes 03100R-1)
- D. Submittal Log: Maintain an accurate submittal log for the duration of the Contract, showing current status of all submittals at all times. Make the submittal log available for the Architect's review upon request.

3.02 COORDINATION OF SUBMITTALS:

- A. Coordinate, prepare, and process submittals in accordance with work to be performed.
- B. General: Prior to submittal for approval, use all means necessary to fully coordinate all materials and work task activities including, but not necessarily limited to:
 - 1. Determine and verify all conditions, catalog numbers, and similar data.
 - 2. Coordinate with other trades as required.
 - 3. Clearly indicate all deviations from requirements of the Contract Documents.
- C. Grouping of Submittals: Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying with the provisions of the Contract Documents and the Contractor shall be strictly liable for all delays so occasioned.

3.03 SUBMITTAL SCHEDULE:

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmitted, ordering, manufacturing, fabrication, and delivery when establishing dates.
 - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
 - 2. Material Submittal: Submit all material submittals required to maintain orderly progress of the Work and those required early because of long lead-time for manufacture or fabrication or for final color selection.

3.04 TIMING OF SUBMITTALS:

- A. General: Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery. Allow time for the above tasks in construction submittal schedule.

SECTION 01300
SUBMITTALS/SUBSTITUTIONS

- B. Submittal time schedules: Submittals shall be provided to architect for project based on:
- 3 months to 6 month projected completion 1 month from date of contract for items requiring color selection and 2 months for other items.*
- 7 months to 12 month projected completion 2 months from date of contract for items requiring color selection and 3 months for other items.*
- 13 months to 16 month projected completion 3 months from date of contract for items requiring color selection and 4 months for other items.*
- over 17 months projected completion 4 months from date of contract for items requiring color selection and 5 months for other items.*
- C. Architect's Initial Review Time: In scheduling, allow at least fifteen (15) working days for initial review by the Architect following receipt of the submittal. Items requiring color coordination will be delayed pending receipt of all items that require color coordination and owner approval.
- D. Consultant's review time: In scheduling allow at least (20) work days for initial review of each submittals.
- E. Delays: Delays caused by tardiness in receipt of submittals will not be an acceptable basis for extension of the Contract completion date.

3.05 ARCHITECT'S REVIEW:

- A. General: Review by the Architect shall not be construed as a complete check, but only that the general method of construction and detailing is satisfactory. Review shall not relieve the Contractor from responsibility for errors which may exist.
- B. Authority to Proceed: The notations "**no exception taken**" or "**make corrections noted**" authorize the Contractor to proceed with fabrication, purchase, or both, of the items so noted, subject to the revisions, if any, required by the Architect's review comments.
- C. Revisions: Make all revisions required by the Architect. If the Contractor considers any required revision to be a change, he shall so notify the Architect as provided for under "Changes" in the General Conditions before proceeding with the work. Show each drawing revision by number, date, and subject in a revision block on the drawing. Make only those revisions directed or approved by Architect.
- D. Revisions after Approval: When a submittal has been reviewed by the Architect, resubmittal for substitution of materials, or equipment, will not be considered.

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULE

PART 1: GENERAL:

1.01 CONSTRUCTION SCHEDULE:

- A. The Contractor shall, within thirty (30) working days after Notice to Proceed, prepare and submit to the Owner and Architect for approval, a practicable Work Schedule, showing the order in which the Contractor proposes to carry on the Work and the time at which the several milestone features will be started and completed.
- B. The Contractor shall incorporate into this analysis that work being performed by each subcontractor so that all work involved is shown in the schedule for the complete project.
- C. Activities shown on the schedule shall consist not only of the actual construction operations, but will include also the submittal of shop drawings and samples, procurement of materials and equipment and installation and testing of major and critical items.
- D. Activities of the Owner that affect the progress, such as approvals and the deliveries of Owner-furnished materials shall also be shown.
- E. Related activities shall be grouped on the schedule for simplification. The selection of activities will be subject to approval by the Owner and Architect.
- F. For each activity there shall be listed an earliest and latest start time, the earliest and latest finish time and the slack time.
- G. During progress of the work, any changes in the original schedule desired by the Contractor must be approved by the Owner and Architect before being put into effect.
- H. When changes in the work are required and directed by the Owner and Architect under applicable paragraphs of this Contract, the original schedule may if required, be revised without delay to incorporate such changes, or new work, and indicate the effect, if any, thereof on the Project as a whole. The cost of such schedule change shall be considered as part of the overhead cost of revised work.
- I. If the Contractor falls behind the original Schedule, the Contractor shall take such steps as may be necessary to improve the progress, which may require the contractor to increase the number of shifts, and/or overtime operation, days of work and/or the amount of construction plant, and to submit for approval revised schedules in the form above in order to demonstrate the manner in which the agreed rate of progress will be regained, all without additional cost to the Owner.

END OF SECTION

SECTION 01320

DAILY CONSTRUCTION PROGRESS REPORT

PART 1: GENERAL:

1.01 GENERAL:

- A. The Contractor shall submit to the Architect upon request, Daily Reports, wherein the following data is provided relative to his work and the Work of his Subcontractors:
1. Location and description of work being performed.
 2. Problems, if any, encountered during the course of the day's work.
 3. Number of personnel on job for Contractor and each Subcontractor (broken down as to the number of journeymen, apprentices, etc.).
 4. Temperature and weather conditions.
 5. Report of any accident or accidents that may have occurred during the reporting period.
 6. General description of delivery of material to be stored on site.

END OF SECTION

SECTION 01330

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1: GENERAL:

1.01 RELATED DOCUMENTS:

A. Related Documents:

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

1.02 SUMMARY:

A. This Section includes administration and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittal Schedule.
4. Daily construction reports.
5. Material location reports.
6. Field condition reports.
7. Special reports.
8. Construction photographs.

B. Related Sections include the following:

1. Division 1 Section Schedule of Values for submitting the Schedule of Values.
2. Division 1 Section "Project meetings" for submitting and distributing meeting and conference minutes.
3. Division 1 Section "Submittal and Substitutions" for submitting schedules and reports.
4. Division 1 Section "Testing Laboratory Services" for submitting a schedule of tests and inspections.
5. Division 1 Section "Contract Closeout" for submitting photographic negatives as Project Record Documents at Project closeout.

1.03 DEFINITIONS:

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determined when activities can be performed and the critical path of Project.

C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

- E. Float the measure of leeway in starting and completing an activity.
1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Fragment: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- G. Major Area: A story of construction, a separate building, or a similar significant construction element.
- H. Milestone: A key or critical point in time for reference or measurement.
- I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

1.04 SUBMITTALS:

- A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format.
1. Scheduled date for first submittal.
 2. Specification Section number and title.
 3. Submittal category (action or informational).
 4. Name of subcontractor.
 5. Description of the Work covered.
 6. Scheduled date for Architect's final release or approval.
- B. Contractor's Construction Schedule: The construction schedule shall be in the form of a CPM. Provide the CPM in graphic flow chart format along with reports. Submit two copies of the CPM in printed for and one in reproducible form. Concurrent with CPM schedule, submit three printed copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.
1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of all activities sorted in ascending order of total float.
- C. Daily Construction Progress Reports: Contractor shall maintain a daily log on the site. It shall be available for review by the Architect and Owner at any time during normal working hours.

The Contractor shall submit to the Architect upon request, Daily Reports, wherein the following data is provided relative to the work and the Work of the Subcontractors:

1. Location and description of work being performed.
2. Problems, if any, encountered during the course of the day's work.
3. Number of personnel on job for Contractor and each Subcontractor (broken down as to the number of journeymen, apprentices, etc.).
4. Temperature and weather conditions.
5. Report of any accident or accidents that may have occurred during the reporting period.
6. General description of delivery of material to be stored on site.

SECTION 01330
CONSTRUCTION PROGRESS DOCUMENTATION

- D. Material Location Reports: Should materials be stored off site for which the contractor is requesting payment, a complete inventory of the material shall be made. Each month the off-site inventory continues to be stored off-site then the report shall be maintained including the description of the material, the location of the material and a certification by the General Contractor that he has inventoried and examined the material at the location and certifies to the correctness of the report. The General Contractor shall accompany the Architect each month to verify the inventory prior to the progress payment.

1.05 COORDINATION:

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from parties involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

END OF SECTION

SECTION 01370

SCHEDULE OF VALUES

PART 1: GENERAL:

1.01 SUMMARY:

- A. Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the Work, as specified herein and in other provisions of the Contract Documents.
- B. RELATED WORK:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Preparation and submittal of a Schedule of Values is required by the General Conditions.
 - 3. Schedule of Values is required to be compatible with the "Continuation Sheet" accompanying Applications for Payment, as described in Section 01152.

1.02 SUBMITTAL:

- A. With first Application for Payment, submit a proposed Schedule of Values to the Architect.

1.03 QUALITY ASSURANCE:

- A. Use required means to assure arithmetical accuracy of the sums described.
- B. When so required by the Architect, provide copies of the subcontracts or other data acceptable to the Architect, substantiating the sums described.

END OF SECTION

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1: GENERAL:

1.01 CONSTRUCTION PHOTOGRAPHS:

- A. Construction progress photographs shall be taken once a month with the time, direction of view and vantage points noted, **and submit to architect at monthly construction meeting.**
- B. Photograph from locations to adequately illustrate the condition of construction and the state of the Project.
 - 1. At successive periods of construction, take at least one photograph from the same overall view as previously and other locations to demonstrate the daily activity of construction please submit photos in electronic format in form of DVD.

END OF SECTION

SECTION 01400

TESTING LABORATORY SERVICES

PART 1: GENERAL:

1.01 DESCRIPTION:

- A. Work Included: Testing includes, but is not necessarily limited to:
 - 1. Soil Compaction
 - 2. Concrete
 - 3. Grout
 - 4. Mortar
- B. Related Work Described Elsewhere: Requirements for testing may be described in various specification sections.
- C. Testing Laboratory: The Testing Laboratory will be selected & paid by the **Owner**.

1.02 QUALITY ASSURANCE:

- A. Qualifications of testing laboratory: The laboratory will be qualified in accordance with ASTM E-329-70 "Recommended Practice for Inspection and Testing Agencies for Concrete and Steel Used in Construction".
- B. Codes and Standards: (Testing) In accordance with pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

1.03 PRODUCT HANDLING:

- A. Promptly process and distribute test reports and related instructions to assure necessary retesting and/or replacement of materials with least possible delay in work.

PART 2: PRODUCTS:

2.01 PAYMENT FOR RETESTING SERVICES:

- A. Retesting: When initial tests indicate non-compliance with Contract Documents, subsequent retesting shall be performed by the same laboratory and costs borne by Contractor.

2.02 CODE COMPLIANCE TESTING:

- A. Inspections and test required by codes or ordinances, or by plan approval authority, and made by a legally constituted authority, shall be the responsibility of, and shall be paid for, by the Contractor.

2.03 CONTRACTOR'S CONVENIENCE TESTING:

- A. Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

PART 3: EXECUTION:

3.01 COOPERATION WITH TESTING LABORATORY:

SECTION 01400
TESTING LAB SERVICES

- A. Representative of testing laboratory shall have access to Work at all times; provide facilities for such access in order that laboratory may properly perform its functions.

3.02 SCHEDULES FOR TESTING:

- A. Establishing Schedule:
1. Determine with laboratory, time required to perform tests and issue findings.
 2. Provide required time in construction schedule.
- B. Revising Schedule: Coordinate changes of schedule with laboratory as required. Testing Laboratory shall provide a twenty-four (24) hour phone number to enable the Contractor to revise the schedule at times other than regular business hours.
- C. Adherence to Schedule: When laboratory is prevented from testing or taking specimens according to the determined schedule due to incompleteness of work, extra costs attributable to delay may be backcharged to Contractor and not borne by Owner.

3.03 TAKING SPECIMENS:

- A. Testing Laboratory shall perform the following services:
1. Take samples and specimens.
 2. Furnish sampling equipment and personnel.
 3. Deliver specimens and samples to laboratory.

END OF SECTION

SECTION 01510

TEMPORARY UTILITIES

PART 1: GENERAL:

1.01 SCOPE:

- A. Furnish, install and maintain temporary utilities required for construction; remove on completion of Work.

1.02 TESTING:

- A. All power, water, light or heat required for testing of Architectural, Structural, Mechanical and Electrical Work shall be paid for by the Contractor.

1.03 REQUIREMENTS OF REGULATORY AGENCIES:

- A. Comply with National Electric Code.
- B. Comply with Federal, State and local codes and regulations and with utility company requirements.

PART 2: PRODUCTS:

2.01 MATERIALS, GENERAL:

- A. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING:

- A. Provide connections and temporary metering, size to provide services required for power and lighting; Contractor shall pay for the costs of power used for construction.
- B. Install ground fault interrupting circuit(s) and branch wiring, with area distribution boxes located so that power and lighting is available throughout the construction by the use of construction-type power cords.
- C. Provide adequate artificial lighting for all areas of work when natural light is not adequate for work.
- D. Each Sub-contractor shall provide it's own extension cords and any additional lighting that may be required to complete it's work.
- E. Prior to final inspection remove temporary lamps and install new lamps if permanent fixtures were used for temporary lighting.

2.03 TEMPORARY HEAT AND VENTILATION:

- A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature or humidity.
- B. Provide adequate forced ventilation of enclosed areas for curing of installed materials to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.

SECTION 01510
TEMPORARY UTILITIES

- C. Portable heaters shall be standard U.L. approved units complete with controls. Pay all costs of installation, maintenance, operation and removal, and for fuel consumed.

2.04 TEMPORARY TELEPHONE SERVICE:

- A. Arrange with local telephone service company, provide direct line telephone service at the construction site for the use of personnel and the Architect.
- B. List telephone with information operator in the name of the Project and in the name of the Contractor.
- C. Pay all costs for installation, maintenance and removal, and service charges for local calls. Contractor may install a pay telephone for sub-contractors use.

2.05 TEMPORARY WATER:

- A. General Contractor shall provide water at site for construction purposes; General Contractor will pay costs of water used for construction.
- B. General Contractor shall provide potable drinking water at the site.

2.06 TEMPORARY SANITARY FACILITIES:

- A. Provide and maintain adequate temporary outside toilet facilities for use of persons working at the Site, same shall be padlocked at all times when no construction personnel are on Site.
- B. Keep toilets clean and in sanitary condition. Provide toilet tissue in suitable holders. Comply with applicable legal, health and OSHA requirements.

2.07 TEMPORARY FIRE PROTECTION:

- A. Observe and enforce throughout the work during the whole period of construction all requirements of the local City and State Fire Marshal and Insurance Authorities to minimize the fire hazard during the progress of the work.

PART 3: EXECUTION:

3.01 GENERAL:

- A. Comply with applicable requirements specified in Division 15 - Mechanical, and in Division 16 - Electrical.
- B. Maintain and operate systems to assure continuous service.
- C. Modify and extend systems as work progress requires.

3.02 REMOVAL:

- A. Completely remove temporary materials and equipment when their use is no longer required.
- B. Clean and repair damage caused by temporary installation or use of temporary facilities.
- C. Restore permanent facilities used for temporary services to specified condition.

END OF SECTION

SECTION 01520
CONSTRUCTION AIDS

PART 1: GENERAL:

1.01 SCOPE:

- A. Furnish, install and maintain temporary personnel, traffic and materials handling facilities required for construction; remove on completion of Work.

1.02 REQUIREMENTS OF REGULATORY AGENCIES:

- A. Comply with Federal, State and local codes and regulations and with utility company and insurance agencies' requirements.

PART 2: PRODUCTS:

2.01 MATERIALS, GENERAL:

- A. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.
- B. Provide and maintain signs to prevent damage or injury. Surround site with signs warning of construction hazards at intervals not greater than 200' apart.
- C. Should it become necessary to remove runways, safety handrails, or other safety items it will be that Contractor's responsibility to replace the runway, safety handrails, or other safety items, immediately in keeping with OSHA standards.
- D. Pay all costs for installation, maintenance relocation and removal, and service charges for rented equipment.

2.02 SCAFFOLDING:

- A. Erect and maintain in a safe manner scaffolding, ramps, runways, platforms, guards, rails, stairs and ladders as necessary for the work.

2.03 LIFTING AND HOISTING:

- A. Provide hoists, temporary elevators, lifts, cranes and towers necessary for expediting the handling of materials.
- B. Install lifting and hoisting equipment to meet applicable safety requirements.

2.04 PUMPING AND DRAINING:

- A. Keep working and storage areas free from water that could cause damage or that would interfere with work.
- B. Do not pump or drain water onto adjacent property. Distribute discharge to prevent excessive erosion.

PART 3: EXECUTION:

3.01 GENERAL:

- A. Maintain and operate systems to assure continuous service.
- B. Modify and extend systems as work progress requires.

3.02 REMOVAL:

- A. Completely remove temporary materials and equipment when their use is no longer required.
- B. Clean and repair damage caused by temporary installations or use of temporary facilities.
- C. Restore permanent facilities used for temporary services to specified condition.

END OF SECTION

SECTION 01530

BARRIERS

PART 1: GENERAL:

1.01 FENCING AND BARRICADES:

- A. Provide proper and adequate barricades, runways, safety handrails, fencing or other safety items to protect and provide access in or around the site by other than construction personnel. Non construction personnel must be accompanied by general contractor, architect or architect representative, owner or owner representative.
- B. Provide all vertical shafts with safe, temporary railings and supports, adequately braced.
- C. Cover trenches and holes when not in use. Erect barriers at sharp changes in plane more than 3 feet high.

1.02 CONSTRUCTION SCREEN FENCE:

- A. Provide a construction fence around the structure and material storage areas to prevent unauthorized entry to the construction site.
- B. Install fence at the beginning of excavation operations and maintain in good condition until removal is approved by the Architect.
- C. Unless otherwise required by local codes or ordinances, construct wire mesh fence a minimum of 6'-0" high with securely anchored line, corner and gate posts. Windscreen shall be: Polyester fabric scrim with grommets for attachment to chain link fence.
- D. Provide a minimum number of gates which will be padlocked shut during nonworking hours.
- E. Locate pedestrian entrance gates as required to provide controlled personnel entry, in suitable relation to construction parking facilities.

1.03 REMOVAL:

- A. Completely remove barricades and other safety barriers including foundations, when construction has progressed to the point that they are no longer needed, and when approved by Architect.
- B. Clean and repair damage caused by installation, fill and grade the areas of the Site to required elevations and slopes, and clean the area.

END OF SECTION

SECTION 01580

PROJECT SIGN

PART 1: GENERAL:

1.01 PROJECT SIGN:

- A. Install and maintain one (1) project sign, located as directed, 8 feet by 8 feet.
- B. Construct sign of metal or 3/4" thick exterior grade plywood.
- C. Support sign on a minimum of two 4x4 posts securely embedded and braced to resist wind load.
- D. Letter sign with project data, including: *name of project, Owner representatives, Architect, Engineers and Contractor.*
- E. Provide vinyl 3M printed surface, Architect to provide a digital image.
- F. The Architect will prepare a Drawing indicating lettering, layout and location of the sign.
- G. No other signs or advertising will be permitted on the Site except as noted below.
2 foot x 4 foot signs with contractor's name may be used for directing material delivery or directing of construction traffic or for other safety issues.
- H. Maintain sign in good condition for the duration of the job.

END OF SECTION

SECTION 01600
MATERIAL AND EQUIPMENT

PART 1: GENERAL:

1.01 MANUFACTURER'S INSTRUCTIONS:

- A. When Contract Documents require that installation of work shall comply with manufacturer's instructions, obtain and distribute copies of such instructions to parties involved in the installation, including three (3) copies to the Architect.
 - 1. Maintain one set of complete instructions at the job site during installation and until completion.
- B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.
 - 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Architect for further instructions.
 - 2. Do not proceed with work without clear instructions.
- C. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.02 DELIVERY OF MATERIALS:

- A. All materials shall be delivered in their original, unopened, containers which shall bear the seal, trademark or hallmark of the respective associations or councils and the identification label of the manufacturer.
- B. The Contractor shall inspect all materials upon their arrival at the job and see that they conform to the requirements of these Specifications and prevent the unloading of unsatisfactory material or promptly remove same from the premises without waiting instruction from the Architect to do so.
- C. Time deliveries and unloading to prevent traffic congestion and blocking of access, and to avoid interferences and delays in work.
- D. Provide for continuity of any phase of work. Sufficient quantities for completion of a phase shall be on the Project Site before that phase is started.
- E. Pack and handle materials to prevent damage during delivery. Store materials at designated locations to avoid interference with work and arrange in order of intended use.

1.03 STORAGE AND PROTECTION:

- A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
 - 1. Store products subject to damage by the elements in weathertight enclosures.
 - 2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
- B. Exterior Storage:
 - 1. Store fabricated products above the ground, on blocking or skids, to prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.
 - 2. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
- D. After installation provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

END OF SECTION

SECTION 01631

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1: GENERAL:

1.01 SUBSTITUTIONS:

- A. Bids or proposals shall be based upon providing the specified materials, processed products, persons or organizations, etc., identified in this Specification and/or indicated on the Drawings.
- B. Product substitution requests shall be submitted no later than 7 days prior to Opening of Bids (Proposals) as noted in Section 00020.**
- C. The burden of proof of equality rests with the Contractor, and supporting technical literature, samples, drawings and performance data must be submitted with each request for substitutions.
- D. The Owner and/or Architect reserve the right to accept or reject proposed substitutions. Each request shall state the amount of savings to the Owner, if the substitution is approved.
- E. Cost of any testing required for analysis of proposed substitution shall be paid for by the Contractor at a testing agency selected and approved by the Architect.
- F. Should a substitution be accepted, the Contractor shall be responsible to make all necessary adjustments in the Work which may be affected as a result of the substitution at no additional cost to the Owner.
- G. Should a substitution be accepted and this substitution prove to be defective within the one year guarantee period, the Contractor shall replace the substituted material with that specified and bear the costs incurred thereby.

1.02 PRODUCT OPTIONS:

- A. Contractor's Options:
 - 1. For Products specified only by reference standard, select any product meeting that standard.
 - 2. For Products specified by naming several products or manufacturers, select any one of the products, or manufacturer's names, which complies with the Contract Documents.
 - 3. For Products specified by naming only one Product or manufacturer, Contractor must submit a request as for substitutions for any Product or manufacturer not specifically named.
 - 4. For Products specified by naming only one Product and manufacturer and indicated as "no substitute", there is no option.
- B. Submit a separate request for each Product Substitution, supported with complete data, with drawings and samples as appropriate, including:
 - 1. Comparison of the qualities of the proposed substitution with that specified.
 - a. Cutsheets & supporting data of specified product.
 - b. Cutsheets & supporting data of proposed product substitution.
 - 2. Changes required in other elements of the work because of the substitution.
 - 3. Effect on the Construction Schedule.
 - 4. Cost data comparing the proposed substitution with the Product specified.
 - 5. Any required license fees or royalties.
 - 6. Availability of maintenance service, and source of replacement materials.

SECTION 01631
SUBSTITUTIONS AND PRODUCT OPTIONS

- C. A request for a substitution constitutes a representation that Contractor:
1. Has investigated the proposed Product and determined that it is equal to or superior in all respects to that specified.
 2. Will provide the same warranties or bonds for the substitution as for the Product specified.
 3. Will coordinate the installation of an accepted substitution into the Work, and make such other changes as may be required to make the Work complete in all respects.
 4. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
- D. Architect will review requests for substitutions with reasonable promptness, and notify Contractor, in writing, of the decision to accept or reject the requested substitution.

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART 1: GENERAL:

1.01 REQUIREMENTS:

- A. Comply with requirements stated in Conditions of Contract and in Specifications for administrative procedures in closing out the Work.
- B. Related requirements in other parts of the Project Manual:
 - 1. Fiscal provisions, legal submittals and additional administrative requirements: Conditions of the Contract.
- C. Related requirements specified in other Sections:
 - 1. CLEANING: Section 01710.
 - 2. PROJECT RECORD DOCUMENTS: Section 01720
 - 3. OPERATING AND MAINTENANCE DATA: Section 01730
 - 4. WARRANTIES AND BONDS: Section 01740
 - 5. CONTRACTOR'S ASBESTOS FREE AFFIDAVIT: Section 01800
- D. General Contractor to provide the following:
 - 1.) 5 DVD sets containing PDF files, organized in a PDF portfolio, containing all pertinent information in this section and related sections. File naming and organization should be as per Rike Ogden Figueroa Allex Architect's Closeout Document - Electronic Submission Form (attached).
 - 2.) 1 Set of hard copies in binders divided into tab sections organized and named in the same way as folders are in the electronic submissions.
 - 3.) AS-BUILT drawings and specifications incorporating all addenda's, approved change proposals/change orders, Architectural Supplemental Instructions (ASI), and Request For Information (RFI).

1.02 SUBSTANTIAL COMPLETION:

- A. When Contractor considers the Work is substantially complete, he shall submit to Architect, written notice that the Work, or designated portion thereof, is substantially complete and include a list of items (Contractor's punchlist) that have already been addressed.
- B. Within 10 working days of receipt of such notice, Architect will review the work to determine the status of completion.
- C. Should Architect determine that the work is not substantially complete:
 - 1. Architect will promptly notify the Contractor in writing, giving the reasons therefore including list of items to be completed or corrected.
 - 2. Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Architect.
 - 3. Architect will re-review the Work.
- D. When Architect concurs that the Work is substantially complete, the architect will:

SECTION 01700
CONTRACT CLOSEOUT

1. Prepare a Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected, as verified and amended by the Architect.
2. Submit the Certificate to Owner and Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

1.03 CONTRACTOR CERTIFICATION OF FINAL COMPLETION:

- A. When Contractor considers the Work is complete, he shall submit **written certification** that:
1. Contract Documents have been reviewed.
 2. Work has been inspected for compliance with Contract Documents.
 3. Work has been completed in accordance with Contract Documents.
 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
 5. Work is completed.
- B. Architect will review the work to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should Architect consider that the Work is incomplete or defective:
1. Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.
 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the Work is complete.
 3. Architect will re-inspect the Work.
- D. When the Architect finds that the Work is acceptable under the Contract Documents, the architect shall request the Contractor to make closeout submittals.

1.04 RE-REVIEW FEES:

- A. Should Architect perform re-review due to failure of the Work to comply with the claims of status of completion made by the Contractor:
1. Owner will deduct the amount of such compensation from the final payment to the Contractor, for re-review compensation to architect.

1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS:

- A.) List of all subcontractors and suppliers organized by specification section
- B.) Contractor's Release of Lien
Provide AIA Document G707 and G706A
- C.) Subcontractor's release of liens waiver.
- D.) One Year Warranties – General and Subcontractors
- E.) Meeting Notes: Refer to requirements of Section 1720 – Project Record Documents
- F.) Submittals organized by specification section: Refer to requirements of Section 1720 – Project Record Documents
- G.) Construction Photographs organized by month: Refer to requirements of Section 1720 – Project Record Documents

- H.) All City and/or County Inspections
- I.) All Substantial Completion & Punchlists
- J.) All Certificate of Occupancy
- K.) Contractor's Asbestos Free Affidavit Letter: Refer to requirements of Section 1800 – General Notes
- L.) Keying Schedule: Refer to requirements of Section 08710 - Finish Hardware
- M.) Training Sign-In Sheets with signatures of attendees
- N.) HVAC Test and Balance Report
- O.) Product Warranties organized by specification section: Refer to requirements of Section 1740 Warranties and Bonds
- P.) Operating and Maintenance Data organized by specification section: Refer to requirements of Section 1730 – Operating and Maintenance Data
- Q.) Material Testing: Refer to requirements of Section 1720 – Project Record Documents
- R.) Material Safety and Data Sheets (MSDS) of products organized by specification section.

1.06 FINAL ADJUSTMENTS OF ACCOUNTS:

- A. Submit a final statement of accounting to Architect. Statement shall reflect all adjustments to the Contract sum:
 - 1. The original Contract sum.
 - 2. Additions and deductions resulting from:
 - a} Previous change orders.
 - b} Allowances.
 - c} Unit Prices.
 - d} Deductions for uncorrected work.
 - e} Deductions for re-review payments.
 - f} Other adjustments.
 - 3. Total Contract sum, as adjusted.
 - 4. Previous payments.
 - 5. Sum remaining due.
- B. Architect will prepare a final Change Order, reflecting approved adjustments to the Contract sum, which were not previously made by Change Orders.

1.07 FINAL APPLICATION FOR PAYMENT:

- A. Contractor shall submit the final Application for Payment, labeled as Final, and in accordance with procedures and requirements stated in the Conditions of the Contract.

1.08 CLOSEOUT DOCUMENTS – ELECTRONIC SUBMISSION FORMAT:

A. Contractor shall submit 5 DVD's, each DVD with the following information and format:

Folder Name: 01 List of Subcontractors

- Filename: *List of Subcontractors.pdf*

Folder Name: 02 Contractor's Payment and Release of Liens

- Filename: *AIA – G706A Contractor's Affidavit of Release of Liens.pdf*
- Filename: *AIA-G707 – Consent of Surety to Final Payment Form.pdf*

Folder Name: 03 Subcontractor's payments & release of liens waiver.

- Filename: *Release of Lien – Company Name.pdf*

Examples:

Release of Lien - EMI

Release of Lien - D&J Site Utilities

Conditional Release of Liens are acceptable when retainage is still pending. Conditional release should explicitly say release of liens upon receiving retainage.

Folder Name: 04 One Year Warranties – General and Subcontractors

- Filename: *One Year Warranty – Company Name.pdf*

Examples:

One Year Warranty – Spawglass.pdf

One Year Warranty – D&J Site Utilities.pdf

Folder Name: 05 Meeting Notes

- Filename: Date – *Meeting Agenda.pdf*
- Filename: Date – *Meeting Notes.pdf*

Examples:

2016.03.03 – Meeting Agenda.pdf

2016.03.03 – Meeting Notes.pdf

Folder Name: 06 Submittals

- Filename:
Specification Number – Specification Name – Shop Drawings.pdf
Specification Number – Specification Name – Data Sheets.pdf

Examples:

08740 – Access Control Systems – Shop Drawings.pdf

11131 – Motorized Projection Screens – Data Sheets.pdf

Folder Name: 07 Construction Photographs

Note: All photos need to be submitted in .JPG format.

Sub-Folder: Year - Month

- Filename of photograph: Year – Month – Date - #.jpg

Examples:

2016 – 03 – 01 – Photo 1.jpg

2016 – 03 – 01 – Photo 2.jpg

Folder Name: 08 City – County Inspections

- Filename: *Inspection - Type.pdf*

Examples:

Inspection - Underground Plumbing.pdf

Folder Name: 09 Substantial Completion & Punchlists

- Filename: *Substantial Completion.pdf*
If more than one Substantial Completions are used in the project, such as different buildings, file naming should be as follows:
- Filename: *Substantial Completion – Building Name.pdf*
Building Name is the actual name of the building
Examples:
Substantial Completion – Administration.pdf
Substantial Completion – Gymnasium.pdf
- Filename: *Punchlist - Entity.pdf*
Entity is the actual name of the entity performing the punchlist
Examples:
Punchlist – Architect.pdf
Punchlist – Owner.pdf
Punchlist – MEP.pdf

Folder Name: 10 Certificate of Occupancy

- Filename: *Certificate of Occupancy.pdf*
If more than one Certificate of Occupancies are used in the project, such as different buildings, file naming should be as follows:
- Filename: *Certificate of Occupancy – Building Name.pdf*
Building Name is the actual name of the building
Examples:
Certificate of Occupancy – Administration.pdf
Certificate of Occupancy – Gymnasium.pdf

Folder Name: 11 Contractor's Asbestos Free Affidavit Letter

- Filename: *Contractor's Asbestos Free Affidavit.pdf*

Folder Name: 12 Keying Schedule

- Filename: *Keying Schedule.pdf*
Provide date of key transfer meeting.

Folder Name: 13 Training

- Filename: *Specification Number – Specification Name – Sign-In.pdf*
Examples:
08740 – Access Control Systems – Sign-in.pdf
11131 – Motorized Projection Screens – Sign-in.pdf
15950 – Building Automatic Controls – Sign-in.pdf

Folder Name: 14 HVAC Test and Balance Report

- Filename: *Project Name – HVAC Test and Balance Report.pdf*

Folder Name: 15 Product Warranties

- Filename: *Specification Number – Specification Name – Warranty.pdf*
Examples:
07535 – Fully Adhered Multi-Ply Roofing System - Warranty.pdf
15732 – Rooftop Units – Warranty.pdf

Folder Name: 16 Operating and Maintenance Data.

- Filename: *Specification Number – Specification Name – Maintenance or Manual.pdf*

Examples:

10100 – Markerboards and Tackboards – Maintenance.pdf

15732 – Rooftop Units – Operating Manual.pdf

Folder Name: 17 Material Testing

Note: Please use sub-folders to separate different tests, such as compaction, concrete, grout, welding, asphalt, etc.

Sub-Folder: Compaction

- Filename as per testing laboratory

Sub-Folder: Concrete Breaks

- Filename as per testing laboratory

Sub-Folder: Grout

- Filename as per testing laboratory

Folder Name: 18 Material Safety and Data Sheets

- Filename: *Specification Number – Specification Name – MSDS.pdf*

Examples:

09260 – Gypsum Drywall – MSDS.pdf

09300 - Tiling – MSDS.pdf

Sample Folder Hierarchy



END OF SECTION

SECTION 01710
CLEANING

PART 1: GENERAL:

1.01 DESCRIPTION:

- A. Execute cleaning, during progress of the Work, and at completion of the Work, as required by General Conditions.

1.02 DISPOSAL REQUIREMENTS:

- A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2: PRODUCTS:

2.01 MATERIALS:

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3: EXECUTION:

3.01 DURING CONSTRUCTION:

- A. Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by his operations or his subcontractor's operations. Oversee cleaning and ensure that building and grounds are maintained free from accumulations of waste materials and rubbish.
- B. At reasonable intervals during progress of work, clean up site, building and access, and dispose of waste materials, rubbish and debris. Provide containers and locate on site for collection of waste materials, rubbish and debris. Do not allow waste materials, rubbish and debris to accumulate and become an unsightly or hazardous condition.
- C. Transport waste materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces. Sprinkle dusty debris with water.
- D. Burning or burying of rubbish and waste materials on the project site is not permitted. Disposal of volatile fluid wastes (such as mineral spirits, oil, or paint thinner) in storm or sanitary sewer systems is not permitted. Remove waste materials, rubbish and debris from the site and legally dispose of at public or private dumping areas off the Owner's property.
- E. Contractor shall coordinate efforts to properly protect new and existing material from damage by ongoing construction work.

3.02 FINAL CLEANING:

- A. At completion of construction and just prior to acceptance or occupancy conduct a final inspection of exposed surfaces. Perform final cleaning and maintain cleaning until building, or portion thereof, is accepted by Owner.
- B. Remove dirt stains, labels, fingerprints and other foreign materials from surfaces. Repair marred surfaces to match adjacent finishes.
- C. Remove all waste materials and rubbish from and about the Project as well as all tools, construction equipment, machinery and surplus materials.

END OF SECTION

SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1: GENERAL:

1.01 GENERAL:

- A. Maintain at the site for the Owner one record copy of:
 - 1. Drawings
 - 2. Specifications
 - 3. Addenda
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Architect/Engineer Field Orders or written instructions.
 - 6. Approved Shop Drawings, Product Data and Samples.
 - 7. Field Test records.
 - 8. Construction photographs.
 - 9. Meeting Reports.
- B. The Contractor shall use one set of Construction Drawings provided to the Contractor at the time construction is commenced. These Drawings shall be marked-up by each Contractor, throughout the construction period, indicating all changes, revisions and additions to the Work, including field relocations of work concealed from view.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES:

- A. Store documents and samples in Contractor's field office apart from documents used for construction.
 - 1. Provide files and racks for storage of documents.
 - 2. Provide locked cabinets or secure storage space for storage of samples.
- B. File documents and samples in accordance with Data Filing Format of the Uniform Construction Index.
- C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
- D. Make documents and samples available at all times for view by Architect.

1.03 RECORDING:

- A. Label each document "PROJECT RECORD" in neat large printed letters.
- B. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.
- C. Drawings: Legibly mark to record actual construction:
 - 1. Depths of various elements of foundation in relation to finish first floor datum.
 - 2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
 - 4. Field changes of dimension and detail.
 - 5. Changes made by Field Order, Architectural Supplemental Instructions, Request for Information, Addenda, Construction Change Directive or by Change Order.
 - 6. Details not on original Contract Drawings.
- D. Specifications and Addenda: Legibly mark each Section to record:
 - 1. Manufacturer, trade name, catalog number, and supplier of each Product and item of equipment actually installed.
 - 2. Changes made by Field Order, Architectural Supplemental Instructions, Request for Information, Addenda, Construction Change Directive or by Change Order.

1.04 SUBMITTAL:

- A. At the completion of work, Contractor shall certify, by endorsement thereof, that each of the revised drawings is complete and accurate. Prior to Contractor's application for final payment, and within forty-five {45} days of final acceptance of all the work by the Owner, unless otherwise modified by the Contract Agreement, and as a condition of acceptance by the Owner, Contractor shall deliver the certified Record Documents to the Architect for transmittal to the Owner.

END OF SECTION

SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1: GENERAL:

1.01 INFORMATION DATA:

- A. Compile Manufacturer's Directions and Manuals, Product Data and related information appropriate for Owner's maintenance and operation of product furnished under the Contract.
 - 1. Furnish operating and maintenance data as specified in other pertinent sections of Specifications.
- B. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

1.02 FORM OF SUBMITTALS:

- A. Prepare data in the form of an instructional manual for use by Owner's personnel.
- B. Provide indexed tabs fly-leaf for each separate product, or each piece of operating equipment. Provide typed description of product and major component parts of equipment.
- C. Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS".
- D. Bind in and identify in DVD PDF files, organized in a PDF portfolio with index.
- E. When multiple binders are used, correlate the data into related consistent groupings.

1.03 CONTENT OF MANUAL:

- A. Neatly typewritten table of contents for each volume, arranged in a systematic order.
 - 1. Contractor, name of responsible principal, address and telephone number.
 - 2. A list of each product required to be included, indexed to the content of the volume.
 - 3. List with each product, the name, address and telephone number of:
 - a. Subcontractor or installer.
 - b. Maintenance contractor, as appropriate.
 - c. Identify the area of responsibility of each.
 - d. Local source of supply for parts and replacement.
 - 4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
- B. Product Data: Include only those sheets which are pertinent to the specific product. Annotate each sheet to:
 - 1. Clearly identify the specific product or part installed.
 - 2. Clearly identify the data applicable to the installation.
 - 3. Delete references to inapplicable information.
- C. Drawings: Supplement product data with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.
 - 1. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - 2. Do not use Project Record Documents as maintenance drawings.

- D. Written text, as required to supplement product data for the particular installation:
 - 1. Organize in a consistent format under separate headings for different procedures.
 - 2. Provide a logical sequence of instructions for each procedure.
- E. Copy of each warranty, bond and service contract issued. Provide information sheet for Owner's personnel, give:
 - 1. Proper procedures in the event of failure.
 - 2. Instance which might affect the validity of warranties or bonds.

1.04 MANUAL FOR MATERIALS AND FINISHES:

- A. Submit in electronic file complete manual in final form and document in respective division.
- B. Content, for architectural products, applied materials and finishes:
 - 1. Manufacturer's data, giving full information on products.
 - 2. Instructions for care and maintenance.
- C. Content, for moisture-protection and weather-exposed products:
 - 1. Manufacturer's data, giving full information on products.
- D. Additional requirements for Maintenance Data: the respective sections of Specifications.

1.05 MANUAL FOR EQUIPMENT AND SYSTEMS:

- A. Submit in electronic file complete manual in final form and document in respective division.
- B. Content, for each unit of equipment and system, as appropriate:
 - 1. Description of unit and component parts.
 - 2. Operating procedures.
 - 3. Maintenance procedures.
 - 4. Servicing and lubrication schedule.
 - 5. Manufacturer's printed operating and maintenance instructions.
 - 6. Description of sequence of operation by control manufacturer.
 - 7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 8. As-installed control diagrams by controls manufacturer.
 - 9. Each contractor's coordination drawings.
 - 10. Charts of valve tag numbers, with the location and function of each valve.
 - 11. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
 - 12. Other data as required under pertinent sections of specifications.
- C. Content, for each electric and electronic system, as appropriate:
 - 1. Description of system and component parts.
 - 2. Circuit directories of panelboards.
 - 3. As-installed color coded wiring diagrams.
 - 4. Operating procedures.
 - 5. Maintenance procedures.

SECTION 01730
OPERATING AND MAINTENANCE DATA

6. Manufacturer's printed operating and maintenance instructions.
 7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
 8. Other data as required under pertinent sections of specifications.
- D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- E. Additional requirements for Operating and Maintenance Data: the respective sections of specifications.

1.06 INSTRUCTIONS OF OWNER'S PERSONNEL:

- A. Prior to final review or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems.
- B. Operating and maintenance manual shall constitute the basis of instruction.
- C. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1: GENERAL:

1.01 SUBMITTAL REQUIREMENTS:

- A. Assemble warranties, bonds and services and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Review submittals to verify compliance with Contract Documents. Submit to Architect for review and transmittal to Owner.

1.02 TIME OF SUBMITTALS:

- A. For equipment or component parts of equipment put into service during progress of construction submit within ten {10} days after review and acceptance.
- B. Otherwise make submittals within ten {10} days after Date of Substantial Completion, prior to final request for payment.
- C. For items of work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten {10} days after acceptance, listing the date of acceptance as the start of the warranty period.

END OF SECTION

SECTION 01800
GENERAL NOTES

PART 1: GENERAL:

1.01 GENERAL NOTES:

- A. Contractor shall protect all streets and sidewalks and shall make all necessary repairs at his own expense.
- B. Shall at all times protect the excavations, trenches, and/or the building from damage from rain water, ground water, backing up drains or sewers and all other water. He shall provide all pumps and equipment and enclosures to provide this protection.
- C. Contractor shall provide all shoring, bracing and sheathing as required for safety and proper execution of the work and remove same when work is completed. Contractor shall be responsible for all scaffolding, shoring, bracing, sheathing, temporary construction and temporary walkways, etc., and shall hold harmless the Owner and Architect from any injury or litigation as a result of causes related to any scaffolding, shoring, bracing, sheathing, temporary construction, temporary walkways, and similar construction techniques.
- D. Contractor shall comply with the Trench Safety Law Requirements.

2.01 WAIVER OF LIEN:

- A. In submitting a Proposal (Bid) Contractor, if awarded the Contract, explicitly warrants that the Owner shall be held free of any claim or lien of any nature resulting from Contractor's pursuance or prosecution of the work. This shall cover any third party lien in any manner whatsoever concerning Contractor's performance or payment on this project.

3.01 PREVAILING WAGES:

- A. *Article 5159a, Vernon's Annotated Texas Civil Statutes as below noted apply to this project.*

"Not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed, and not less than the general per diem wages for legal holiday and overtime work, shall be paid to all laborers, workmen and mechanics employed by or on behalf of the State of Texas, or by or on behalf of any county, district or other political subdivision of the State, engaged in the construction of public works, exclusive of maintenance work".

- B. See attached.

4.01 CONTRACTOR'S ASBESTOS FREE AFFIDAVIT:

- A. In order to protect staff, employees and public in general from any unnecessary exposure to asbestos fibers, the Asbestos Hazard Emergency Response Act prohibits the use of asbestos containing materials in all forms in the construction and operation of this facility.
- B. Failure to complete this waiver constitutes non-compliance with the job specifications. This document shall be attached to the Contract between Owner and Contractor.

4.02 AFFIDAVIT:

- A. I certify that I am familiar with the materials used in the construction of, and incorporated into, the construction described below. I further certify that to the best of my knowledge and belief no asbestos containing materials, either friable or otherwise were used in the process of constructing or incorporated into the construction.

SECTION 01800
GENERAL NOTES

- B. The undersigned, being duly sworn upon his/her oath deposes and says that he/she is the person making the foregoing statements and that they are made in good faith and are true in every respect.

Contractor's signature:

STATE OF

COUNTY OF

I, _____, a Notary Public in and for said County, in the State aforesaid, DO THEREBY CERTIFY THAT _____ personally known to me to be the same person whose name is subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that he/she signed, sealed, and delivered said instrument as his/her free and voluntary act, for the uses and purposes herein set forth.

GIVEN UNDER MY HAND AND NOTARIAL SEAL THIS _____ DATE OF _____, 20 .

NOTARY PUBLIC: _____

MY COMMISSION EXPIRES: _____

(NOTARY SEAL)

END OF SECTION

SECTION 01800
GENERAL NOTES

Superseded General Decision Number: TX20170305

State: Texas

Construction Type: Building

County: Hidalgo County in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.35 for calendar year 2018 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.35 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2018. The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2018
1	09/14/2018

BOIL0074-003 01/01/2017

	Rates	Fringes
BOILERMAKER.....	\$ 28.00	22.35

ENGI0178-005 06/01/2014

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
(1) Tower Crane.....	\$ 29.00	10.60
(2) Cranes with Pile Driving or Caisson Attachment and Hydraulic Crane 60 tons and above.....	\$ 28.75	10.60
(3) Hydraulic cranes 59 Tons and under.....	\$ 27.50	10.60

* IRON0084-011 06/01/2018

	Rates	Fringes
IRONWORKER, ORNAMENTAL.....	\$ 23.77	7.12

PLUM0412-004 04/01/2013

	Rates	Fringes
PLUMBER.....	\$ 31.14	12.43

SECTION 01800
GENERAL NOTES

SUTX2014-031 07/21/2014

	Rates	Fringes
BRICKLAYER.....	\$ 16.17	0.00
CARPENTER.....	\$ 14.21	2.22
CEMENT MASON/CONCRETE FINISHER...	\$ 12.46	0.00
ELECTRICIAN.....	\$ 18.44	4.53
INSULATOR - MECHANICAL (Duct, Pipe & Mechanical System Insulation).....	\$ 11.54	2.17
IRONWORKER, REINFORCING.....	\$ 12.01	0.00
IRONWORKER, STRUCTURAL.....	\$ 15.04	4.34
LABORER: Common or General.....	\$ 8.00	0.00
LABORER: Mason Tender - Brick...	\$ 10.00	0.00
LABORER: Mason Tender - Cement/Concrete.....	\$ 10.89	0.96
LABORER: Pipelayer.....	\$ 11.00	3.47
LABORER: Roof Tearoff.....	\$ 10.06	0.00
OPERATOR: Backhoe/Excavator/Trackhoe.....	\$ 14.04	1.01
OPERATOR: Bobcat/Skid Steer/Skid Loader.....	\$ 13.93	0.00
OPERATOR: Bulldozer.....	\$ 18.29	1.31
OPERATOR: Drill.....	\$ 16.22	0.34
OPERATOR: Forklift.....	\$ 14.83	0.00
OPERATOR: Grader/Blade.....	\$ 10.00	0.00
OPERATOR: Loader.....	\$ 12.87	0.70
OPERATOR: Mechanic.....	\$ 17.00	0.00
OPERATOR: Paver (Asphalt, Aggregate, and Concrete).....	\$ 16.03	0.00
OPERATOR: Roller.....	\$ 12.70	0.00
PAINTER (Brush, Roller, and Spray).....	\$ 11.27	0.00
PIPEFITTER.....	\$ 15.22	3.16
ROOFER.....	\$ 11.42	0.00
SHEET METAL WORKER (HVAC Duct Installation Only).....	\$ 18.40	2.12
SHEET METAL WORKER, Excludes		

SECTION 01800
GENERAL NOTES

HVAC Duct Installation.....	\$ 21.13	6.53
TILE FINISHER.....	\$ 11.22	0.00
TILE SETTER.....	\$ 12.15	0.00
TRUCK DRIVER: Dump Truck.....	\$ 12.39	1.18
TRUCK DRIVER: Flatbed Truck.....	\$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck.....	\$ 12.50	0.00
TRUCK DRIVER: Water Truck.....	\$ 12.00	4.11

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this

classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests

SECTION 01800
GENERAL NOTES

for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

SECTION 02049
DEMOLITION

PART 1: GENERAL

1.01 SUMMARY:

- A. Section Includes:
1. Demolition shall include, unless otherwise noted on Drawing, removal of existing objects of improvements, whether indicated on Drawings or not, that would, in the opinion of the Owner, prevent or interfere with progress or completion of proposed work.
 2. Permits, fees, and licenses shall be secured and paid for by Contractor, including disposal charges as required to ensure progress of work will proceed.
 3. Work shall comply with requirements of governing authorities in demolition of ***existing pavement, curbs and gutters, drainage structures, and utilities*** as may required.
 4. Demolition requires removal and disposal off site of following:
 - A} ***Building structures indicated of Drawings or as required by specifications.***
 - B} ***Building foundations and supporting walls to uniform depth of 12" below lowest foundation elevation.***
 - C} ***Building materials as indicated on drawings.***

1.02 RELATED REQUIREMENTS:

- A. Demolition drawings.

1.03 JOB CONDITIONS:

- A. Conditions existing at time of inspection will be maintained by Owner in so far as practicable. Variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work. Owner shall indicate at pre-proposal conference those material decided to be salvaged for future use by Owner.
- B. Items of salvageable value to Contractor may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.
- C. Explosives shall not be brought to site or used without written consent of authorities having jurisdiction. Such written consent will not relieve Contractor of total responsibility or injury to persons or for damage to property due to blasting operations. The performance of any required blasting shall comply with governing regulations.

1.04 PROTECTION:

- A. SUMMARY:
1. Ensure safe passage of persons around all areas of demolition.
 2. Conduct operations to prevent damage to adjacent buildings, structures, other facilities, or injury to persons.
 3. Promptly repair any damages caused to adjacent facilities by demolition operations at no cost to Owner.
 4. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.
 5. Prevent interruption of existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction.
 6. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities.
 7. Make arrangements, before initiating demolition, for relocating, disconnection, rerouting, abandoning, or similar action as may be required relative to utilities and other underground piping, to permit work to proceed without delay. Arrangements shall be made in accordance with regulations of authorities of utilities concerned, including but not restricting any other services not mentioned, such as overhead and underground power and telephone power lines and equipment, gas piping, storm sewers, sanitary sewers, or water piping. Contractor shall not use water when it may create hazardous or objectionable conditions, such as ice, flooding, or/or pollution.
 8. Use water sprinkling and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level.

9. Comply with governing regulations pertaining to environmental protection.
10. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations.
Return adjacent areas to condition existing prior to start of work.

PART 2: PRODUCTS:

- A. This part not used.

PART 3: EXECUTION:

3.01 BUILDING DEMOLITION:

- A. Demolish buildings completely and remove from site using methods as required to complete work within limitations of governing regulations.
- B. Proceed with demolition in systematic manner, from top of structure to ground and complete demolition work above each floor or tier before disturbing supporting members on lower levels.
- C. Locate demolition equipment and remove materials so as to prevent excessive loading to supporting walls, floors, or framing.
- D. Remove structural framing members and lower to ground by hoists, derricks, or other suitable methods.
- E. Demolish concrete and masonry in small sections. Break up and remove concrete slabs-on-grade unless otherwise shown to remain.
- F. Demolish and remove below grade construction and concrete slabs on grade to a minimum depth of twelve inches below lowest foundation elevations.

3.02 FILLING BASEMENTS AND VOIDS:

- A. Completely fill below grade areas and voids resulting from demolition or removal of structures (tanks, wells, cisterns, etc.) using approved select fill materials free from debris, trash, roots, and other organic matter.
- B. Ensure that areas to be filled are free of standing water, trash, and debris prior to fill placement.
- C. Place fill materials in horizontal layers not exceeding eight inches (8") in loose depth and compact each layer at optimum moisture content of fill material to density equal to original adjacent ground, unless subsequent excavation for new work is required.
- D. Grade surface to match adjacent grades and to provide flow to surface drainage structures after fill placement and compaction.

3.03 DISPOSAL OF DEMOLISHED MATERIALS:

- A. Remove from site, debris, rubbish, and other materials resulting from demolition operations.
- B. No burning of any materials, debris, or trash on-site or off-site will be allowed, except when allowed by the appropriate governing authority. If allowed as stated above, burning shall be performed in manner prescribed by governing authority.
- C. Transport materials removed from demolished structures and dispose off-site to areas which are approved for disposal by governing authorities and appropriate property owners.

END OF SECTION

SECTION 02050 - DEMOLITION

PART 1 - EXECUTION

1.01 GENERAL REQUIREMENTS

- A. The work includes demolition or removal of all construction indicated or specified. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the limits of the project. Rubbish and debris shall be removed from the project site daily. Materials that cannot be removed daily shall be stored in areas specified by the Owner.

1.02 DUST CONTROL

- A. The amount of dust resulting from demolition shall be controlled to prevent the spread of dust and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

1.03 PROTECTION

A. Protection of Existing Work

Before beginning any cutting or demolition work, the Contractor shall carefully survey the existing work and examine the drawings and specifications to determine the extent of the work. The Contractor shall take all necessary precautions to insure against damage to existing work to remain in place, to be reused, or to remain the property of the Owner, and any damage to such work shall be repaired or replaced at no additional cost to the Owner. The Contractor shall carefully coordinate the work of this section with all other work and construct and maintain shoring, bracing and supports, as required. The Contractor shall insure that structural elements are not overloaded and be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this contract.

B. Protection of Buildings from the Weather

All materials and equipment shall be protected from the weather at all times.

C. Protection of Trees

Trees within the project site which might be damaged during demolition and which is indicated to be left in

place shall be protected by a 6-foot high fence. The fence shall be securely erected a minimum of 5-feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to

remain that is damaged during the work under this contract shall be replaced.

1.04 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.05 USE OF EXPLOSIVES

Use of explosives will not be permitted.

1.06 EXISTING FACILITIES

A. Existing structures indicated shall be removed to grade.

B. Removal of Utilities

C. Existing utilities shall be removed as indicated. When utility lines are encountered that are not indicated on the drawings the Engineer shall be notified prior to removal.

1.07 DISPOSITION OF MATERIAL

A. Title to Materials

Title to all materials and equipment to be demolished is vested in the Contractor upon receipt of notice to proceed. The Owner will not be responsible for the condition, loss or damage to such property after notice to proceed.

B. Material for Contractor Salvage

Salvage materials shall be removed from project site before completion of the Contract. Material for salvage shall not be sold on the site.

END OF SECTION

SECTION 02055

SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Subsoil materials.
 - 2. Topsoil materials.
- B. Related Sections:
 - 1. Section 02060 - Aggregates for Earthwork.
 - 2. Section 02061 - Aggregates for Exterior Improvements.
 - 3. Section 02311 - Rough Grading.
 - 4. Section 02320 - Backfill.
 - 5. Section 02324 - Trenching.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

PART 2 PRODUCTS

2.1 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Inspection Services Testing and analysis of soil material.
- B. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698.
- C. Testing and Analysis of Topsoil Material: Perform in accordance with ASTM D698.

- D. When tests indicate materials do not meet specified requirements, change material and retest.
- E. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.
- B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.
- C. Remove excess excavated materials subsoil and topsoil not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.2 STOCKPILING

- A. Stockpile materials on site at locations designated by Architect/Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.
- E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 02100 - SITE PREPARATION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Demolition of existing site elements per Demolition Plan and/or as required for installation of new work.
- B. Clearing of site.

1.02 RELATED SECTIONS:

- A. Temporary erosion and sediment control during construction - Section 02150s.
- B. Earthwork - Section 02200 or Section 02202 and/or Section 02222

1.03 NOTIFICATION TO OWNERS OF UTILITY LINES AND EQUIPMENT:

- A. Notify any corporation, company, individual or local authority owning conduits, wires, pipes or equipment on site that is affected by work.
- B. Arrange for removal or relocation of indicated items and pay any fees or costs in conjunction with removal or relocation, except as otherwise noted.
- C. Cap lines in accordance with instructions of governing authorities or Owners.

1.04 PROTECTIONS:

- A. Protect trees, plants and other landscape features designated to remain.

1.05 EXPLOSIVES:

- A. Use of explosives is strictly prohibited.

PART 2 - PRODUCTS - NONE IN THIS SECTION

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Verify that abandoned utilities have been properly disconnected and capped.
- B. Verify that barricades and other protective measures are in place.

3.02 CLEARING:

- A. Remove existing scrub trees and shrubs, including root systems.
- B. Strip and clear building areas, or areas requiring cutting or filling, free of vegetation. Leave construction areas clean, free of vegetation and debris, and ready for earthwork.
- C. Remove debris and trash from site.

END OF SECTION

SECTION 02102 - GENERAL CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

- A. Cleaning and grubbing shall consist of the removal of trees, stumps, brush, roots, vegetation, logs, rubbish, and other objectionable matter within the project site limits described in the specifications or as shown on plans.
- B. Cleaning and grubbing shall be done in advance of grading operation. Grubbing may be done simultaneously with excavation, if the cuts are over 3 feet in depth and objectionable matter is removed as specified.
- C. Clearing and Grubbing shall consist of the disposal of all debris resulting from the work specified herein.

1.02 PROTECTION OF ADJACENT WORK:

- A. Provide protection necessary to prevent injury or damage to existing improvements, adjacent property, utilities and other facilities, and trees and plants, indicated to remain in place.
- B. Protect improvements on adjoining properties and all areas outside indicated construction areas from injury or damage.
- C. Restore damaged improvements to their original condition, as acceptable to the Engineer and property owners.
- D. Conduct site clearing and grubbing operations to ensure minimum interference with road, streets, walks, and other adjacent, occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

1.03 MEASUREMENT AND PAYMENT

- A. Clearing and Grubbing shall be measured for payment either in acres or by lump sum only for areas indicated on the plans, or as provided in the proposal and contract.
- B. When not listed as separate contract pay item, Clearing and Grubbing shall be considered as

incidental work, and the cost thereof shall be included in such contract pay items as are provided in the proposal contract.

- C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor equipment, tools and in incidentals required for the work, all in accordance with the plans and these specifications.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Provide all required personnel, equipment, and materials required to perform the work as specified.

PART 3 - EXECUTION

3.01 CLEARING:

- A. Clear all areas covered by dikes, roads, structures and embankments within project limits unless otherwise shown in plans.
- B. Remove all saplings, brush, down-timber and debris unless shown or directed otherwise.
- C. Use tree wound paint to treat scars, gashes or limbs stubs on trees not removed.

3.02 GRUBBING:

- A. Trees, stumps, root systems, rocks and other obstructions shall be removed to the depths shown when they fall within the construction templates for the following items:
 - 1. Footings 18-inches below bottom of footing.
 - 2. Sidewalks (or other types of walks) 12-inches below bottom of walk.
 - 3. Roadways or Streets 24-inches below bottom of base material.
 - 4. Parking Areas 24-inches below bottom of base material.
 - 5. Grassed Areas 18-inches below top soil.
 - 6. Fills 24-inches below bottom of fill.

- B. Blasting not permitted.

3.03 REMOVAL OF DEBRIS AND CLEANUP

- A. Burn as permitted by regulating agencies or the Engineer as work progresses.
- B. Unguarded fires will not be permitted.
- C. Permits will be obtained, where required, for necessary burning or disposal sites.
- D. Dispose of all waste materials not burned by removal from site.
- E. Materials cleared and grubbed shall be the property of the Contractor and shall be his responsibility for disposal.

*** * * END OF SECTION * * ***

SECTION 02110 - SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of site clearing is shown on drawings.
- B. Site clearing work includes, but is not limited to:
 - 1. Protection of existing trees and shrubs.
 - 2. Removal of trees and other vegetation.
 - 3. Topsoil stripping and storing.
 - 4. Clearing and grubbing.
 - 5. Removing above grade improvements.
 - 6. Removing below grade improvements.

1.03 JOB CONDITIONS

- A. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
 - 1. Protect improvements on adjoining properties and on Owner's property.
 - 2. Restore damaged improvements to their original condition as acceptable to parties having jurisdiction.
- B. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated

materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
2. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations in a manner acceptable to Architect. Employ licensed arborist to repair damages to trees and shrubs.
3. Replace trees which cannot be repaired and restored to full growth status as determined by Arborist.

PART 2 - PRODUCTS (Not applicable to work of this section)

PART 3 - EXECUTION

3.01 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps and roots.
 1. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.
- B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2" in diameter and without weeds, roots, and other objectionable material.
 1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.
 - a. Remove heavy growth of grass from areas before stripping.
 - b. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to main root system.
 2. Stockpile topsoil in storage piles in areas shown or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind blown dust.

3. Dispose of unsuitable or excess topsoil same as waste material, herein specified.
- C. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation except for those indicated to be left standing.
 1. Completely remove stumps, roots, and other debris protruding through ground surface.
 2. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.
 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 4. Place fill material in horizontal layers not exceeding 6" loose depth and thoroughly compact to a density equal to adjacent original ground.
- D. Removal of Improvements: Remove existing above grade and below grade improvements necessary to permit construction and other work as indicated.
 1. Abandonment or removal of certain underground pipe or conduits may be shown on mechanical or electrical drawings and is included under work of those sections. Removal of abandoned underground piping or conduit interfering with construction is included under this section.

3.02 DISPOSAL OF WASTE MATERIALS

- A. Burning on Owner's Property: Burning is not permitted on Owner's property.
- B. Removal from Owner's Property: Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off site in legal manner.

END OF SECTION

SECTION 02150 - TEMPORARY EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Temporary measures required to control erosion and sediment during construction. This includes measures to meet the requirements of the National Pollution Discharge Elimination System (NPDES) administered by the Environmental Protection Agency (EPA).
- B. Temporary hay bale dike.
- C. Stabilized construction entrance.
- D. Silt fence.
- E. Rock check dam.
- F. Sediment basin with stone and pipe outlet
- G. Diversion dike.
- H. Storm Water Pollution Prevention Plan (SWP3).

1.02 RELATED SECTIONS:

- A. Grass seeding for slope protection and erosion control - Section 02270.
- B. Site Preparation - Section 02100.
- C. Earthwork - Section 02200 or Section 02202 and/or 02222

1.03 REFERENCES:

- A. ASTM D3786 - Hydraulic Bursting Strength of Knitted Goods and Non-woven Fabrics. (Mullen Burst)
- B. ASTM D3787 - Bursting Strength of Knitted Goods; Constant Rate of Traverse (CRT) Ball

Burst Test

- C. ASTM D4355 - Deterioration of Geotextiles From Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
- D. ASTM D4491 - Water Permeability of Geotextiles by Perrnitivity.
- E. ASTM D4533 - Index Trapezoidal Tearing Strength of Geotextiles.F. ASTM D4632 Grab Breaking Load and Elongation of Geotextiles. (Tensile Strength).
- F. ASTM D4751 - Determining the Apparent Opening Size of a Geotextile.
- H. ASTM A16, - Zinc Coated (Galvanized) Steel Woven Wire Fence Fabric.
- I. ASTM D698 - Test for Moisture Density Relations for Soils (Standard).
- J. Texas Department of Transportation (TXDOT) 2004 Standard Specifications for Construction of Highways, Streets and Bridges. Measurement and payment sections do not apply. Item 432 - Rip Rap.

1.04 SUBMITTALS:

- A. Procedures for Submittals: Section 01300.
- B. Product Data:
 - 1. Silt fencing.
 - 2. Non-woven filter fabric.
 - 3. Erosion control and revegetation mat
- C. Prepare and submit a Storm Water Pollution Prevention Plan (SWP3).
- D. Inspection Reports and Certificates:
 - 1. Submit period inspection reports and certificates required for SWP3.
 - 2. Submit Contractor/Subcontractor certifications required for SWP3.
- E. Submit revisions or modifications to the erosion and sediment control plan and SWP3.

1.05 MAINTENANCE:

- A. Maintain erosion control devices as necessary to comply with NPDES. This includes any revisions or modifications to the plan. Any work required for modifications, revisions and maintenance shall be the responsibility of the Contractor and shall -not be a basis for additional compensation.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Hay bales, if used, shall weigh a minimum of (50) pounds and shall be at least thirty (30) inches in length. Bales shall be composed entirely of vegetable matter and be free of seeds. Binding shall be either wire or nylon string, jute or cotton binding is unacceptable. Bales shall be used for not more than two months before being replaced. However, if weather conditions cause biological degradation of the hay bales, they shall be replaced sooner than the two month time period to prevent a loss of structural integrity of the hay bale dike.
- B. Stone material at all drainage structures shall consist of stone rip-rap conforming to TXDOT Standard Specification Item 432 and shall have gradation and be placed as shown on the plans and in a layer of at least 24 inches thick. Stone material for rock check dams shall consist of only well graded crushed rock, 4-8 inches in diameter, and shall be placed as detailed on plans. Stone material for stabilized construction exit shall consist of 3" to 5" crushed rock mixed with Type "A" Flexbase to create a drivable surface and shall be placed as shown on the plans.
- C. Geotextile Fabrics shall be a non-woven polypropylene fabric designed specifically for use as a soil filtration media. Fabric shall have an approximate weight of 8 oz/sqyd.
- D. Geotextile Silt Fence Fabric shall be a nylon reinforced polypropylene woven fabric having a reinforcing cord running the entire length to the top edge of the fabric.

Representative Manufacturer Mirafi, Inc. silt fence, Amoco (2130) or owner approved equal.
- E. Fence Posts for Silt Fence of sufficient length and strength to support the silt fence system.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION:

- A. Submit SWP3 and the erosion and sediment control plan and modify as required for the Contractor's construction sequence. Modifications shall maintain conformance with the Contractor's storm water pollution prevention plan and the requirements of NPDES. Work and materials required for installation, modification and maintenance of the Erosion Control System shall be incidental to the contract.
- B. Locate and protect survey horizontal and vertical control.

3.02 TEMPORARY HAY BALE DIKE:

- A. Install where shown on the plans or as needed for erosion control.
- B. Hay bales shall be embedded a minimum of four (4) inches and securely anchored using 3/8. inch diameter steel stakes or 2" x 2" wood stakes driven through the bales into the ground a minimum of six (6) inches. Hay bales are to be placed end to end directly adjacent to one another leaving no gap between them.
- C. Hay bale dikes are to be used in locations receiving overland sheet flow only.

3.03 STABILIZED CONSTRUCTION EXIT

- A. A temporary construction exit shall be installed at any point where traffic will be leaving the construction site to a public right-of-way, street, alley, sidewalk or parking area. The purpose of a stabilized construction exit is to reduce or eliminate the tracking or flowing of sediment onto public rights-of-way. The exit must be properly graded or incorporate a drainage swale to prevent runoff from leaving the construction site. The length of the exit shall be as required, but not less than 100 feet and the width shall be at least 20 feet. The stabilized exit shall be constructed of rock as described in 2.1.B. and shall be completely underlined with geotextile filter fabric described in 2.1.C, Value 1.
- B. The temporary construction exit shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or clean out of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public rights-of-way must be removed immediately by the Contractor.
- C. When necessary, wheels must be washed or brushed to remove sediment prior to entrance

onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch or watercourse using approved methods.

3.04 SILT FENCE:

- A. Silt Fence: Shall consist of nylon reinforced polypropylene woven fabric supported by posts set a minimum depth of 18 inches and spaced not more than 6 feet on center. A 6-inch wide trench is to be cut 6 inches deep at the toe of the fence on the uphill side to allow the fabric to be laid below the surface and back filled with gravel. Fabric shall have a 6-inch, double overlap securely fastened at a post at abutting ends, and shall be joined such that no leakage or bypass occurs. Remove accumulated sediment when the depth of sediment reaches 6 inches.

3.05 ROCK CHECK DAM:

- A. Rock Check Dams shall be constructed at locations shown on the plans and in swales as needed to reduce velocity in swales. Geotextile fabric as described in 2.1.C., Value I shall be placed beneath the rock and shall conform to these specifications. Rock shall conform to these specifications.

3.06 DIVERSION DIKE:

- A. Diversion dikes, if used by the Contractor, shall be installed prior to and maintained for the duration of construction and shall intercept no more than five (5) acres of runoff. Dikes shall have a minimum top width of 2'-0" and a minimum height Of Compacted fill of 18" measured from the top of the existing ground at the upslope toe to top of the dike and having side slopes of 3:1 or flatter. The channel which is formed by the dike must have a minimum slope of one (1) percent for the entire length to an outlet. When the slope exceeds three (3) percent, or velocities exceed one foot per second (regardless of slope), stone stabilization (Type "Am rip-rap) is required. Plant grass on dikes not requiring stone stabilization.

3.07 STORM WATER POLLUTION PREVENTION PLAN (SWP3):

- A. The Contractor is required to prepare the SWP3 required for this project.

3.08 NOTICE OF INTENT (NOI), NOTICE OF TERMINATION (NOT):

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- A. Contractor shall submit a Notice of Intent (NOI) at least 48 hours prior to the start of construction.
 - B. Contractor shall submit a Notice of Termination (NOT) as required by the NPDES regulations.
- 3.09 At the close of this contract the Contractor shall remove the temporary erosion control devices when permanent facilities are in place.

END OF SECTION

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of earthwork as indicated on drawings, and includes:
 - 1. Preparation of subgrade for flatwork, pavements and all other earthwork installation.
 - 2. Removal and Replacement of Top Soil.
 - 3. This section "does not include" work beneath foundations or structural fill.
- D. Definitions:
 - "Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.
 - "Density" is referred to as a percentage of the ASTM D698. Standard Proctor Density

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Testing and Inspection Service: Employ, at Contractor's expense, testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations. Laboratory to be approved by Architect and Owner.

1.04 SUBMITTALS

- A. Test Reports-Excavating: Submit following reports directly to Architect/Engineer from the testing services with a copy to the Contractor and Owner.

1. Test reports on borrow material. (as required)
 2. Field density test reports.
 3. One optimum moisture-maximum density curve for each type of soil encountered.
- B. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil bearings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available for convenience of Contractor.
1. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.
- C. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.
1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult Utility Owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Utility Owner.
 2. Do not interrupt existing utilities serving facilities occupied and used by Owner or others during occupied hours except when permitted in writing by Architect and Owner and then only after acceptable temporary utility services have been provided.
 - a. Provide a minimum of forty eight (48) hour notice to Owner and receive written notice to proceed before interrupting any utility.
 3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.
- D. Use of Explosives: The use of explosives is not permitted.
- E. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
1. Operate warning lights as recommended by authorities having jurisdiction.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
3. Perform excavations within drip line of large trees to remain by hand and protect root system from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Definitions:

1. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.
2. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.
3. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock, or gravel larger than 2" in any dimension, debris, waste, frozen materials, and other deleterious matter and having a PI < 20.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Excavation is Unclassified and includes excavation to subgrade elevations indicated regardless of character of materials and obstruction encountered.
- B. Unauthorized Excavation:
 1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect/Engineer. Unauthorized excavation, as well as remedial work directed by the Architect/Engineer, shall be at Contractor's expense.

2. Under footings, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to Architect/Engineer.
 3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavation of same classification, unless otherwise directed by Architect/Engineer.
- C. Top Soil:
1. Contractor shall strip 6" of existing topsoil and stockpile on-site at locations specified by owner. The topsoil shall be uniformly spread and graded after earthwork is complete.
 - 2.
- D. Additional Excavation:
1. When excavation has reached required subgrade elevations, notify the Architect/Engineer who will make an inspection of conditions.
 2. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Architect/Engineer.
 3. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.
- D. Stability of Excavations:
1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
 2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- F. Trench Safety Systems:
1. Provide materials for shoring and bracing such as sheet piling, uprights, stringers, and cross-braces in good serviceable condition.
 2. Trench shoring and bracing or trench boxes shall be required for trenches exceeding 5 foot in depth.

3. Maintain shoring and bracing or trench boxes in excavations regardless of time period excavations will be open.

G. Dewatering:

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding property.
2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well pints, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavation.
3. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavation to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

H. Material Storage:

1. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
2. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
3. Dispose of excess soil material and water materials unless otherwise shown on plans.

I. Excavation for Structures: (refer to plans)

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
2. In excavating for footing and foundation, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

J. Excavation for Pavements:

1. Cut surface under pavements to comply with cross sections, elevations and grades as shown.

K. Excavation for Trenches:

1. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.
3. Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed stone or gravel prior to installation of pipe.
5. For RCP Storm Sewer Pipe 12" or larger in nominal size provide a 4" thick embedment material. Approved embedment material shall include sand, blow sand or similar material. No crusher fines will be allowed for embedment material.
6. Except as otherwise indicated, excavate for exterior water bearing piping (water, sewer, gas and drainage) so top of piping is not less than 3'-6" below finished grade.
7. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe. Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.
8. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Architect/Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
9. For piping or conduit less than 2'-6" below surface of roadways, provide 4" thick concrete base slab support. After installation and testing of piping or conduit, provide minimum 4" thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.

- L. Cold Weather Protection: Protect excavation bottoms against freezing when atmosphere temperature is less than 35° F. (1° C.).

3.02 COMPACTION

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.
- B. Percentage of Maximum Density Requirements:
 - 1. Structures, Building Slabs and Steps: Compact top in accordance with Structural Drawings.
 - 2. Roadways, parking areas and sidewalks: Compact subgrade and each layer of backfill or fill material at 95% standard Proctor ASTM D-698-91 at a moisture content of no more than 3% above optimum moisture for cohesive material or 95% maximum density for cohesionless material.
 - 3. Open areas: Compact subgrade and each layer of backfill or fill material at 90% standard Proctor ASTM D-698-91 at a moisture content of no more than 3% above optimum moisture for cohesive material or 90% maximum density for cohesionless material.
- C. Moisture Control:
 - 1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compaction operations.
 - 2. Remove and replace or scarify and air dry soil material that is too wet to permit compaction to specified density.
 - 3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.03 BACKFILL AND FILL

- A. Under grassed areas, use satisfactory excavated or borrow material.
- B. Under roadway, parking and flatwork use backfill and fill materials that comply with 2.01-3
- C. Under steps, use subbase material.
- D. Under building slabs (refer to structural drawings / specifications)

- E. Under piping and conduit, use subbase material where subbase is indicated under piping or conduit; shape to fit bottom 90° of cylinder.
- F. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Acceptance of construction below finish grade including where applicable, dampproofing, waterproofing, perimeter insulation, inspection, testing, approval, and recording locations of underground utilities.
 - 2. Removal of concrete formwork.
 - 3. Removal of shoring and bracing and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 - 4. Removal of trash and debris.
 - 5. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
- G. Ground Surface Preparation:
 - 1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
 - 2. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- H. Placement and Compaction:
 - 1. Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand operated tampers.

2. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture contact. Compact each layer to required percentage of maximum density. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
3. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

3.04 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.
- B. Grading Outside Building Lines:
 1. Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
 2. Finish surfaces free from irregular surface changes, and as follows:
 - a. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.
 - b. Sidewalks and Flatwork: Shape surface of areas under walks to line, grade, and cross section, with finish surface not more than 0.10' above or below required subgrade elevation.
 - c. Pavements: Shape surface of areas under pavement to line, grade, and cross section, with finish surface not more than 1/2" above or below required subgrade elevation.
- C. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge.

3.05 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.
1. Roadways, Parking Areas and Building Slab Subgrade: Make at least one (1) field density test of subgrade for every 20,000 sq. ft. of paved area or building slab, but in no case less than three (3) tests. In each compacted fill layer, make one (1) field density test for every 10,000 sq. ft. of overlaying building slab or paved area, but in no case less than three (3) tests.
 2. All other areas: In each compacted fill layer, make at least one (1) field density test for every 50,000 sq. ft. of fill area, but in no case less than two (2) tests.

If in the opinion of the Architect/Engineer based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.07 MAINTENANCE

- A. Protection of Graded Areas:
1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
 2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.
- C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.08 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.

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END OF SECTION

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EARTHWORK
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SECTION 02221 - TRENCH EXCAVATION, BACKFILL, AND COMPACTION

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

- A. Excavation, shoring, dewatering, pipe bleeding, trench backfill, compaction, grading and cleanup of all pipeline trenching for the project.
- B. All work must be done in accordance with these specifications and the safety requirements of the State and OSHA Standards.

1.02 JOB CONDITIONS

- A. Site Acceptance
 - 1. Accept site in condition existing during Contract time frame.
 - 2. Ground water/surface water found during construction are conditions of the contract and responsibility of Contractor.
- B. Adverse Weather
 - 1. Place no backfill that is excessively wet or frozen.
 - 2. Place no backfill in excessively wet or frozen trenches.

PART 2 - PRODUCT

2.01 PIPE BEDDING AND BACKFILL

- A. The type of bedding shall be stated on the Plans or in the Special Provisions of the contract document. Determination of source of materials for bedding and backfill to meet the stated conditions shall be responsibility of Contractor, but use of such materials shall be subject to approval of Engineer.

B. Excavated Material Backfill

1. Excavated material may be used in the trench backfill, provided that all hard rock and stones having any dimensions greater than 6" and frozen earth debris and roots larger than 2" are removed for the initial backfill. Engineer must approve use of excavated backfill material as bedding material.

C. Select Backfill

1. Select Backfill shall be gravel, fine rock cuttings, sand, sandy loam or loam, free from excessive clay. Rock cuttings shall have no dimensions greater than 2 inches. Engineer must approve select backfill.

D. Sand Backfill

1. Sand backfill shall be clean, hard, durable, uncoated grains, free from clay lumps and organic material. All materials must pass a No. 8 Sieve.

E. Granular Backfill

1. Granular backfill shall be free flowing, such as sand or hydraulically graded stone fines, or mixed sand and gravel, or sandy loam. The material shall be free from lumps, stones over 2 inches in diameter, clay and organic matter.

F. Controlled Density Fill

1. Use high slump mixture of portland cement, fly ash and fine aggregate formulated, licensed and marketed as K-Krete or equal. Provide mixture with minimum 28-day compressive strength of 70 psi with no measurable shrinkage or surface settlement.

2.02 CRADLING ROCK

- A. Use crushed rock or stone with 70-100% passing 1½ inch sieve and no more than 50% passing 1 inch sieve.

2.03 SHEETING, SHORING AND BRACING

- A. Use sound timber or structural steel.

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- B. Use shapes and sizes as required.

PART 3 - EXECUTION

3.01 GENERAL

A. Dewatering

1. Execute work "dry". No pipe or conduits shall be laid or concrete poured on excessively wet soil.
2. Prevent surface water from flowing into excavation.
3. Provide equipment for handling water encountered as required. Obtain approval of proposed method of dewatering from the Engineer.
4. No Sanitary sewer shall be used for disposal of trench water.

B. Protection of Existing Utilities:

1. Notify all utilities of location and schedule of work.
2. Locations and elevations of utilities shown on plans are to be considered approximate only. Notify utility owners and Engineer of conflicts between existing and proposed facilities.
3. Repair, relay or replace existing utilities damaged, destroyed or disrupted during work. Unless specified otherwise, replacement will be at the Contractors expense.

C. Sheet piling, Shoring and Bracing

1. All sheet piling, shoring, and bracing shall be in accordance with these specifications and the safety requirements of the State and OSHA Standards.
2. Provide as necessary, to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.

3. Leave sheeting and shoring in place where removal might cause damage to persons or work or as otherwise indicated on drawings.
4. When movable trench shield is used below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.

D. Changes in Grade

1. Grades may be adjusted 1½ feet (plus or minus) from plan grades to suit unforeseen construction conflicts or conditions with approval of Engineer.
2. No additional compensation will be made for such changes.

3.02 EXCAVATION AND TRENCHING

A. General

1. Method of excavation is Contractor's option.
2. Excavate any areas around trees, structures and utilities by hand.
3. Stockpile and replace topsoil to a minimum of 8-inches for surface restoration in grassed or agricultural areas.

B. Trench Characteristics

1. Depth

- a. As indicated for pipe installation to lines and grades required with proper allowance for thickness of pipe and type of bedding specified or indicated.

2. Width

- a. Keep width of trench as narrow as possible with adequate room for backfilling and jointing.

- b. Maximum width as follows:

<u>Pipe Size Inches</u>	<u>Maximum Trench Width</u>
4	2-feet 0-inches
6	2-feet 0-inches
8	2-feet 4-inches
10	2-feet 4-inches
12	2-feet 6-inches
15	2-feet 9-inches
18	3-feet 0-inches
Over 18	Pipe O.D. + 12-inches

3. Trench walls must be vertical below top of pipe and may be vertical or sloped above pipe to conform to excavating codes.
2. Provide bell holes for each pipe joint where pipe bears on undisturbed earth.
3. Trench bottom shall be free of large stones and other foreign material.

3.03 SOFT, SPONGY OR UNSTABLE MATERIALS

- A. Stop work and notify Engineer.
- B. Perform remedial work as directed.

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- C. If material is judged unsuitable and removal is authorized, remove and replace with trench stabilizing material as directed by Engineer.

3.04 ROCK EXCAVATION

- A. Excavate any rock to maintain minimum 6-inch clearance around pipe.
- B. Dispose of rock material not suitable for backfill as directed by Engineer.
- C. Use of explosives not permitted without prior written authorization from owner and Engineer.
- D. Provide Special Hazard Insurance covering liability for blasting operations.

3.05 BEDDING

- A. Place after bottom of trench has been excavated to proper depth and grade.
- B. Place, compact and shape bedding material to conform to barrel of pipe to insure continuous firm bedding for full length of pipe.
- C. Provide bedding as described in following table unless indicated otherwise on Plans or in Special Provisions.

<u>Pipe Material</u>	<u>Minimum Bedding Class</u>
1. Vitrified Clay Pipe	Class C*
2. Non-reinforced Concrete Pipe	Class C*
3. Reinforced Concrete Pipe	Class D*
4. Ductile Iron Pipe	Class D*
5. Steel Cylinder	Class C*
6. Flexible or Composite Pipe	Class 1**

*Refers to standard detail

**Refers to standard detail,

3.06 TRENCH BACKFILL

- A. Use excavated material backfill (2.01B) unless otherwise specified.
- B. Use Sand Backfill for all trenches within 5 feet of buildings and beneath walks, parking areas, paved streets or existing exposed utilities.
- C. Initial Backfill
 - 1. Place after pipe has been bedded and checked for alignment, grade and internal obstructions.
 - 2. Carry out in an orderly fashion after authorization to cover pipe has been given.
 - 3. Allow no more than 300 feet of trench to be open at one time.
 - 4. Do not backfill until concrete or mortar has sufficiently cured.
 - 5. Record location of connections and appurtenances before backfilling.
 - 6. Place by hand and hand tamp to not less than 12-inches above top of pipe, in approximately 4-inch layers.
 - 7. Backfill simultaneously on both sides of pipe to prevent displacement.
 - 8. Place cushion of 4-feet above pipe envelope before using heavy compacting equipment.
- D. Subsequent Backfill
 - 1. Place backfill into trench at an angle so that impact on installed pipe is minimized.
 - 2. Compaction of all backfill material shall be performed in a manner that shall not crack, crush, and/or cause the installed pipe to be moved from the established grade and/or alignment.
 - 3. Area under or within 5-feet of pavement; and under or within 2-feet of utilities, buildings, or walks shall be mechanically compacted to the top of the subgrade in 6-inch (8 inch loose

measure) lifts to a minimum of 95 % Standard Proctor Density.

4. Areas not subject to vehicular traffic shall be backfilled in layers not more than 12-inches in depth, loose measure, and mechanically compacted.
5. Structural and non structural backfill will be mechanically compacted. Compaction method at discretion of Contractor with following exceptions:
 - a. If in Owner's opinion compaction method presents potential damage to pipe, it will not be allowed.
 - b. Flooding or water jetting may be permitted only if a geotechnical report justifying the use of water jetting is submitted to the Engineer by a qualified laboratory and the Engineer approves.
6. Mound excavated materials in piles no greater than 6-inches in height in open areas only.
7. Fill upper portion of trench with topsoil as specified hereinbefore.

E. Controlled Density Fill

1. Use where shown on plans.
2. Provide suitable forms to limit volume of control density fill material.
3. Prevent flow of material into existing drain lines.
4. Protect exposed utility lines during placement.
5. Place material in accordance with suppliers' written recommendations unless directed otherwise by Engineer.

3.07 EXCESS MATERIAL

- A. Store excess excavated material where directed by Engineer.

3.08 TESTING

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- A. Unless specified elsewhere, testing will be responsibility of Owner.
- B. Standard Proctor Density
 - 1. ASTM D698.
 - 2. One (1) required for each type of material encountered.
- C. In Place Density
 - 1. ASTM D1556 (Sand Cone)
 - 2. ASTM D2167 (Balloon)
 - 3. ASTM D3017 (Nuclear)
- D. One (1) test per 250 linear feet of trench on alternating lifts, with a minimum of three tests per visit, for non-structural areas. One (1) test per 100 linear feet of trench on alternating lifts, with a minimum of three tests per visit, for structural areas.
- E. Contractor will be responsible for any costs associated with testing performed as a result of failed tests

PART 4 - MEASUREMENT AND PAYMENT

4.01 TRENCH EXCAVATION

- A. Trench excavation shall be considered incidental to pipeline installation.
- B. Payment shall be made at the contract unit price per cubic yard only if a bid item is established in the contract.

4.02 BACKFILL

- A. Payment for backfill shall be made at the contract unit price per cubic yard only if a separate bid item is established in the contract.

- B. No allowance for waste shall be made.
- C. If Engineer orders an initial backfill material other than that specified in contract, it shall be paid for as an extra in price per cubic yard as compacted in place, EXCEPT if a higher class embedment is ordered by Engineer because the Contractor has over-excavated the trench width.
- D. If the Engineer orders the excavated material to be removed and disposed of and replaced with another material and a separate bid item is not established as a bid item, the material shall be paid as an extra.
- E. If the Contractor fails to compact the backfill to the density requirements, the Engineer may order the material removed and replaced at no cost to the Owner.
- F. The disposal of rejected material shall be at no cost to the Owner.

*** * * END OF SECTION * * ***

SECTION 02223 - FLEXIBLE BASE

PART I - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

- A. This work shall consist of furnishing and placing a foundation course for surface courses or for other base courses.
- B. Flexible base shall be composed of either caliche (argillaceous limestone, calcareous or calcareous clay particles, with or without stone, conglomerate, gravel, sand or other granular materials), crushed stone, gravel, iron ore topsoil, shell, or crushed slag.
- C. Flexible base shall be constructed as specified herein in one or more courses in conformance with the details, lines and grades shown on the plans, and as established by the ENGINEER.

1.02 MEASUREMENT AND PAYMENT

- A. Flexible base will be measure by the square yard of surface area of completed and accepted work based on the thickness of flexible base as shown on the plans.
 - 1. The flexible base shall be measured for depth by the units of 2000 square yards, with one measurement taken at a location selected by the ENGINEER.
 - 2. In that unit where flexible base is deficient by more than 1/2 inch in thickness, the deficiency shall be corrected by scarifying, adding material as required, reshaping and recompacting by sprinkling and rolling.
 - 3. No additional payment over the contract unit price will be made for any flexible base of a thickness exceeding that required by plans.
- B. The CONTRACTOR shall schedule his operations in such a manner as to facilitate the measurement of the pay item.
- C. The ENGINEER may accept the work provided no more than 2 out of 10 depth tests performed are deficient by not more 1/2 inch and where no two consecutive

tests on continuous work are outside the specified depth.

- D. The accepted quantities of flexible base of the type, grade, and compaction method specified will be paid at the contract unit bid price per square yard, complete and in place.
- E. Where "Ordinary Compaction" is used, all sprinkling, rolling, and manipulation required will not be paid for directly, but will be incidental to other bid items.
- F. The unit prices bid shall each be full compensation for shaping and fine grading the roadbed; for securing and furnishing all materials, including all royalty and freight involved; for furnishing scales and labor involved in weighing the material when required; for loosening, blasting, excavating, screening, crushing and temporary stockpiling when required; for loading all materials for all hauling and delivering on the road; for spreading, mixing, blading, dragging, shaping and finishing, and for all manipulation, labor, tools and incidentals necessary to complete the work.

PART 2 -PRODUCTS

2.01 MATERIALS:

- A. Materials for flexible base shall be crushed or uncrushed as necessary to comply with the requirements hereinafter specified.
- B. Materials shall consist of durable, coarse aggregate particles mixed with approved binding materials.

2.02 LIME STABILIZATION:

- A. Where shown on the plans, or directed by the ENGINEER, material for flexible base shall be lime stabilized in accordance with Texas Department of Transportation (TXDOT) 2004 Standard Specifications for Construction of Highways, Streets and Bridges. Measurement and payment sections do not apply. Item 260 – Lime Treatment (Road-Mixed).

2.03 TYPES:

- A. Type A - Crushed or broken aggregate (excluding gravel aggregate).
- B. Type B - Gravel Aggregate
- C. Type C - Iron Ore Topsoil
- D. Type D - Shell Aggregate with Sand Admixture
- E. Type E - Shell Aggregate with Sand and Caliche Admixture
- F. Type F - Caliche
- G. Type G - Crushed Slag
- H. Unless otherwise noted on the plans or directed by the ENGINEER, the CONTRACTOR may use any one type of these types provided the material used meet the requirements set forth in the specification test limits herein.

2.04 GRADES:

- A. Unless otherwise shown on the plans or directed by the ENGINEER, the final course of base material shall consist of Grades 1,2,3, or 4, as specified in Table 02601-1.
- B. Base courses or subbase materials, unless otherwise noted on the plans or directed by the ENGINEER, may consist of Grades 1, 2, 3, or 4, as specified in Table 02601-1.
- C. All grades shall, when tested in accordance with standard laboratory test procedures, meet the physical requirements set forth in Table 02601-1.
- D. Testing of flexible base materials shall be in accordance with the following test procedures:

TEST
Preparation for soil constants
and sieve analysis

TESTING PROCEDURE
TEX-101-E

Liquid Limit

TEX-104-E

Plastic Limit	TEX-105-E
Plasticity Index	TEX-106-E
Sieve Analysis	TEX-110-E
Wet Ball Mill	TEX-116-E
Triaxial Test	TEX-117-E (Part I or II)

- E. Unless otherwise specified on the plans, samples for testing the material for Soil constants, Gradation and Wet Ball Mill shall be taken prior to the compaction operations.
- F. Unless otherwise specified on the plans, samples for triaxial tests shall be taken from the stockpile or from production, as directed by the ENGINEER, where stockpiling is required and from production where stockpiling is not required.

TABLE 02223-1

PHYSICAL REQUIREMENTS FOR FLEXIBLE BASE MATERIALS

GRADES				
TYPES	Grade 1: (Triaxial class 1) Min. compressive strength, psi: 45 at 0 psi lateral pressure and 175 at 15 psi lateral pressure	Grade 2: (Triaxial Class 1 to 2.3) Min. com- pressive strength, psi: 35 at 0 psi lateral pressure and 175 at 15 psi lateral pressure	Grade 3: (Unspecified Tri axial Class)	Grade 4: (Unspecified Tri axial Class)
TYPE A	Retained on %	Retained on %	Retained on %	
Crushed or.	Sq. Sieve	Sq. Sieve	Sq. Sieve	
Broken	1-3/4".....0	1-3/4".....0-10	1-3/4".....0-10	
Aggregate	7/8".....10-35	No. 4.....45-75	No. 40.....60-85	As
(excluding	3/8".....30-50	No. 40.....60-85	Max LL.....45	Shown
gravel	No. 4.....45-65	Max LL.....40	Max Pl.....15	on
aggregate)	No. 40.....70-85	Max Pl.....12	Wet Ball Mill	Plans
	Max LL.....35	Wet Ball Mill	Max Amt.....55	
	Max Pl.....10	Max. Amt.....50	Max Increase	
	Wet Ball Mill	Max Increase	in Passing	

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Max Amt40	in Passing	No. 40.....20
Max Increase	No. 40.....20	
in Passing		
No. 40.....20		

TYPE B	Retained on	%	Retained on	%	
Gravel	Sq. Sieve		Sq. Sieve		
Aggregate	1-3/4".....0-10		1-3/4".....0-5		As
	No. 4.....30-75	No. 4.....30-75	Shown		
	No. 40.....70-85	No. 40.....65-85	On		
	Max LL.....35	Max LL.....35	Plans		
	Max PI.....12	Max PI.....12			

TYPE C	Retained on	%	Retained on	%	
Iron Ore	Sq. Sieve		Sq. Sieve		
Topsoil	2-1/2".....0		2-3/4".....0		As
	No. 40.....50-85		No. 40.....45-85		Shown
	Max LL.....35	Max LL.....35	on		
	Max PI.....12	Max PI.....12	Plans		

TYPE D	Retained on	%	Retained	%	
Sand-Shell	Sq. Sieve		Sq. Sieve		
	1-3/4".....0-10		1-3/4".....0		As
	No. 4.....45-65		No. 40.....45-65		Shown
	No. 40.....50-70		Max LL.....35		on
	Max LL.....35	Max PI.....,12	Plans		
	Max PI.....12				

TYPE E	Retained	%	Retained	%	
Shell with	Sq. Sieve		Sq. Sieve		
Sand and	1-3/4".....0		1-3/4".....0		As
Caliche	No. 40.....45-65	No. 40.....45-65	Shown		
	Max LL.....35	Max LL.....35	on		
	Max PI.....10	Max PI.....12	Plans		

TYPE F	Retained	%	Retained	%	
Caliche	Sq. Sieve		Sq. Sieve		
	1-3/4".....0		1-3/4".....0		As

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No. 4.....45-75	No. 40.....50-85	Shown on Plans
No. 40.....50-85	Max LL.....40	
Max LL.....40	Max PI.....12	
Max PI.....12		

TYPE G	As
Crushed	Shown
Blast Fur-	on
nace Slag	Plans

G. Materials exhibiting reasonably close conformity with the specified gradation and plasticity index are defined by the following criteria:

1. The ENGINEER may accept the material, providing not more than 2 of 10 consecutive gradation tests performed are outside the specified limits on any individual or combination of sieves by no more than 5% and where no two consecutive tests are outside the specified limits.
2. The ENGINEER may accept the material providing not more than 2 of 10 consecutive plasticity index samples tested are outside the specified limit by no more than two points and where no two consecutive tests are outside the specified limit.

2.05 STOCKPILING:

- A. When specified on the plans, the material shall be stockpiled prior to delivery on the road. The stockpile shall be not less than the height indicated and shall be made up of layers of material not to exceed the depth shown on the plans.
- B. After a sufficient stockpile has been constructed as specified on the plans, the CONTRACTOR may proceed with loading from the stockpile for delivery to the road.
- C. In loading from the stockpile for delivery to the road, the material shall be loaded by making successive vertical cuts through the entire depth of the stockpile.
- D. If the CONTRACTOR elects to produce the Type A material from more than one material or more than one source, each material shall be crushed separately and placed in separate stockpiles so that at least 75 percent of the material in the course aggregate stockpiles will be retained on the No. 4 sieve and at least 70 percent of the material in the fine aggregate stockpile will pass the No. 4 sieve.

- E. The materials shall be combined in a central mixing plant in the proportions determined by the ENGINEER to produce a uniform mixture which meets all of the requirements of the specification. In the event that combinations of the materials produced fail to meet all of the specification requirements, the CONTRACTOR will be required to secure other materials which will meet specifications requirements.
- F. The central mixing plant shall be of either the batch or continuous flow type, and shall be equipped with feeding and metering devices which will add the materials into the mixer in the specified quantities.
- G. Mixing shall continue until a uniform mixture is obtained.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE:

- A. The roadbed shall be excavated and shaped in conformity with the typical sections shown on the plans and to the lines and grades as established by the ENGINEER.
- B. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with approved material.
- C. All holes, ruts and depressions shall be filled with approved material and, if required, the subgrade shall be thoroughly wetted with water and reshaped and rolled to the extent directed in order to place the subgrade in an acceptable condition to receive the base material.
- D. The surface of the subgrade shall be finished to line and grade as established and in conformity with the typical section shown on plans. Any deviation in excess of 1/2 inch in cross section and in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.
- E. Sufficient subgrade shall be prepared in advance to insure satisfactory execution of the work.

- F. Material excavated in the preparation of the subgrade shall be utilized in the construction of adjacent shoulders and slopes or otherwise disposed of as directed. Any additional material required for the completion of the shoulders and slopes shall be secured from sources indicated on plans or as directed by the ENGINEER.

3.02 PLACEMENT OF FIRST COURSE - TYPE A, TYPE B, TYPE C, TYPE F, AND TYPE G MATERIAL:

- A. Immediately before placing the base material, the subgrade shall be checked as to conformity with grade and section.
- B. The material shall be delivered in approved vehicles of a uniform capacity, and it shall be the charge of the CONTRACTOR that the required amount of specified material shall be delivered to each 100-foot station.
- C. Material deposited upon the subgrade shall be spread and shaped the same day.
- D. In the event that inclement weather, or other unforeseen circumstances, render the spreading of the material during the first 24-hour period impractical, the materials shall be scarified and spread as directed by the ENGINEER.
- E. The material shall be sprinkled, if directed, and shall then be bladed, dragged and shaped to conform to typical sections as shown on plans.
- F. All areas and "nests" of segregated coarse or fine material shall be removed and replaced with well graded material, as directed by the ENGINEER.
- G. If additional binder is considered desirable or necessary after the material is spread and shaped, it shall be furnished and supplied in the amount directed by the ENGINEER. Such binder material shall be carefully and evenly incorporated with the material in place by scarifying, harrowing, brooming or by other approved methods.
- H. The course shall be compacted by methods of compaction hereinafter specified as the "Ordinary Compaction" method or the "Density Control" method of

compaction as indicated on the plans, or as directed by the ENGINEER.

1. When the "Ordinary Compaction" method is to be used, the following provisions shall apply:
 - a) The course shall be sprinkled as required and rolled as directed until a uniform compaction is secured. Throughout this entire operation, the shape of the course shall be maintained by blading. Upon completion, the surface shall be smooth and in conformity with the typical sections shown on plans and the established lines and grades.
 - b) In the area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section and in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.
 - c) All irregularities, depressions and weak spots which develop in the laid course shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.
2. When the "Density Control" method of compaction is to be used, the following provisions shall apply:
 - a) The course shall be sprinkled as required and compacted to the extent necessary to provide not less than the percent density as hereinafter specified under "Density".
 - b) In addition to the requirement specified for density, the full depth of the flexible base shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment.
 - c) After each section of flexible base is completed, tests as necessary will be made by the ENGINEER. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements.
 - d) Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and in conformity with the typical sections shown on the plans

and to the established lines and grades.

- e) In the areas on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section and 16 feet in length, measured longitudinally, shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.
 - f) All irregularities, depressions, or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.
- I. Should the base course, due to any reason or cause, lose the required stability, density or finish before the surfacing is complete, it shall be recompact and refinished at the sole expense of the CONTRACTOR.
- J. Where Type C material is used, the material shall be scarified, thoroughly wetted, mixed, manipulated, and bladed so as to secure a uniformly wetted material, and pulled in over the subgrade in courses and set under the action of blading and rolling. The work of mixing, blading, rolling, shaping, and subsequent maintenance shall be performed by the continuous use of sufficient number of satisfactory rollers and power maintainers with adequate scarifier attachments.

3.03 PLACEMENT OF FIRST COURSE - TYPE D MATERIAL:

- A. Immediately before placing the base material, the subgrade shall be checked as to conformity with grade and section, and corrections made if necessary.
- B. All materials shall be delivered in approved vehicles of a uniform capacity.
- C. The required amount of shell shall be uniformly spread across the section and allowed to dry sufficiently to insure proper slaking and mixing of the binder material. Immediately upon completion of the drying period, as determined by the ENGINEER, the specified amount of sand admixture, as required to produce

a combined material meeting the requirements hereinbefore specified, shall be spread uniformly across the shell.

- D. The material shall then be sprinkled as required and thoroughly mixed by blading and harrowing, or other approved methods.
- E. Failure to proceed with the placing of sand admixture or mixing and placing operations will be grounds for the suspension of placing of shell.
- F. Under no conditions will the CONTRACTOR be allowed to place an excessive amount of shell without proceeding with the mixing and placing operations.
- G. The course shall be compacted by the method of compaction hereinafter specified as the "Ordinary Compaction" method or the "Density Control" method of compaction as indicated on the plans, or as directed by the ENGINEER.
 - 1. When the plans indicate that the "Ordinary Compaction" method is to be used, the following provisions shall apply:
 - a) After mixing, all material shall be windrowed, and then spread over the section in layers.
 - b) The layer shall not exceed 2 inches in loose depth.
 - c) If necessary to prevent segregation, the material shall be wetted in the windrow prior to spreading.
 - d) After each lift is spread, it shall be sprinkled and rolled to secure maximum compaction as directed by the ENGINEER. Succeeding layers shall then be placed similarly until the course is completed.
 - e) All areas and "nests" of segregated coarse or fine material shall be removed and replaced with well graded material, as directed by the ENGINEER.
 - f) The course shall then be sprinkled as required and rolled as directed until a uniform compaction is secured.

- g) Throughout this entire operation, the shape of the course shall be maintained by blading; and the surface, upon completion, shall be smooth and in conformity with the typical sections shown on plans, and to the established lines and grades.
 - h) In the areas on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section and 16-feet in length, measured longitudinally, shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.
 - i) All irregularities, depressions, or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.
- 2. When the plans indicate that the "Density Control" method of compaction is to be used, the compaction method shall be the same as prescribed for Type A, Type B, Type C, Type F and Type G material.
- H. When indicated on the plans or permitted by the ENGINEER, Type D material may be mixed in a central mixing plant and delivered to the road as a combined mixture. When this method is used, the combined mixture shall meet the requirements for type D material as hereinbefore specified and the placing and compaction requirement shall be the same as prescribed for Type A, Type B, Type C, Type F and Type G material.

3.03 PLACEMENT OF FIRST COURSE - TYPE E MATERIAL:

- A. The construction methods for placing the first course of Type E material shall be the same as prescribed for Type D material except that after the shell and sand have been placed, the prescribed amount of caliche shall then be spread across the sand and shell.
- B. The composite mixture shall then be sprinkled as required and thoroughly mixed by blading and harrowing or other approved methods.
- C. Compaction of the first course of Type E material shall be the same as prescribed above for Type D material.

- D. Failure to proceed with placing the sand and caliche admixture or mixing and placing operations will be grounds for the suspension of placing of shell.
- E. Under no conditions will the CONTRACTOR be allowed to place an excessive amount of shell without proceeding with the mixing and placing operations.

3.05 PLACEMENT OF SUCCEEDING COURSES - ALL MATERIAL TYPES:

- A. Construction methods shall be the same as prescribed for the first course.
- B. Prior to placing the surfacing on the completed base, the base shall be "dry cured" to the extent directed by the ENGINEER.

3.06 REWORKING AN EXISTING BASE COURSE

- A. Existing base courses shall be reworked in accordance with TxDOT Item 251, or as directed by the ENGINEER, and result in a section that conforms the approved lines and grades.

3.07 DENSITY CONTROL:

- A. When the "Density Control" method of compaction is indicated on the plans, each course of flexible base shall be compacted to the percent density shown on the plans.
- B. The testing will be as outlined in Test Method Tex-114-E.
- C. It is the intent of this specification to provide that the part of the base included in the top 8 inches, immediately below the finished surface of the roadway, be not less than 100 percent of the density, as determined by the compaction ratio method.
- D. Field density determination shall be made in accordance with Test Method Tex-115-E.

3.08 TOLERANCES:

- A. Flexible base will be measured by the square yard of surface area of completed

and accepted work based on the thickness of flexible base as shown on the plans.

1. The ENGINEER may accept the work providing not more than 25 percent of the density tests performed each day are outside the specified density by no more than three pounds per cubic foot and where no two consecutive tests on continuous work are outside the specified limits.

*** * * END OF SECTION * * ***

SECTION 02230

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removing surface debris.
 - 2. Removing designated trees, shrubs, and other plant life.
 - 3. Removing abandoned utilities.
 - 4. Excavating topsoil.
- B. Related Sections:
 - 1. Section 02311 - Rough Grading.
 - 2. Section 02316 - Rock Removal.

PART 2 EXECUTION

2.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify existing plant life designated to remain is tagged or identified.
- C. Identify waste area for placing removed materials.

2.2 PREPARATION

- A. Call Local Utility Line Information not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.

2.3 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain, from damage.
- B. Protect trees, plant growth, and features designated to remain, as final landscaping

- C. Protect bench marks, survey control points, and existing structures from damage or displacement.

2.4 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees and shrubs within marked areas. Remove stumps.
- C. Clear undergrowth and deadwood, without disturbing subsoil.
- D. Apply herbicide to remaining stumps to inhibit growth.

2.5 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.
- B. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.
- C. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
- D. Do not burn or bury materials on site. Leave site in clean condition.

2.6 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion.
- D. Remove excess topsoil not intended for reuse, from site.

END OF SECTION

SECTION 02238 - REMOVAL OF CONCRETE

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

- A. This work shall consist of breaking up, removing and satisfactorily disposing of existing concrete, as classified, at locations indicated or as directed by the Engineer.
- B. Existing concrete, when under this section, will be classified as follows:
 - 1. Concrete Curb will include curb and curb-and-gutter combinations.
 - 2. Concrete Slabs will include, but not be limited to, patio slabs, porch slabs, foundation slabs, concrete riprap and concrete pavement.
 - 3. Sidewalks and Driveways will include concrete sidewalks and driveways.
 - 4. Concrete Walls will include all walls, regardless of height and wall footings.
 - 5. Concrete Steps will include all steps and combinations of walls and steps.
 - 6. Abandoned Foundations will include abandoned Electric Department foundations.
 - 7. Miscellaneous Concrete shall include, but not be limited to, manholes, inlets, junction boxes and headwalls, as indicated by the plans or the Engineer.

PART 2 PRODUCTS

2.01 MORTAR:

- A. Mortar, for repair of existing concrete structures, shall conform to the requirements thereof in Section 03300 - Cast-In-Place Concrete.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS:

- A. Prior to commencing this work, all erosion control and tree protection measures required shall be in place and all utilities located and protected. The existing concrete shall be broken up, removed and disposed of at a permitted disposal site by the Contractor.
- B. Where only a portion of the existing concrete is to be removed and the remaining portion is to continue to serve its purpose, care shall be exercised to avoid damage to the portion that will remain in place.
- C. The existing concrete shall be cut along neat lines when indicated, or as established by the Engineer, by sawing with an appropriate type circular concrete saw to a minimum depth of 1/2 inch.
- D. Any reinforcing steel encountered shall be cut off 1 inch inside of the concrete sawed line. Any existing concrete which is damaged or destroyed beyond the neat lines so established, shall be replaced at the Contractor's expense.
- E. The remaining concrete shall be mortared to protect the reinforcing steel and provide a neat, clean appearance.
- F. When applicable, a minimum of 1 foot of steel length shall be cleaned of all old concrete and left in place to tie into the new construction when reinforcement is encountered in the removed portions of structures to be modified.
- G. All unsuitable material shall be removed and replaced with approved material.
- H. All foundation, walls or other objectionable material shall be removed to a minimum depth of 18 inches below all structures and 12 inches below areas to be vegetated.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

- A. Concrete curb and concrete wall, when removed as prescribed above, will be measured by the linear foot, in its original position, regardless of the dimensions or size.
- B. Concrete slabs and concrete sidewalks and driveways removed as prescribed above will be measured by the square foot in original position, regardless of the thickness and reinforcing.
- C. Concrete steps removed will be measured per linear foot of each individual step tread including the bottom step.
- D. Concrete foundation removed will be measured per each.
- E. Miscellaneous concrete removed will be measured per each.

4.02 PAYMENT:

- A. This item will be paid for at the contract unit price bid for "Removed Concrete Curb", "Removed Concrete Slab", "Remove Concrete Sidewalks and Driveways", "Removed Concrete Foundations" and "Remove Miscellaneous Concrete", which price shall be full compensation for all work herein specified, including the disposal of all material not required in the work, the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work.
- B. When not listed as a separate contract pay item, removal of concrete shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provided in the proposal contract.
- C. Compensation, whether by contract pay item or incidental work, will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

*****END OF SECTION*****

SECTION 02241 - PNEUMATIC TIRE ROLLING

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

- A. This work shall consist of the compaction of embankment, flexible base, surface treatments, or pavements by the operation of approved pneumatic tire rollers.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS:

- A. When used on seal coats, asphaltic surface treatments, and bituminous mixture pavements, the roller shall be self propelled and equipped with smooth tread tires with a tire pressure of 45 psi.
- B. The roller shall be so constructed as to be capable of being operated in both a forward and a reverse direction.
- C. When used on bituminous mixture pavements, the roller shall have suitable provision for moistening the surface of the tires while operating.
- D. When turning is impractical or detrimental to the work and when specifically directed by the ENGINEER, the roller shall be of the self-propelled type.
- E. In lieu of the rolling equipment specified, the CONTRACTOR may operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction within the same period of time, its use shall be discontinued.
- F. Rollers shall be maintained in good repair and operating condition and shall be approved by the ENGINEER.

2.02 LIGHT PNEUMATIC TIRE ROLLER:

- A. The light pneumatic tire roller shall consist of not less than 9 pneumatic tire wheels, running on axles in such manner that the rear group of tires will cover the entire gap between adjacent tires of the forward group, mounted in a rigid frame, and provided with a loading platform or body suitable for ballast loading.
- B. The front axle shall be attached to the frame in such manner that the roller may be turned within a minimum circle.
- C. Under working conditions the pneumatic tire roller shall have an effective rolling width of approximately 60 inches and shall be so designed that by ballast loading the total load can be varied uniformly from 9,000 pounds or less to 18,000 pounds or more.
- D. The roller shall be equipped with tires that will afford ground contact pressures to 45 pounds per square inch or more. The operating load and tire air pressure shall be within the range of the manufacturer's chart. The roller under working conditions shall provide a uniform compression under all wheels.
- E. Individuals tire inflation pressures shall be within +5 psi of each other.
- F. The pneumatic tire roller shall be drawn by a suitable crawler type tractor, a pneumatic tired tractor, a truck of adequate tractive effort or may be of the self-propelled type and the roller, when drawn or propelled by either type of equipment, shall be considered a light pneumatic tire roller unit.

2.03 MEDIUM PNEUMATIC TIRE ROLLER (TYPE A):

- A. The medium pneumatic tire roller (Type A) shall consist of not less than 7 pneumatic tired wheels, running on axles in such manner that the rear group of tires will cover the entire gap between adjacent tires of the forward group and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading.
- B. The front axles shall be attached to the frame in such a manner that the roller may be turned within a minimum circle. The pneumatic tire roller, under working conditions, shall have an effective rolling width of approximately 84 inches and shall be so designed that, by ballast loading, the total load may be varied uniformly from 23,500 pounds or less to 50,000 pounds or more.

- C. The roller shall be equipped with tires that will afford ground contact pressures to 80 pounds per square inch or more. Individual tire inflation pressures shall be within +5 psi of each other.
- D. The operating load and tire air pressure shall be within the range of the manufacturer's chart.
- E. The pneumatic tire roller shall be drawn by a suitable crawler type tractor, a pneumatic tired tractor, a truck of adequate tractive effort or may be of the self-propelled type.
- F. The roller, when drawn or propelled by any type of equipment, shall be considered a medium pneumatic tire roller unit.
- G. The power unit shall have adequate tractive effort to properly move the operating roller at variable uniform speeds up to approximately 5 miles per hour.

2.04 MEDIUM PNEUMATIC TIRE ROLLER (Type B):

- A. The medium pneumatic tire roller (Type B) shall conform to the requirements for Medium Pneumatic Tire Roller (Type A) as specified above, except that the roller shall be equipped with tires that will afford ground contact pressures to 90 psi or more.

PART 3 -EXECUTION

3.01 CONSTRUCTION METHODS:

- A. The embankment layer or the base course be sprinkled if directed and rolling with a pneumatic tire roller shall start longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 of width of the pneumatic tire roller.
- B. On super-elevated curves, rolling shall begin at the low sides and progress towards the high sides.
- C. Alternative trips of the roller shall be slightly different in length.
- D. The light pneumatic tire roller shall be operated at speeds between 2 and 6 miles per hour for asphalt surfacing work and all other work.

- E. The medium pneumatic tire roller shall be operated at speeds which produce a satisfactory product.
- F. Sufficient rollers shall be provided to compact the material in a satisfactory manner. When operations are so isolated from one another that 1 roller unit cannot perform the required compaction satisfactorily, additional roller units shall be provided.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT:

- A. No additional compensation will be made for materials, equipment or labor required by this item, but shall be considered subsidiary to the various items of the contract.

*** * * END OF SECTION * * ***

SECTION 02242 - PROOF ROLLING

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION WORK:

- A. This work shall consist of furnishing and operating heavy, pneumatic-tired, compaction equipment for testing the compaction of embankment, subgrade or flexible base.
- B. Proof roll is to be used to locate unstable areas.

PART 2 - PRODUCTS

2.01 EQUIPMENT:

- A. The proof rolling equipment shall consist of not less than 4 pneumatic tired wheels, running on axles carrying not more than 2 wheels, mounted in a rigid frame, and provided with a loading platform or a body suitable for ballast loading.
- B. All wheels shall be arranged so that they will carry approximately equal loads when operating on uneven surfaces.
- C. Under working conditions the proof roller shall have a rolling width of 8 feet to 10 feet and shall be so designed that by ballast loading the gross load may be varied uniformly from 25 tons to 50 tons.
- D. The tires shall be capable of operating under the various loads with variable air pressure up to 150 pounds per square inch. The operating load and tire pressure shall be within the range of the manufacturer's chart and as directed by the ENGINEER.
- E. The proof roller may be of the self-propelled type or shall be drawn by a suitable crawler-type tractor or a rubber tired tractor of adequate tractive effort. There shall be a sufficient quantity of ballast available to load the equipment to a maximum gross weight of 50 tons.
- F. Rubber tired tractive equipment shall be used on base courses.
- G. Other type tractive equipment may be used on embankment subgrade.
- H. The heavy pneumatic tired roller unit shall be capable of turning 180 degrees in the crown width.

- I. In lieu of the rolling equipment specified, the CONTRACTOR may, upon written permission from the ENGINEER, operate other equipment that will produce equivalent results as the specified equipment. If the substituted equipment fails to produce the desired results as would be expected of the specified equipment as determined by the ENGINEER, its use shall be discontinued.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS:

- A. This work shall be done to proof all prepared subgrade and flexible base courses or as directed by the ENGINEER.
- B. On embankment compaction, each layer will be placed to specified thickness at optimum moisture and compacted with conventional equipment to comply with the requirements of the governing embankment item.
- C. Prior to placing the overlaying course, the layer shall be proof rolled as directed by the ENGINEER.
- D. When the operation of the proof rolling unit shows an area to be unstable or nonuniform, such area shall be brought to satisfactory stability and uniformity by additional compaction or by removal of unsuitable materials and replacement with suitable materials and recompacted.
- E. The surface tested shall then be checked for conformity with line and grade and any irregularities corrected.
- F. Roller shall be operated at speeds between 2 and 6 miles per hour or as directed by the ENGINEER.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT:

- A. No additional payment will be made for the materials, equipment or labor required by this item and shall be considered subsidiary to the various items included in the contract.

*** * * END OF SECTION * * ***

SECTION 02250 - PRIME COAT

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION:

- A. Prime coat shall consist of the application of asphaltic materials on a completed base course and/or other approved area, which shall be applied in accordance with these specifications, as shown on the plans, and as directed by the ENGINEER.

1.02 QUALITY ASSURANCE:

A. Test and Certification of Bituminous Materials.

1. Bituminous materials to be tested in accordance with the requirements of AASHTO M-82 and sampled in conformance with AASHTO T-40.
2. Supply, at the time of delivery of each shipment of asphalt, two certified copies of test reports from the supplying vendor to the ENGINEER.
3. Test reports shall indicate name of vendor, type and grade of asphalt delivered, date and point of delivery, quantity delivered, delivery ticket number, purchase order number, and result of specified tests.

The test report shall be signed by an authorized representative of the vendor and certify that the product delivered conforms to the specifications for type and grade indicated.

Certified test reports and the testing required in the preparation of such report shall be at no cost to the Owner.

4. Final acceptance of bituminous materials shall be dependent on the determination by the ENGINEER that the material meets prescribed standards.

PART 2- PRODUCTS

2.01 MEDIUM CURING CUTBACK ASPHALT:

- A. Medium-curing liquid asphalt, designated by the letters MC, shall consist of an

uncracked petroleum base stock, produced by the processing of asphaltic or semi-asphaltic base crude petroleum, blended with a kerosene-type solvent. The base stock for all MC materials shall be straight run asphalt produced within the penetration range of 100 to 300, and the end point of the kerosene type solvent shall not exceed 525° F. Medium curing liquid cutback asphalt shall be free from water and show no separation.

- B. Medium curing cutback asphalt shall consist of materials specified above and conforming to the requirements set forth in Table 2250-1.

TABLE 2250-1

Specification Designation	AASHTO Test Method	ASTM Test Method	MC 30	MC 70	MC 250	MC 800	MC 3000
Flash Point (Open Cleave) °F, Min.	T 48	D 92	100	100	150	150	150
Viscosity, 140°F, Kinematic, CS	T 201	D 2170	30 - 60	70 - 140	250 - 500	800 - 1600	3000 - 6000
Furol Viscosity at: 77° F (Sec.) 122° F (Sec.) 140° F (Sec.) 180° F (Sec.)	T 72	D 88	75-150	60-120	125-250	100-200	300-600
Distillation Distillate (% of Total Distillate to 680° F)	T 78	D 402					
437° F			0-25	0-20	0-10	0	0
500° F			40-70	25-60	20-55	10-35	0-15
600° F			75-93	75-90	70-85	65-80	50-75
Residue from Distillation to 680° F Volume % by Difference Min.			50	55	67	75	80
Tests on Residue from Distillation Penetration at 77° F	T 49	D 5	120 - 250	120 - 250	120 - 250	120 - 250	120 - 250
* Ductility 77° F, cm, Min.	T 51	D 113	100	100	100	100	100
Solubility in CCl ₄ , % Min.	T 44		99.5	99.5	99.5	99.5	99.5
Water, % Max.	T 55	D 95	0.2	0.2	0.2	0.2	0.2

Reaction to	Spot					
Test	T 102**	0	0	0	0	0
*	If penetration of residue is more than 200 and its ductility at 77° F is less than 100, the material will be acceptable if the ductility at 60° F is greater than 100.					
**	Using 85% Standard Naptha and 15% Xylene.					

NOTE: Viscosity tests may be made by either Kinematic or Furol test methods.

- C. Unless otherwise noted on the plans or directed by the ENGINEER, cutback asphalt Grade MC-30 shall be used.

2.02 BLOTTER MATERIAL:

- A. Supply blotter material consisting of native sand and/or sweepings from base course.
- B. Native sand shall be local material obtained from approved sources as approved by the ENGINEER.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS:

- A. Unless otherwise specified on the plans or required by the ENGINEER, only asphaltic material shall be used. Where required, a combination of asphaltic and blotter material shall be used.
- B. Application of Asphaltic Materials Only.
1. Apply prime coat to prepared surface when ambient air temperature is above 40° F and rising and shall not be applied when the ambient air temperature is below 50° F and falling.
 2. Apply prime coat to surfaces that have been cleaned by sweeping or other approved methods and where base is thoroughly dry and satisfactory for receiving prime coat.
 3. Apply prime coat to cleaned base, at a rate of 0.2 to 0.5 gallons per square yard of surface area, using an approved type of self-propelled pressure distributor so constructed and operated to distribute the material evenly and smoothly.

4. Provide necessary facilities for the determination of temperature of asphaltic material in all heating equipment and distributors; and for determination of rate at which it is applied; and for securing uniformity at the junction of two distributor loads.
5. Keep in clean and good working condition all storage tanks, piping, reports, booster tanks and distributors used in the storage and handling of asphaltic materials.
6. Operate all associated equipment in a manner such that there is no contamination of asphaltic material with foreign material.
7. Calibrate distributor and furnish ENGINEER with an accurate and satisfactory record of such calibrations.
8. Recalibrate distributor, in a manner satisfactory to the ENGINEER, after the beginning of work, should the yield on the asphaltic material applied appear to be in error.
9. No traffic, hauling or placing of subsequent courses shall be permitted over freshly applied prime coat until authorized by the ENGINEER.
10. Apply asphaltic material at a temperature within 15° F of temperature of application selected by the ENGINEER based on temperature viscosity relationship noted in Table 2250-1.
11. Maintain surface until work is Blotter Material.

C. Application of Asphaltic and Blotter Material

1. Haul blotter material in vehicles of uniform capacity and placed on shoulders at spacings designated by the ENGINEER.
2. After application of asphaltic material as specified above, cover surface with blotter material as directed by the ENGINEER.
3. After application of blotter material, drag surface with approved drag

broom, evenly and smoothly distributing the blotter material. Brooming or dragging operation shall continue, as directed by the ENGINEER, until the course has properly cured under traffic.

PART 4 - MEASUREMENT AND PAYMENT

4.01 PRIME COAT:

- A. Asphaltic material for prime coat will be measured for payment at point of delivery on the project in gallons at applied temperature. Payment will be paid at the unit bid price for "Prime Coat".
- B. When not listed as a separate contract pay item, prime coat shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provided in the proposal contract.
- C. Compensation, whether by contract pay item or incidental work will be for furnishing all material, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

4.02 BLOTTER MATERIALS:

- A. Blotter material will be considered incidental to asphaltic material for prime coat with no direct payment.

*** * * END OF SECTION * * ***

SECTION 02311

ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating topsoil.
 - 2. Excavating subsoil.
 - 3. Cutting, grading, filling, compacting site for site structures, building pads.
- B. Related Sections:
 - 1. Section 02055 - Soils for Earthwork: Soils for fill.
 - 2. Section 02060 - Aggregates for Earthwork: Aggregates for fill.
 - 3. Section 02230 - Site Clearing: Excavating topsoil.
 - 4. Section 02315 - Excavation and Fill: Building excavation.
 - 5. Section 02316 - Rock Removal.
 - 6. Section 02320 - Backfill: General building area backfilling.
 - 7. Section 02324 - Trenching: Trenching and backfilling for utilities.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - 7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
 - 8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

PART 2 EXECUTION

2.1 PREPARATION

- A. Call Local Utility Line Information service not less than three working days before performing Work.
 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum.
- C. Protect utilities indicated to remain from damage.
- D. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

2.2 FILLING

- A. Fill areas to contours and elevations with unfrozen materials.
- B. Place fill material in continuous layers and compact as required.
- C. Maintain optimum moisture content of fill materials to attain required compaction density.
- D. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.
- E. Make grade changes gradual. Blend slope into level areas.

2.3 FIELD QUALITY CONTROL

- A. Perform in place compaction tests in accordance with the following:
 1. As required by geotechnical engineer.

END OF SECTION

SECTION 02315

EXCAVATION AND FILL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Soil densification.
 - 2. Excavating for building foundations.
 - 3. Excavating for slabs-on-grade.
 - 4. Excavating for site structures.
- B. Related Sections:
 - 1. Section 02055 - Soils for Earthwork: Stockpiling excavated materials.
 - 2. Section 02060 - Aggregates for Earthwork: Stockpiling excavated materials.
 - 3. Section 02311 - Rough Grading: Topsoil and subsoil removal from site surface.
 - 4. Section 02316 - Rock Removal: Removal of rock during excavating.
 - 5. Section 02320 - Backfill.
 - 6. Section 02324 - Trenching: Excavating for utility trenches.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- B. Local utility standards when working within 24 inches of utility lines.

PART 2 EXECUTION

2.1 EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation work.
- B. Excavate subsoil to accommodate building foundations, slabs-on-grade.

- C. Excavate to working elevation for piling work.
- D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 02320 and Section 02324.
- E. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- F. Trim excavation. Remove loose matter.
- G. Notify Architect/Engineer of unexpected subsurface conditions.
- H. Correct areas over excavated with structural fill.
- I. Remove excess and unsuitable material from site.
- J. Repair or replace items indicated to remain damaged by excavation.

2.2 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 02316

TERMITE CONTROL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Soil treatment for termite control.
- B. Related Sections:
 - 1. Section 02055 - Soils for Earthwork: Backfill materials.
 - 2. Section 02315 - Excavation and Fill: Subgrade preparation.
 - 3. Section 03300 - Cast-In-Place Concrete: Slabs on grade and foundations placed over treated soil.

1.2 REFERENCES

- A. Environmental Protection Agency:
 - 1. EPA FIFRA - Federal Insecticide, Fungicide and Rodenticide Act.
- B. National Pest Management Association:
 - 1. NPMA WDO - Wood Destroying Organism Library.

1.3 SUBMITTALS

- A. Product Data: Submit toxicants to be used, composition by percentage, dilution schedule, intended application rate. Include product label information.
- B. Test Reports: Indicate regulatory agency approval reports.
- C. Manufacturer's Application Instructions: Indicate caution requirements and in accordance with current product label of chosen pesticide.
- D. Certify applications followed NPMA WDO for termite control or other regional location guidance.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record moisture content of soil before application, date and rate of application, areas of application, diary of toxicity meter readings and corresponding soil coverage.

- B. Operation and Maintenance Data: Indicate re-treatment schedule.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing the Work of this section and licensed in State of Texas.

1.6 SEQUENCING

- A. Section 01100 - Summary: Work sequence.
- B. Apply toxicant immediately prior to installation of vapor barrier under slabs-on-grade in accordance with product label supplemented by the NPCA's ARP for termiticiding or local requirements.

1.7 WARRANTY

- A. Warranty: Include coverage for damage and repairs to building and building contents caused by termites. Repair damage. Re-treat where required.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Toxicant Chemical: EPA FIFRA approved; synthetically color dyed to permit visual identification of treated soil.
- B. Diluent: Recommended by toxicant manufacturer.

2.2 MIXES

- A. Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

C. Verify final grading and excavation are complete.

3.2 APPLICATION

A. Apply toxicant at locations indicated in Schedule at end of section.

B. Apply extra treatment to structure penetration surfaces including pipe or ducts, and soil penetrations including grounding rods or posts.

C. Re-treat disturbed treated soil with same toxicant as original treatment.

D. When inspection or testing identifies presence of termites, re-treat soil and re-test.

3.3 PROTECTION OF FINISHED WORK

A. Section 01700 - Execution Requirements: Protecting finished Work.

B. Do not permit soil grading over treated work.

END OF SECTION

SECTION 02470

DRILLED CONCRETE PIERS AND SHAFTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Machine drilled shaft.
 - 2. Placing shaft liner.
 - 3. Shear rings.
 - 4. Concrete fill.
 - 5. Reinforcement.
- B. Related Sections:
 - 1. Section 03200 - Concrete Reinforcement: Requirements for concrete reinforcement.
 - 2. Section 03300 - Cast-In-Place Concrete.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 336.1 - Reference Specification for the Construction of Drilled Piers.
- B. ADSC - The International Association of Foundation Drilling:
 - 1. ADSC TL-4 - Drilled Shafts: Construction Procedures and Design Methods.
- C. ASTM International:
 - 1. ASTM A252 - Standard Specification for Welded and Seamless Steel Pipe Piles.
 - 2. ASTM D1143 - Standard Test Method for Piles Under Static Axial Compressive Load.
 - 3. ASTM D4380 - Standard Test Method for Density of Bentonitic Slurries.
 - 4. ASTM D4381 - Standard Test Method for Sand Content by Volume of Bentonitic Slurries.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Store and handle controlled slurry materials in accordance with manufacturers instructions.
- C. Mix, store, and transport controlled slurry materials using equipment made for this purpose.

PART 2 PRODUCTS

2.1 DRILLED CONCRETE PIERS AND SHAFTS

- A. Concrete Materials and Mix: Specified in Section 03300.
- B. Reinforcement: Specified in Section 03200.
- C. Equipment: Appropriate to dewater excavated shaft.
- D. Controlled Slurry:
 - 1. Use controlled bentonite or polymer slurry only at locations specified or indicated on Drawings.
 - 2. Bentonite and Polymer Materials: Suitable for intended purpose according to manufacturer.
 - 3. Controlled Slurry Properties:

Properties	Results at 68EF	Test Methods
Density, before concreting, for slurry 1 ft from pier bottom	64 pcf max.for polymer slurry	API 13B,Section 1 (Mud Balance)
	85 pcf max for bentonite slurry	ASTM D4380
Marsh funnel viscosity, for entry slurry and pier slurry	26-50 sec/qt	API 13B,Section 2 (Marsh Funnel and Cup)
Sand content by volume, before concreting for slurry 1 ft from pier bottom	1% max for polymer slurry	API 13B,Section 4 (Sand Screen Set)
	25% max for bentonite slurry	ASTM D4381
pH, during excavation	8-12	API 13B,Section 6 (Paper test strips or glass-electrode pH meter)

- 4. Provide physical or chemical treatment of water or slurry necessary to meet specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify site conditions are ready for Work of this section.

3.2 PREPARATION

- A. Use placement method that will not cause damage to nearby structures.
- B. Document existing conditions for existing structures susceptible to damage:
 - 1. Before move, inspect existing structure thoroughly and notify Architect/Engineer in writing of visible defects and factors capable of affecting safe movement of structure to final location.
 - 2. Compile list of existing visible defects to building structure, finishes, and accessories. This list will form basis for determining required repair Work after move.
- C. Notify adjacent and affected land owners and building occupants within 14 days before proceeding with the Work.
- D. Notify utility companies to mark location of existing underground services. Do not begin work of this section until existing underground services are marked.
- E. Provide survey benchmarks and control points before beginning construction of piers.
- F. Protect underground utilities and structures near the Work, from damage.

3.3 INSTALLATION

- A. Drill vertical pier shafts to diameters and depths indicated.
- B. Place steel liners immediately after drilling. Set firmly in place. Use shaft liner when free water is encountered.
- C. Clean shaft and bottom of loose material. Maintain shafts free of water.
- D. Allow inspection of shaft and liner prior to placement of reinforcement and concrete.
- E. Provide dowels for connection of caps and grade beams.
- F. Concreting: In accordance with Section 03300 and the following requirements:
 - 1. General:
 - a. Do not place concrete before Architect/Engineer has inspected pier.
 - b. Inspect piers before concreting, to verify loose material within pier has been removed.
 - c. Place concrete immediately after completion of cleaning operation and inspection. When concreting is postponed, repeat cleaning and inspection.
 - d. Place concrete in one continuous operation without cessation from bottom of pier to cut-off elevation to ensure complete homogeneity of concrete throughout pier with no possibilities of cavities, air pockets, honeycombing or cold joints forming in concrete.
 - e. Use only concrete mix designed for tremie placement.

- f. Concrete Slump Dry Method: **5 to 6 inches.**

3.4 DRILLING TOLERANCES

- A. Section 01400 - Quality Requirements Tolerances.
- B. Tolerances for deviations from design position, orientation and elevation:
1. Maximum Deviation from Position at Top of Shaft: **3 inches.**
 2. Maximum Deviation of Pier Shaft Radius at Bottom of Shaft: Minus **0 inches.**
 3. Maximum Deviation of Pier Cut-Off Elevations: Plus **1 inch** and minus **3 inches.**
- C. Furnish corrective design and construction required to accommodate deviations exceeding specified tolerances, including replacement of piers, when necessary.

3.5 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing and Section inspection services.
- B. Engage licensed surveyor to perform survey work specified in this section, including survey of design and actual pier locations, and plumbness.
- C. Monitor benchmarks and survey control points for displacement during construction. Correct or replace displaced survey controls. Verify previous measurements relying on displaced controls.
- D. Submit survey information as the Work progresses, to expedite construction operations.
- E. Contractor Supervision: Provide supervision of each phase of drilled pier construction. Check each drilled pier or shaft for required depth, clean-up, workmanship, and for tolerance requirements before concrete is placed.
- F. Unacceptable Piers: Piers that fail, are placed out of position, exceed allowable tolerances, have defect inclusions, or are damaged.
- G. Provide additional piers or replace piers failing to conform to specified requirements.

END OF SECTION

SECTION 02510 - CONCRETE CURB AND GUTTER AND VALLEY GUTTER

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

- A. This work shall consist of the construction of concrete curb, concrete curb and gutter, concrete gutter or valley gutter, or combination thereof in compliance with the specifications, lines, grades, and details shown on the plans, or as directed by the ENGINEER.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Concrete and manufactured curb and gutter materials shall be subject to inspection and tests at plants and construction sites for compliance with quality requirements.
- B. Concrete curb and gutter or concrete valley gutter shall be constructed with concrete conforming to the provisions of Section 02614 - Portland Cement Concrete Paving, or Class "B" concrete conforming to the requirements of Section 03300 - Cast-In-Place Concrete.
- C. Preformed expansion Joint Filler shall conform to the requirements of AASHTO M-33 or M-153.
- D. Linseed Oil shall conform to the requirements of AASHTO D-260.
- E. Mineral Spirits shall conform to the requirements of AASHTO D-235.

2.02 FOUNDATION:

- A. Concrete curb and gutter or concrete valley gutter shall be placed on an approved foundation conforming to the requirements of the following Specifications:
 - 1. Section 02210 - Subgrade Preparation,
 - 2. Section 02223 - Flexible Base,

3. Section 0223 - Roadway Excavation, Borrow, and Embankment.

PART 3 - EXECUTION

3.01 EXCAVATION:

- A. When required, excavation shall be made to the specified depth, and the base upon which the curb and gutter or valley gutter is to be placed shall be compacted to a firm, even surface conforming to the requirements of Subsection 2.02 above.
- B. All soft and unacceptable material shall be removed and replaced with material approved by the ENGINEER in conformance with the requirements of Subsection 2.02 above.

3.02 FORMS:

- A. Forms shall be of wood or metal, straight, free from warp, and of such construction that facilitates the inspection of the grade and alignment for compliance with the approved plans and specifications.
- B. All forms shall extend for the entire depth of the curb and gutter and shall be braced and secured sufficiently so that no deflection from alignment or grade will occur during the placement of the concrete. Flexible forms shall be used in curved sections so that the top surface of the forms will form a smooth, continuous arc.

3.03 MIXING AND PLACING:

- A. Concrete shall be proportioned, mixed, and placed in accordance with the requirements of Section 02614 and Section 03300.
- B. Compaction of the concrete placed in forms shall be by vibration or other acceptable methods.
- C. Unless otherwise provided, the exposed surfaces of curbs and gutters shall be finished by belting or with wooden floats. Forms shall be left in place until the concrete has set sufficiently so that they can be removed without injury to the curb and gutter.

3.04 SECTIONS:

- A. Curb and gutter shall be constructed in sections having a uniform length of 20 feet, unless otherwise directed by the ENGINEER. Except at expansion joints, sections shall be separated by open joints 1/8 inch wide.

3.05 EXPANSION JOINTS:

- A. Expansion joints shall be formed at the intervals shown on the plans using a preformed expansion joints filler having a thickness of 3/4 inch.
- B. When the curb and gutter or concrete valley gutter is constructed adjacent to an existing concrete pavement, an expansion joint shall be located between the curb and gutter section and the existing concrete pavement.

3.06 CURING

- A. Immediately upon completion of the finishing, the curb and gutter shall be moistened and kept moist for 3 days, or the curb and gutter shall be cured by the use of a membrane-forming material. The method and details of curing shall be subject to the approval of the ENGINEER.

3.07 SURFACE TREATMENT:

- A. The surface of concrete curb and gutter or concrete valley gutter shall be treated with a solution of Linseed Oil and Mineral Spirits in accordance with the applicable requirements of Section 03300 - Cast-In-Place Concrete.

3.08 BACKFILLING:

- A. After the concrete has set sufficiently, the spaces in front and behind the curb and gutter section shall be refilled to the required elevation with material approved by the ENGINEER, and shall be thoroughly tamped in layers of not more than 6 inches.

3.09 SLIP-FORM CONCRETE CURB, CONCRETE CURB AND GUTTER OR CONCRETE VALLEY GUTTER:

- A. Any concrete curb or concrete curb and gutter, except on structures, may be placed using a slip form machine provided that the finished concrete curb or concrete curb and gutter is true to line and grade, the concrete is dense, and of the required surface texture.
- B. The concrete shall be of a consistency that it will maintain the shape of the concrete curb or concrete curb and gutter section without support after slip forming.
- C. The top and face of the finished concrete curb or concrete curb and gutter shall be true a straight and the top surface of the concrete curb or concrete curb and gutter shall be of uniform width and free from humps, sags, or other irregularities.
- D. The forming portion of the slip form machine shall be readily adjustable vertically during the forward motion of the slip form machine to provide a variable height of concrete curb or concrete curb and gutter grade when necessary. A grade line gauge or pointer shall be attached to the slip form machine in such a manner that a continual comparison can be made between the concrete curb or concrete curb and gutter grade as indicated by the offset guidelines.
- E. Concrete shall be fed to the slip form machine at a uniform rate. The slip form machine shall be operated under sufficient uniform restraint to forward motion to produce a well compacted mass of concrete free from surface pits larger than 3/16 inch in diameter and requiring no further finishing, other than light brushing with a wet brush. Finishing with a brush application of grout will not be permitted.
- F. Transverse weakened planes and expansion joints shall be constructed at right angles to the line of the concrete curb, concrete curb and gutter, or concrete valley gutter.
- G. Expansion joints may be constructed by sawing through the concrete curb or concrete curb and gutter section to its full depth. The width of the cut shall be such as to admit the joint filler with a snug fit.
- H. The operations of sawing and inserting the joint filler shall be completed before curing the concrete. At the conclusion of the curing period the filler in each joint shall be checked for tightness of fit. Loose filler in any joint shall be mortared in place and cured.

- I. Excavation shall be as per Subsection 3.02 above.
- J. All remaining provisions of Subsection 2.02 above also apply, unless otherwise specified.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

- A. Curb and gutter, curb, and valley gutter shall be measured by the linear foot.
 - 1. Curb shall be measured along the front face of the section at the finished grade elevation.
 - 2. Combination curb and gutter will be measured along the face of the curb at the flowline of the gutter.
 - 3. Valley gutter will be measured along the flowline of the gutter.
- B. A deduction in length shall be made for drainage structures, such as catch basins or inlets, in the curb, gutter, or combination thereof.
- C. There will be no direct measurement or payment of materials used to construct curb and gutter, curb, or valley gutter.
- D. Excavation or construction of embankment for foundation of curb, valley gutter, or combination curb and gutter will not be measured for payment.

4.02 PAYMENT:

- A. The accepted quantities of curb, valley gutter, and curb and gutter will be paid for at the contract unit bid price per linear foot for each kind and type specified, complete and in place.
- B. Foundation preparation by excavating or constructing embankment to the required subgrade elevation is considered incidental to the completion of the work and no direct payment will be made thereof.

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- C. Compensation will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

*** * * END OF SECTION * * ***

2018.14
M GARCIA ENGINEERING, LLC

CONCRETE CURB AND
GUTTER AND VALLEY GUTTER
02510- 6/6

SECTION 02514 – CONCRETE FLATWORK, CURBS, & APPROACHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of portland cement concrete paving is shown on drawings including walks, curbs, and approaches.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with local governing regulations.

1.04 JOB CONDITIONS

- A. Traffic Control:
 - 1. Maintain access for vehicular and pedestrian traffic as required for other construction activities.
 - 2. Utilize barricades and warning signs as required.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
 - 1. Use flexible spring steel forms or laminated boards to form radius bends as required.
 - 2. Coat forms with a nonstaining form release agent that will not discolor or deface surface of concrete.

- B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Architect.
- C. Reinforcing Bars: Deformed steel bars ASTM A615, Grade 40.
- D. Fabricated Bar Mats: Welded or clip assembled steel bar or rod mats, ASTM A184. Use ASTM A615, Grade 40 steel bars, unless otherwise indicated.
- E. Joint Dowel Bars: Plain steel bars, ASTM A615, Grade 40. Cut bars true to length with ends square and free of burrs.
- F. Concrete Materials:
 - 1. Portland Cement: ASTM C 150, Type I
 - a. Use one brand cement throughout project, unless otherwise acceptable to Architect.
 - 2. Normal Weight Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for exposed concrete.
 - a. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling causing deleterious substances.
 - b. Local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.
- G. Expansion Joint Materials: Contractor shall use pre-formed expansion joint fillers and sealers.
- H. Liquid Membrane Forming Curing Compound: Complying with ASTM C309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Masterseal", Master Builders
 - b. "Clear Seal", A.C. Horn

- c. "Sure Cure", Kaufman Products, Inc.
 - d. "Sealkure", Toch Div. - Carboline
 - e. "Kure-N-Seal", Sonneborn-Contech
 - f. "Sonocrete", Sonneborn-Contech
 - h. "L&M Cure", L&M Construction Chemicals
- I. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Weldcrete", Larsen Products
 - b. "Everbond", L&M Construction Chemicals
 - c. "Hornweld", A.C. Horn
 - d. "Sonocrete", Sonneborn-Contech
 - e. "Acrylic Bondcrete", The Burke Co.

2.02 CONCRETE MIX, DESIGN, AND TESTING

- A. Design mix to product normal weight concrete consisting of portland cement, aggregate, and water to produce the following properties.
 - 1. Compressive Strength: 3000 psi, minimum at 28 days, unless otherwise indicated.
 - 2. Slump Range: 5" for concrete containing HRWR admixture (super-plasticizer); 3" for other concrete.
 - 3. Air Content: 5% to 8%.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

- B. Proof roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.02 FORM CONSTRUCTION

- A. Set forms to required grades and lines rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least twenty four (24) hours after concrete placement.
- B. Check completed formwork for grade and alignment to following tolerances:
 - 1. Top of forms not more than 1/8" in 10'.
 - 2. Vertical face on longitudinal axis, not more than 1/4" in 10'.
- C. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

3.03 REINFORCEMENT

- A. Locate, place, and support reinforcement as specified in this section unless otherwise indicated on plans.
- B. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.
- C. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.
- D. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- E. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Engineer.
- F. Place reinforcement to obtain at least minimum coverage's for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete

placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

- G. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.04 CONCRETE PLACEMENT

- A. General: Comply with requirements of Division 3 sections for mixing and placing concrete and as herein specified.
 - 1. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
 - 2. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
 - 3. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.
- B. Fabricated Bar Mats:
 - 1. Keep mats clean and free from excessive rust and handle units to keep them flat and free of distortions. Straighten bends, kinks, or other irregularities or replace units as required before placement. Set mats for a minimum 2" overlap to adjacent mats.
 - 2. Place concrete in 2 operations; strike-off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike-off and screed.

- a. Remove and replace portions of bottom layer of concrete which has been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.
- C. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

3.05 JOINTS

- A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the center line unless otherwise indicated.
 1. When joining existing structures, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness as follows:
 1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.
 2. Sawed Joints: (Contractor's Option) Form weakened-plane joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
- C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such placements terminate at expansion joints.
 1. Construct joints as shown or, if not shown, use standard metal keyway-section forms.
 2. Where load transfer slip dowel devices are used, install so that one end of each dowel bar is free to move.

- D. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.
1. Locate expansion joints at 50' o.c. for each pavement lane, unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
 3. Furnish joint fillers in one piece lengths for full width being placed wherever possible where more than one length is required, lace or clip joint filler sections together.
 4. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.
- E. Fillers and Sealants: Comply with requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

3.06 CONCRETE FINISHING

- A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
- B. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide a continuous smooth finish.
- C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool and round to 1/2" radius unless otherwise indicated. Eliminate tool marks on concrete surface.
- D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing as follows:

1. Broom finish by drawing a fine hair broom across concrete surface perpendicular to the line of traffic. Repeat operation, if required, to provide a fine line texture acceptable to Architect.
 2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff bristled broom perpendicular to the line of traffic.
- E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects as directed by Architect.

3.07 CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.
1. Provide moisture curing by one of the following methods.
 2. Keep concrete surface continuously wet by covering with water.
 3. Use continuous water-fog spray.
 4. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet.
 5. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.
 6. Provide moisture-cover curing as follows:
 - a. Cover concrete surfaces with moisture-retarding cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by water proof tape or adhesive.

- b. Immediately repair any holes or tears during curing period using cover material and water proof tape.
- c. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:
 - i. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen as disappeared).
 - ii. Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions.
 - iii. Recoat areas subjected to heavy rainfall within 3 hours after initial application.
 - iv. Maintain continuity of coating and repair damage during curing period.
 - v. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied to concrete.

3.08 REPAIRS AND PROTECTIONS

- A. Repair or replace broken or defective concrete as directed by Architect.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

END OF SECTION

SECTION 02570 - SANITARY SEWERS

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Trenching, Backfilling and Compacting: Section 02221.

1.02 SUBMITTAL

- A. Submit manufacturer's certification that products meet specification requirements.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials on manufacturer's original skids or in original unopened protective packaging. Owner reserves the right to reject material left from another job.
- B. Store materials to prevent physical damage.
- C. Protect materials during transportation and installation to avoid physical damage.

1.04 GENERAL DESCRIPTION OF WORK COVERED

- A. Furnish and install all sewer pipe, fittings and structures, and accessories required for sanitary sewer construction as indicated.

1.05 QUALITY ASSURANCE

- A. Comply with latest published editions of American Society of Testing and Materials (ASTM) Standards:
 - 1. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 2. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 3. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 4. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer

Pipe and Fittings.

5. ASTM F794 - Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
6. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings (SDR35).
7. ASTM F949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
8. ANSI A21.11 - Rubber Gasket Joints for Cast Iron and Ductile- Iron Pressure Pipe and Fittings.
9. ASTM D3753 - Standard Specification for Glass Fiber Reinforced Polyester Manholes.
10. ASTM C-923 - Standard Specification for Resilient Manhole Connectors.
11. ASTM C-478 - Specification for Pre-cast Reinforced Concrete Manhole Sections.
12. ASTM C-443 - Specification for Joints for Circular Concrete Sewer and Culvert pipe using Rubber Gaskets.
13. ASTM C-1244 - Specification for Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
14. AWWA C-151 - Specification for Ductile Iron Pipe and Fittings.
15. ASTM D-1248 - Standard specification for Polyethylene Plastics Molding and Extrusion Materials.
16. AWWA C-105 - Polyethylene Encasement for Gray and Ductile Cast -Iron Piping for Water and Other Liquids.
17. AWWA C-110 - Gray Iron And Ductile Iron Fittings 3-inch through 48-inch, for Water and Other Liquids.
18. ASTM D-3350 - Specification for Polyethylene Plastic Pipe and Fittings Materials.
19. ASTM F-714 - Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter (3-inch IPS and larger).

- 20. ASTM D-3261 - Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Pipe and Tubing.
- 21. ASTM D-1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds, and Chlorinated Poly (Vinyl Chloride) (CPVC) Compound.
- 22. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe 4-inch through 12-inch for water distribution.
- 23. AWWA C905 - Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameter 14-inch through 36-inch.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Pipe furnished may be any one of materials specified herein for sanitary sewer construction unless shown otherwise on plans or bid forms.
- B. All pipe shall be marked in accordance with applicable standard specification under which pipe is manufactured unless otherwise specified.

2.02 POLYETHYLENE PIPE AND FITTINGS (PE)

- A. Comply with ASTM D3350 and ASTM F-714 for polyethylene (PE) solid wall pipe and fittings for use in pressure sanitary sewers. Wall thickness shall be as shown on the plans.
- B. Fittings shall comply with the performance requirements of ASTM D2683 or ASTM D3261 for molded or fabricated fittings of the size and pressure class as required.
- C. Provide pipe and fittings with minimum performance requirements of ASTM D 1248, Type III Class C, Category 5, Grade P34 and ASTM D3350 as indicated in this specification and as shown in the plans and details.

2.03 POLYVINYL CHLORIDE PLASTIC PIPE (PVC)

- A. Comply with ASTM D3033, D3034, ASTM F679, CT-1 walls, or ASTM F-794 for pipe using material conforming to ASTM D1784 for pipe and fittings.
 - 1. Sewers 6-inches to 10-inches shall conform to ASTM D3034.

2. Sewers 12-inches to 30-inches shall conform to ASTM D3034, ASTM F-679 (T-1 wall), or ASTM F-794 for pipe using material conforming to ASTM D1784 for pipe and fitting.
 3. Sewers 36-inches and larger shall conform to ASTM F-949, ASTM D3034, ASTM F-679 or ASTM F-794 for pipe using material conforming to ASTM D1784 for pipe and fitting.
- B. Use single elastomeric gasket push-on joints complying with ASTM D3212.
- C. Provide pipe and fittings with minimum performance capabilities of SDR-35 dimension ratio for gravity sewers of less than 10-feet in depth or cover. Where directed by the Engineer and as indicated on the plans, sewers greater than 10-feet in depth shall meet SDR26 or AWWA C900 or C905 requirements.
- D. Lubricant to be in accordance with the requirements of ASTM D3212. Lubricant to be suitable for lubricating the parts of the joints in the assembly. The lubricant to not have any deteriorating effects on the gasket and pipe materials.
- E. Schedule 40 shall be used for service laterals.
- F. Mark all pipe and fittings.

2.04 DUCTILE IRON PIPE AND FITTINGS

- A. Comply with the latest published edition of American Water Works Association (AWWA) Standards:
1. AWWA C110 & C110a - Gray Iron and Ductile-Iron Fittings, 2-inch through 48-inch for water and other liquids.
 2. AWWA C111 - Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings.
 3. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
 4. AWWA C151 - Ductile-Iron Pipe, centrifugally cast in metal mold or sand lined molds, for water or other liquids.
 5. AWWA C153 - Ductile-Iron Compact fittings, 3-inch through 12-inch for water and other liquids.
 6. ASSA C900 - Polyvinyl Chloride (PVC) Pressure Pipe 4-inches through 12-inches for

water.

7. Polyethylene encasement for the protection of ductile and cast iron pipes, fittings valves, and appurtenances shall be furnished and installed in accordance with the requirements of AWWA C-105.
8. Lining and Coating- Ductile and cast iron pipes, fittings valves, and appurtenances for sanitary sewer service shall be furnished with corrosion resistant interior lining furnished by the manufacturer:
 1. Polyethylene "polybond"
 2. Polyurethane "Corropipe II TX 5"
 3. Ceramic-Epoxy "Protecto 401"
 4. Engineer Approved Equal
9. Exterior Coating - Ductile and cast iron pipes, fittings valves, and appurtenances for sanitary sewer service shall be furnished with outside surfaces coated with a bituminous coating 1 mil thick in accordance with ANSI A21.6 or ANSI A21.51.

2.05 MANHOLES, STRUCTURES AND PIPE ACCESSORIES

A. Fittings

1. Fittings allowed only on service laterals.
2. Fittings shall equal or exceed quality of pipe. Fittings shall be full-bodied gasket fittings or inserted gasketed compression fittings on line size greater than 15-inches as shown in the plans and details.

B. Pre-cast Reinforced Concrete Manholes & Sections

1. Pre-cast reinforced concrete manhole base sections, riser sections, tops, cones and special sections shall conform to the requirements of ASTM C 478-93. The pre-cast sections shall have rubber gasket compression joints conforming to the material and performance requirements of ASTM C 443.
2. Pre-cast Concrete Manhole Base: A steel reinforced concrete base shall be used with pre-cast concrete manhole sections. This base shall be furnished with confined O-ring

joints in conformance with ASTM C 443. The reinforced concrete pre-cast manhole base as shown on the plans shall be manufactured in accordance with ASTM C 478.

3. Watertight, size-on-size resilient connectors allowing for differential settlement shall be used to connect pipe to manholes. Pipe to manhole connectors shall conform to ASTM C-923.
4. Minimum wall thickness will be 5-inches.
5. Concrete and reinforcing steel in foundation shall comply with Section 03300.

C. Cast-in-Place Manholes

1. Concrete and reinforcing steel shall comply with Section 03300.
2. Minimum wall thickness will be 5-inches.
3. Provide cast-in-place rubber gasket for connection of required sewer line or watertight, size-on-size resilient connectors allowing for differential settlement shall be used to connect pipe to manholes. Pipe to manhole connectors shall conform to ASTM C-923.

D. Fiberglass Manholes

1. Fiberglass manholes shall be in accordance with ASTM D3753 "Glass Fiber Reinforced Polyester Manholes, latest revision. The minimum wall thickness for all manholes at all depths shall be .40-inches. The inside diameter of the manhole barrel shall be either 48-inches or 1.5 times the nominal pipe diameter of the largest pipe, which ever is larger, or as indicated on the plan sheets. A concentric reducer over the barrel of the have an inside diameter of 23-inches.
2. Pipe Connectors - Watertight, size-on-size resilient connectors allowing for differential settlement shall be used to connect pipe to manholes. Pipe to manhole connectors shall conform to ASTM C-923 or shall be InsertaTee as shown in the plans and specification details. Joints for sewer pipe for line and drop connections in sizes 4-inches - 15-inches shall be made by means of gasketed inserted watertight compression connection or approved equal as shown in the plans and details. Install in accordance with the manufacturer's written instructions. Connections for pipe larger than 15-inches shall be made using a pre-approved connection. Install in accordance with the manufacturer's written instructions.

E. Manhole Accessories

1. Manhole lid and cover:
 - a. Gray cast iron, with minimum clear opening 24- inches.
 - b. Use Western Iron Works A770R or approved equal with vent holes.
 - c. Provide anchor bolt holes for exposed manhole tops.
2. Manhole Rings:
 - a. Provide minimum of three throat rings between cone and manhole
 - b. lid and cover.
3. Coating - Coating and lining of the interior vertical surfaces, if required, shall be as noted in the plans and details. Materials shall be installed and applied in accordance with the written instructions and specifications of the manufacturer at the thickness and quality as noted in the plans and details as approved by Engineer.
4. Manhole Inserts -Provide manhole insert to fit the manhole frame rim upon which the manhole cover rests.
 - a. Insert body shall be made of high density polyethylene copolymer material that meets ASTM D 1248, Class A, Category 5, Type III. Minimum thickness 1/8-inch.
 - b. Gasket shall be of closed cell neoprene and have pressure sensitive adhesive on one side and be placed under the weight-bearing surface of the insert by the manufacturer.
 - c. Lift strap of 1-inch woven polyethylene (seared on all cut ends to prevent unraveling. Strap shall be attached to the rising edge of the bowl off the insert by means of stainless steel rivet and washer.
 - d. Vent shall have 1/8-inch hole located on the side wall of the insert 3/4-inch below the lip.
 - e. Load capacity insert shall have certified test data verifying minimum collapse load of 1500 lbs. minimum applied to a 5.50-inch square area in the center of

the insert.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Provide all labor, equipment and materials and install all pipe, fittings, specials and appurtenances as indicated or specified.

3.02 PIPE INSTALLATION

A. Handling

1. Handle in a manner to insure installation in sound and undamaged condition.
 - a. Do not drop or bump.
 - b. Use slings, lifting lugs, hooks and usher devices designed to protect pipe, joint elements, and coatings.
2. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.
3. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

B. Installation

1. Installation, jointing and testing of pipe, fittings, and accessories shall be in accordance with the provisions of the applicable reference standard and in accordance with the requirements of this specification and related specifications referenced or contained in the contract documents for pressure or gravity sewers.
2. Lay pipe to slope gradient noted on the drawings.
3. Utilize equipment, methods, and materials insuring installation to lines and grades as indicated.
 - a. Do not lay on blocks unless pipe is to receive total con-crete encasement.
 - b. Use laser or minimum of 3 batter boards for control of line and grade.

- c. Obtain approval from Engineer for method proposed for transfer of line and grade from control to the work.
- 4. Install pipe of size, material, strength class, and joint type with embedment shown for plan location.
- 5. Insofar as possible, commence laying of pipe at downstream end of line, and, install pipe with bell ends in direction of pipe laying. Sewer pipe shall have spigot ends in direction of flow. Obtain approval for deviations therefrom.
- 6. Clean interior of all pipe, fittings and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.
 - a. Close open ends of pipe with snug fitting closures.
 - b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.
 - c. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.
- 7. Inspect pipe prior to installation to determine if any pipe defects are present.
- 8. Brace or anchor as required to prevent displacement after establishing final position.
- 9. Perform only when weather and trench conditions are suitable.
- 10. Observe extra precaution when hazardous atmospheres might be encountered.
- 11. Sanitary sewer relation to water mains:
 - a. Maintain 9-feet horizontal separation whenever possible.
 - b. When conditions prevent a lateral separation of 9- feet, sewer may be installed closer to a water main if:
 - (1) sewer constructed of PVC pipe meeting AWWA Specifications and having a minimum working pressure rating of 150 psi or greater and equipped with pressure type joints, and;
 - (2) the sewer line and water main are separated by a minimum vertical distance of 2-feet and a minimum horizontal distance of 4-feet, measured

between the nearest outside diameters of the pipes.

- c. When a sanitary sewer crosses a water line and that portion of the sewer is constructed as described in 3.02 B.9.b.(1), the sewer may be placed no closer than 6 inches from the water line. The separation distance must be measured between the nearest outside pipe diameters. The sewer line shall be located at a lower elevation than the water line whenever possible and one length of the sewer pipe must be centered on the water line.

- 12. Auger or jack casing pipe in place where shown on plans.

C. Jointing

1. General requirements:

- a. Locate joint to provide for differential movement at changes in type of pipe embedment, at changes from rock to soil trench bottom, and structures.
 - (1) Not more than 18 inches from structure wall, or
 - (2) Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing of structure.
- b. Perform in accordance with manufacturer's recommendations.
- c. Clean and lubricate all joint and gasket surfaces with lubricant recommended.
- d. Utilize methods and equipment capable of fully homing or making up joints without damage.
- e. Check joint opening and deflection for specification limits.

D. Closure Pieces

- 1. Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.
- 2. Observe specifications regarding location of joints, type of joints and pipe materials and strength classifications.

E. Temporary Plugs

1. Furnish and install temporary plugs at each end of work for removal by others when completed ahead of adjacent contract or where indicated.
2. Remove from pipe laid under adjacent contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this contract.
3. Plugs
 - a. Use test plugs as manufactured by pipe supplier, or
 - b. Fabricate by Contractor of substantial construction.
 - c. Must be watertight against heads up to 20 feet of water.
 - d. Secure in place in a manner to facilitate removal when required to connect pipe.

3.03 MANHOLE INSTALLATION

- A. Foundations to be poured in place, or to be pre-cast concrete base sections in accordance with the requirements of ASTM C-478. See Standard Details included herein.
- B. Construct manhole foundation and channel inverts integrally for cast in place manhole foundations. See Standard Details included herein.
- C. Pre-cast manhole sections of ruse with cast in place manhole bases may be installed after foundation concrete has attained 75% of design strength.
- D. Forms for cast-in-place manhole may be installed after foundation concrete has attained 75% of design strength.
- E. Manhole foundation and manhole may be installed simultaneously if manhole section is supported on concrete blocks and foundation concrete placed under and around bottom section.
- F. Install manhole sections and joints in accordance with the requirements of the specification.
- G. Heat materials for casting in place in freezing weather and protect work from cold; maintain temperature of work at 40° F. for at least 24 hours after placing.

- H. Invert Channels: Inverts: The bottom of the manhole shall be provided with a "U" shaped channel that is as much as possible a smooth continuation of the inlet and outlet pipes.
1. For manholes connected to pipes less than 15-inches in diameter the channel depth shall be at least half the largest pipe diameter.
 2. For manholes connected to pipes 15 to 24-inches in diameter the channel depth shall be at least three fourths the largest pipe diameter.
 3. For manholes connected to pipes greater than 24-inches in diameter the channel depth shall be at least equal to the largest pipe diameter.
 4. In manholes with pipes of different sizes, the tops of the pipes shall be placed at the same elevation and flow channels in the invert sloped on an even slope from pipe to pipe. The bench provided above the channel shall be sloped at a minimum of 0.5-inch per foot.
 5. Where sewer lines enter the manhole higher than 24- inches above the manhole invert, the invert shall be filleted to prevent solids deposition.
 6. Drop Manholes: A drop manhole as shown in the details shall be provided for a sewer entering a manhole more than 30-inches above the insert. A drop pipe of the same pipe material and size shall be provided for a sewer pipe entering a manhole more than 24-inches above the invert. The drop pipe shall be constructed on the outside of the manhole utilizing Wyes and Ells to provide a smooth drop and a clean out leg as shown on the details. The drop pipe shall be encased with concrete unless otherwise directed by the Engineer. Concrete shall extend from the bottom of the manhole base up to the bottom of the incoming sewer pipe, concrete shall also extend from the outside wall of the manhole out past the Wye on the Wye branch with a minimum of six inches (6") on each side.
- I. Pipe Connection
1. Make watertight.
 2. Use rubber gasket or size on size resilient connectors allowing for differential settlement conforming to ASTM C-9232.
 3. All connections shall be at flowline of manhole.

J. Exterior Pipe Support (Rigid Pipe)

1. Support vitrified clay pipe on concrete cradle from manhole connection to first joint on each side of manhole as indicated.
2. Provide pipe joint within 18 inches of manhole wall.

K. Castings, frames, and fittings

1. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed.
2. The unit shall be protected until mortar or concrete is set.

L. Coatings if required in the specifications and details shall be applied after Engineer's approval of structure.

3.04 ACCEPTANCE TESTS FOR SEWER PIPELINES

A. Infiltration Testing

1. General

- a. Maximum infiltration for each section of sewer pipe shall not exceed 50 gal/mile/day/inch of pipe diameter.
- b. Infiltration, exfiltration or air test may be used to prove compliance with infiltration requirement.
- c. Acceptance of air test or exfiltration results will not preclude rejection of work if infiltration is measured and exceeds limitation.
- d. After backfilling and removing debris from each section of sewer line, conduct a line acceptance test under observation of the Engineer. Copies of all test results shall be made available to the Engineer upon request. Test the sanitary sewer lines in strict accordance with the following leakage test using low pressure air. If the test results indicate an unacceptable installation, locate the source of leakage, correct the defect, and retest until the installation is proven satisfactory.
- e. Tests should conform to the following requirements:

- (1) Infiltration or Exfiltration Tests. The total exfiltration as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter, per mile of pipe per 24 hours at a minimum test head of two feet above the crown of the pipe at the upstream manhole.
- (2) When pipes are installed below the groundwater level an infiltration test shall be used in lieu of the exfiltration test. The total infiltration, as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of two feet above the crown of the pipe at the upstream manhole, or at least two feet above existing groundwater level, whichever is greater.
- (3) For construction within the 25 year flood plan, the infiltration or exfiltration shall not exceed 10 gallons per inch diameter per mile of pipe per 24 hours at the same minimum test head.
- (4) If the quantity of infiltration or exfiltration exceeds the maximum quantity specified, remedial action shall be undertaken in order to reduce the infiltration or exfiltration to an amount within the limits specified.

2. Air Test

- a. Furnish all facilities required including: (1) Necessary piping connections. (2) Test pumping equipment. (3) Pressure gauges or manometers. (4) Bulkheads. (5) All miscellaneous items required.
- b. Obtain approval from Engineer of equipment and methods proposed for use.
- c. Test pipe in sections determined by Contractor and approved by Engineer.
- d. Plug ends of line and cap or plug all connections to with-stand internal test pressures.
- e. Introduce low pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe. (Add 0.43 psi for each vertical foot of ground water over the top of pipe.)
- f. Allow two minutes for air pressure to stabilize.
- g. Time required for pressure to decrease from 3.5 to 2.5 psi greater than

average back pressure of any ground water above pipe shall not be less than time in following table for given diameters.

AIR TESTING TIMING

<u>Pipe Diameter</u> <u>(Inches)</u>	<u>Minutes</u>
6	3.0
8	4.0
10	5.0
12	5.5
15	7.0
18	8.5
21	10.0
24	11.5
27	12.75
30	14.0
36	17.0

h. Repeat test as necessary after all leaks and defects have been repaired.

C. Deflection Testing

1. Perform on flexible pipe.
2. Use a mandrel to test for a maximum 5 percent deflection unless otherwise specified in the contract document.
3. The mandrel shall be sized and constructed as listed on the applicable table on page 02570-1.
4. Conduct no sooner than thirty (30) days after final backfill.
5. Use no mechanical pulling devices.
6. Uncover all irregularity or pipe deformation exceeding 5%. Replace all damaged pipe reround non-damaged pipe and tamp the embedment and initial backfill.
7. Any pipe removed shall be replaced by use of gasketed repair couplings.
8. Conduct deflection test in the presence of the Owner's or Engineer's representative.

9. Manhole Testing: Successful passage of a vacuum or hydrostatic test shall be required for acceptance of all sanitary sewer manholes and sanitary sewer structures. If a manhole fails a leakage test the manhole must be made watertight and retested. Hydrostatic testing shall be conducted by plugging with Engineer approved plugs all influent and effluent pipes in the manhole and filling the manhole with water to the top of the manhole cone with water. Additional water may be added over a twenty-four (24) hour period to compensate for absorption and evaporate losses. At the conclusion of the twenty-four (24) hour saturation period the manhole shall be filled to the top of the manhole cone and observed. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour. Any loss within a thirty (30) minute period shall be considered an unsuccessful test. Vacuum testing shall be performed in accordance with the requirements of ASTM C-1244, Specification for Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

3.05 SERVICE CONNECTIONS:

- A. Install service connections at each dwelling or business place, or as directed by Engineer.
- B. Services wyes: install wyes, 4-inch branch diameter unless shown otherwise on plans. See standard detail, "Typical Service Connection", Dwg. D-05.
- C. Risers: use in lieu of wyes for service connections where invert of sewer is 15 feet or more below ground surface or where shown on plans. See standard detail, "Typical Riser Service Connection".
- D. Place suitable stopper in end of connection, cement stopper in place with cold bituminous joint compound.
- E. Backfill trench only after recording exact location of service connection. Place engineer approved marker tape above service piping in excavation within 3-feet of the surface.
- F. Make no connections to house sewers or extend service connections beyond this contract without written permission of Engineer.
- G. Backfill trench only after entire service line and wye connection has been inspected and approved by Engineer. Compact as specified in Section 02221, "Trenching, Backfilling and Compacting".
- H. Street crossings shall have a minimum of 3 feet of cover to sub-grade unless approved by

Engineer.

- I. No payment for service lines will be made until all specified requirements have been met.

3.06 CONNECTIONS TO EXISTING DRAINS AND SEWER SYSTEM

- A. Connect existing sanitary service drains which cross new sewer line through equal sized wye.
- B. Connect no storm drains to new sewers.
- C. Connections to existing manholes:
 - 1. Cut hole in existing manhole at required elevation.
 - 2. Insert new sewer pipe flush with inside of manhole.
 - 3. Grout new pipe in place.
 - 4. Reconstruct manhole bottom to suit new connection.
- D. Connections to existing sewer:
 - 1. Build new manhole around existing sewer.
 - 2. Break out existing sewer inside of manhole and construct bottom to suit new connection.

PART 4 - MEASUREMENT AND PAYMENT

4.01 SANITARY SEWER PIPE

- A. Sanitary sewer pipe shall be measured from center of manhole to center of manhole or end of main. The sewer pipe shall be measured along the center of the pipe without considering fittings or other pipe connections. Sanitary sewer pipe will be paid at the contract bid price per linear feet complete in place at various depths for the type, size and depth constructed.
- B. Compensation will be for furnishing all materials, labor, equipment, tools and incidentals required by the construction of the sanitary sewer pipe, all in accordance with the plans and these specifications.
- C. If sanitary sewer pipe fails or does not pass appropriate mandrel test, Contractor shall remove

and replace that part of the sewer pipe at no cost to the Owner.

4.02 SANITARY SEWER MANHOLE

- A. Sanitary sewer manhole will be measured from the top of the ground to the sanitary sewer invert. Manholes shall be paid at the contract bid price per each at the various depths.
- B. Compensation will be for furnishing all materials, labor, equipment, tools and incidentals required including any specified protective coating ring and cover, manhole insert, and/or A grade rings if not included as a separate pay item. All in accordance with the plans and specifications herein.

*** * * END OF SECTION * * ***

SECTION 02577 - HOT MIX ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Hot mix asphalt concrete (HMAC) pavement shall consist of a binder course, a leveling up course, a surface course or a combination of the courses as shown on the plans, or as directed by the ENGINEER.
- B. HMAC pavement shall be composed of a compacted mixture of mineral aggregate and asphaltic material, constructed on previously completed and approved subgrade, subbase course, base course, or existing pavement.
- C. HMAC pavement shall be in accordance with the specifications herein and in conformity with the lines, grades, quantities and typical sections in the contract and/or as directed by the ENGINEER.

1.02 QUALITY CONTROL:

- A. HMAC pavement and its constituent part shall conform to the ASTM, AASHTO and/or TxDOT test methods noted below.

PART 2 - PRODUCTS

2.01 ASPHALTIC MATERIALS:

- A. Asphalt cement binders shall be uncracked petroleum asphalt and shall be carefully refined, by steam, vacuum, or solvent, from asphaltic or semi-asphaltic base crude petroleum at a temperature not to exceed 700° F. Asphalt cements shall be free from thermal decomposition products and shall not be blended with any materials which have been subjected to cracking or produced from a crude petroleum source other than that of the original material. The asphalt cement shall not contain residues from non-asphaltic sources. Asphalt cement shall be homogeneous, free from water, and shall not foam when heated to 347° F.

- B.** Paving asphalt shall be classified by penetration or viscosity and shall conform to the requirements set forth in one of the following tables as designated by the ENGINEER. The CONTRACTOR may supply asphalt meeting the requirements of one of the following tables provided that he obtains prior approval of the ENGINEER and with the provision that once approval has been obtained, that the CONTRACTOR will remain with that grade throughout the project.

TABLE 2577-1

Specification Designation	AASHTO Test Method	ASTM Test Method	40 to 50	60 to 70	85 to 100	120 to 150	150 to 200	200 to 250
Flash Point (Open cup) Min	T48	D92	--	450	450	450	425	350
Penetration of Orig. Sample at 77° F	T49	D5	40 to 50	60 to 70	85 to 100	120 to 150	150 to 200	200 to 250
Thin-Film Oven Loss, Hours at 325° F, % Max	T179	D1754	0.75	0.75	0.75	0.75	1.00	1.00
Test of Residue from Thin-Film Oven Test: % of Orig. Pen., Min.	T49	D5	52	50	50	50	50	50
Ductility at 77°F cm. after loss	T51	D113	50	50	100	100	100	100

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at 325° F, Min.

Solubility in
CCl₄ Min.

T44*

None

99.5

99.5

99.5

99.5

99.5

99.5

Reaction to
Spot Test

T102**

None

-0-

-0-

-0-

-0-

-0-

-0-

* Procedure No. 1 with CCl₄ substituted for CS₂.

** Using 85% Standard Naphtha Solvent and 15% Xylene.

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HOT MIX ASPHALT
CONCRETE PAVEMENT
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TABLE 2577-2

TYPE-GRADE	OA-30		OA-175*8		OA-400	
	Min.	Max	Min.	Max	Min.	Max
Penetration at 32° F, 200g., 60 sec	15	--	--	--	--	--
Penetration at 77° F, 100g., 5 sec	25	35	150	200	--	--
Penetration at 115° F, 50g., 5 sec	--	65	--	--	--	--
Ductility at 77° F, 5 cm/min., cms: Original OA	2	--	70	--	--	--
Flash Point C.O.C., °F	450	--	425	--	425	--
Softening Point, R.&B., °F	185	--	95	130	--	--
Thin Film Oven Test, 1/8 in. Film 50 g., 5 hrs., 325° F, % Loss by wt.	--	0.4	--	1.4	--	2.0
Penetration of Residue, at 77° F, 100g., 5 sec. % of Original Pen	--	--	40	--	--	--
Ductility of Residue at 77° F, 5 cm/min., cms	--	--	--	100	--	--
Solubility in Trichloroethylene, %	99.0	--	99.0	--	99.0	--
Spot Test on Original OA	Neg.		Neg.		Neg.	
Float Test at 122° F, sec	--	--	--	120	150	
Test on 85 to 115 Pen.Residue*	--	--	--	--	75	--
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Residue by Wt., %

Ductility, 77° F, 5 cm/min:

Original Res., cms	--	--	--	--	100	--
Subjected to Thin Film Test, cms	--	--	--	--	100	--

* Determined by Vacuum Distillation (by evaporation if unable to reduce by vacuum).

** For use with Latex Additive only.

2018.14

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HOT MIX ASPHALT
CONCRETE PAVEMENT
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TABLE 2577-3

PROPERTIES	AC-1.5		AC-3		AC-5		AC-10		AC-20		AC-40	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Viscosity, 140° F. stokes. . . .	150	50	300	100	500	100	1000	200	2000	400	4000	800
Viscosity, 275° F. stokes. . . .	0.7	--	1.1	--	1.4	--	1.9	--	2.5	--	3.5	--
Penetration, 77° F. 100 g, 5 sec.	250	--	210	--	135	--	85	--	55	--	35	--
Flash Point, C.O.C.,°F.	425	--	425	--	425	--	450	--	450	--	450	--
Solubility in trichloroethylene, percent. . . .	99.0	--	99.0	--	99.0	--	99.0	--	99.0	--	99.0	--
Test on residues from thin film oven test: Viscosity, 140° F stokes. . . .	--	450	--	900	1500	--	3000	--	6000	--	--	12000
Ductility, 77° F, 5 cms per min,cms	100	--	100	--	100	--	70	--	50	--	30	--
Spot test	-----Negative for all grades-----											

- C. A minimum of two percent, by weight, latex additive (solids basis) shall be added to the OA-175 Asphalt or to AC-5 Asphalt when specified in the contract. The latex additive shall be governed by the following specifications:

The latex is to be an anionic emulsion of butadiene-styrene low-temperature copolymer in water, stabilized with fatty-acid soap so as to have good storage stability, and possessing the following properties:

Monomer ratio, B/S	70/30
Minimum solids content	67%
Solids content per gal.@ 67%	5.3 lbs.
Coagulum on 80-mesh screen	0.01% max.
Type Anti-oxidant	staining
Mooney viscosity of Polymer(M/L 4@212° F)	100 min.
pH of Latex	9.4 - 10.5
Surface tension	28-42 dynes/cm2

The finished latex-asphalt blend shall meet the following requirements:

Viscosity at 140° F, stokes	1500 max.
Ductility at 39.2° F, 1 cm. per min., cm.	100 min.

D. Asphalt content shall be within the limits noted below:

Table 2577-4

HMAC Type	Percent of Mixture by Weight	Percent of Mixture by Volume
"A"	3.5 - 7.0	8.0 - 16.0
"B"	3.5 - 7.0	8.0 - 16.0
"C"	3.5 - 7.0	8.0 - 16.0
"D"	4.0 - 8.0	9.0 - 19.0
"F"	3.5 - 6.5	8.0 - 16.0

E. At the time of delivery of each shipment of asphalt, the vendor supplying the material shall deliver to the purchaser certified copies of the test report which shall indicate the name of the vendor, type and grade of asphalt delivered, date and point of delivery,

quantity delivered, delivery ticket number, and results of the above-specified tests. The test report shall be certified and signed by an authorized representative of the vendor that the product delivered conforms to the specifications for the type and grade indicated.

- F. Until the certified test reports and samples of the material have been checked by the ENGINEER to determine their conformity with the prescribed requirements, the material to which such report relates and any work in which it may have been incorporated as an integral component will be only tentatively accepted by the City. Final acceptance will be dependent upon the determination of the ENGINEER that the material involved fulfills the requirements prescribed therefor. The certified test reports and the testing required in connection with the reports will be at the expense to the City.
- G. Unless otherwise specified in these specifications or in the Supplementary Specifications, the various grades of paving asphalt shall be applied at a temperature range of from 210° F to 325° F, the exact temperature to be determined by the ENGINEER.
- H. Paving asphalt shall be heated in such a manner that steam or hot oils will not be introduced directly into the paving asphalt during heating. The CONTRACTOR shall furnish and keep on the site, at all times, an accurate thermometer suitable for determining the temperature of the paving asphalt.
- I. HMAC asphalt shall be the grade having the highest penetration, within specified limits, to produce a mix having a maximum stability of the compacted mixtures.
- J. Only one (1) grade of asphalt shall be required unless otherwise shown on the plans or as required by the ENGINEER.

2.02 AGGREGATES:

- A. HMAC aggregate will be tested in accordance with the following test standards:

- AASHTO T-30 Mechanic Testing
- AASHTO T-27 Passing No. 200 Sieve
- AASHTO T-89 Liquid Limit
- AASHTO T-96 Los Angeles Abrasion
- AASHTO T-104 Soundness (Magnesium Sulfate)
- ASTM C – 131 Resistance to Degradation

ASTM C – 136 Sieve Analysis
ASTM C – 2419 Sand Equivalence Value
TxDOT Tex -106-E Method of Calculating Plasticity Index of Solids
TxDOT Tex-217 – F (I & II) Determination of Deleterious Materials and
Decantation Test
TxDOT Tex-203 – F Quality Tests for Mineral Aggregates

- B. Aggregates shall have an abrasion of not more than 40 for all courses except the non-skid surface course, which shall have an abrasion of not more than 35.
- C. When properly proportioned, HMAC aggregate shall produce a gradation which will conform to the limitations for classification for HMAC type shown below, or as directed by the ENGINEER.
- D. Course aggregate to be crushed limestone rock or crushed gravel with hydrated lime or limestone filler. (Crushed gravel shall be per TxDOT Specifications.)
- E. Binder aggregate to be composed of 15% crushed limestone screening or as directed by the engineer.

1. Type "A" - Course Graded Base Course

	Percent Aggregate by Weight or Volume
Passing 2" sieve.....	100
Passing 1-3/4" sieve.....	95 to 100
Passing 1-3/4" sieve, retained on 7/8" sieve.....	16 to 42
Passing 7/8" sieve, retained on 3/8" sieve....	16 to 42
Passing 3/8" sieve, retained on No. 4 sieve .	10 to 26
Passing No. 4 sieve, retained on No. 10 sieve.....	5 to 21
Total retained on No. 10 sieve.....	68 to 84
Passing No. 10 sieve, retained on No. 40 sieve.....	5 to 21
Passing No. 40 sieve, retained on No. 80 sieve	3 to 16
Passing No. 80 sieve, retained on No. 200 sieve	2 to 16
Passing No. 200 sieve.....	1 to 8

2. Type "B" - Fine Graded or Leveling-Up Course

	Percent Aggregate by Weight or Volume
--	--

Passing 1" sieve.....100
Passing 7/8" sieve.....95 to 100
Passing 7/8" sieve, retained on 3/8" sieve21 to 53
Passing 3/8" sieve, retained on No. 4 sieve.....11 to 42
Passing No. 4 sieve, retained on No. 10 sieve.....5 to 26
Total retained on No. 10 sieve.....58 to 74
Passing No. 10 sieve, retained on No. 40 sieve.....6 to 32
Passing No. 40 sieve, retained on No. 80 sieve.....4 to 21
Passing No. 80 sieve, retained on No. 200 sieve.....3 to 21
Passing No. 200 sieve.....1 to 8

3. Type "C" - Course Graded Surface Course

	Percent Aggregate by Weight or Volume
Passing 7/8" sieve.....	100
Passing 5/8" sieve.....	95 to 100
Passing 5/8" sieve, retained on 3/8" sieve	16 to 42
Passing 3/8" sieve, retained on No. 4 sieve.....	11 to 37
Passing No. 4 sieve, retained on No. 10 sieve.....	11 to 32
Total retained on No. 10 sieve.....	54 to 74
Passing No. 10 sieve, retained on No. 40 sieve.....	6 to 32
Passing No. 40 sieve, retained on No. 80 sieve.....	4 to 27
Passing No. 80 sieve, retained on No. 200 sieve.....	3 to 27
Passing No. 200 sieve.....	1 to 8

4. Type "D" - Fine Graded Surface Course

	Percent Aggregate by Weight or Volume
Passing 1/2" sieve.....	100
Passing 3/8" sieve.....	85 to 100
Passing 3/8" sieve, retained on No. 4 sieve.....	21 to 53
Passing No. 4 sieve, retained on No. 10 sieve.....	11 to 32
Total retained on No. 10 sieve.....	54 to 74

Passing No. 10 sieve, retained on No. 40 sieve.....6 to 32
Passing No. 40 sieve, retained on No. 80 sieve.....4 to 27
Passing No. 80 sieve, retained on No. 200 sieve.....3 to 27
Passing No. 200 sieve.....1 to 8

5. Type "F" - Fine Graded Surface Course

	Percent Aggregate by Weight or Volume
Passing 3/8" sieve.....	100
Passing No. 4 sieve.....	95 to 100
Passing No. 4 sieve, retained on No. 10 sieve.....	58 to 73
Passing No. 10 sieve, retained on No. 40 sieve.....	6 to 26
Passing No. 40 sieve, retained on No. 80 sieve.....	3 to 13
Passing No. 80 sieve, retained on No. 200 sieve.....	2 to 11
Passing No. 200 sieve.....	1 to 8

2.03 PRIME COAT:

- A. Prime coat, when specified on the plans, or directed by the ENGINEER, shall be in accordance with Section 02250 - Prime Coat, and as specified herein.
- B. Prime coat shall be applied to the surfaces of bases at least 12 hours prior to placing the HMAC unless otherwise directed by the ENGINEER.
- C. Asphalt prime shall be applied uniformly at the rate of 0.10 to 0.30 gallon per square yard, or as directed by the ENGINEER. It shall be applied only when permitted by the ENGINEER and when the air temperature is not less than 40°F.
- D. In order to prevent lapping at the junction of two applications, the distributor shall be promptly shut off. A hand spray shall be used to touch up all spots unavoidably missed by the distributor.
- E. Immediately prior to application of the asphalt prime, an inspection will be made by the ENGINEER to verify that the base course has been constructed as specified. Also, all

loose and foreign material shall be removed by light sweeping. Material so removed shall not be mixed with cover aggregate.

- F. The surface to be primed shall be in a smooth and well-compacted condition, true to grade and cross section, and free from ruts and inequalities.
- G. The pressure distributor used for applying prime coat material shall be equipped with pneumatic tires and shall be so designed and operated as to distribute the prime material in a uniform spray without atomization, in the amount and between the limits of temperature specified. It shall be equipped with a speed tachometer registering feet per minute and so located as to be visible to the truck driver to enable him to maintain the constant speed required for application at the specified rate.
- H. The pressure distributor shall be equipped with a tachometer registering the pump speed, pressure gauge, and a volume gauge. The rates of application shall not vary from the rates specified by the ENGINEER by more than 10%. Suitable means for accuracy indicating at all times the temperature of the prime material shall be provided. The thermometer well shall be so placed as not to be in contact with a heating tube.
- I. The distributor shall be so designed that the normal width of application shall be not less than 6 feet, with provisions for the application of lesser width when necessary. If provided with heating attachments, the distributor shall be so equipped and operated that the prime material shall be circulated or agitated through the entire heating process.
- J. The asphalt prime coat should preferably be entirely absorbed by the base course and, therefore, require no sand cover. If, however, it has not been completely absorbed prior to the start of placing the asphalt concrete mixture and in the meantime it is necessary to permit traffic thereon, sufficient sand shall be spread over the surface to blot up the excess liquid asphalt and prevent it from being picked it up under traffic. Also, sand shall be used in areas where traffic may pass over the prime coat. Prior to placing the asphalt concrete, loose or excess sand shall be swept from the base. If a sand cover is specified in the Supplementary Specifications or noted on the plans to cover asphalt prime, it shall be applied within 4 hours after the application of said prime coat, unless otherwise ordered by the ENGINEER.
- K. Liquid asphalt shall be prevented from being sprayed upon adjacent pavements, structures, guard rails, guide posts, culvert markers, trees, and shrubbery that are not to be removed; adjacent property and improvements; other facilities or that portion of the traveled way being used by traffic.

- L. The CONTRACTOR shall protect the prime coat against all damage and markings, both from foot and vehicle traffic. Barricades shall be placed where necessary to protect the prime coat. If, after the prime coat has been applied to the satisfaction of the ENGINEER and has been accepted, if it is disturbed by negligence on the part of the CONTRACTOR, it shall be restored at his expense to its condition at the time of acceptance. No material shall be placed until the prime coat is in a condition satisfactory to the ENGINEER.

2.04 TACK COAT:

- A. If the asphalt concrete pavement is being constructed directly upon an existing hard-surfaced pavement, a tack coat shall be evenly and uniformly applied to the existing pavement prior to the placing of the new asphalt concrete. The surface shall be free of water, all-foreign material, or dust when the tack coat is applied. No greater area shall be treated in any one day than will be covered by the asphalt concrete during the same day. Traffic will not be permitted over tack coating.
- B. Tack coat for HMAC shall consist of either rapid curing cut-back asphalt RC-2 diluted by addition of (not to exceed 15 percent by volume) an approved grade of gasoline and/or kerosene; emulsified asphalt, EA-11M diluted with 50 percent water, or a cut-back asphalt made by combining 50 to 70 percent of the asphaltic materials specified for the paving mixture with 30 to 50 percent gasoline and/or kerosene by volume.
- C. Tack coat shall conform to the requirements of Section 2620 - Tack Coat, or as specified herein.
- D. Application rate shall be 0.10 to 0.15 gallons per square yard, or as directed by the ENGINEER.
- E. A similar tack coat shall be applied to the surface of any course if in the opinion of the ENGINEER, the surface is such that a satisfactory bond cannot be obtained between it and the succeeding course.
- F. When required, the contact surfaces of all cold pavement joints, curbs, gutters, manholes, and the like shall be painted with a tack coat immediately before the adjoining asphalt concrete is placed. Asphalt tack coat shall be applied in controlled amounts as shown on the plans or determined by the ENGINEER. Surfaces where a tack

coat is required shall be cleaned to the satisfaction of the ENGINEER before the tack coat is applied.

2.05 MINERAL FILLER:

- A. Mineral filler, other than hydrated lime, shall consist of a thoroughly dry stone dust, portland cement or other mineral dust approved by the ENGINEER.
- B. The mineral filler shall be free from foreign or other deleterious matter.
- C. When tested by the method outlined in TxDOT Test Method Tex-200-F (Part 1 or 3), mineral filler shall meet the following gradations by weight:

Passing No. 30 Sieve	95-100%
Passing No. 80 Sieve	75%
Passing No. 200 Sieve	55%

2.06 ANTI-STRIPPING COMPOUND

- A. Anti-Stripping compound, as required in the job mix formula, shall be furnished in the amounts calculated therein.

2.07 JOB MIX FORMULA:

- A. A job mix formula based on representative samples, including filler if required, shall be determined by the ENGINEER, or submitted by the CONTRACTOR for approval of the ENGINEER.
- B. The resultant job mix formula shall be within the master range for the specified type of HMA.
- C. The job mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size and a single percentage of bituminous material to be added to the aggregate and shall provide for 3 to 5% air voids in the resultant design mix. During the mix design process the ENGINEER will consider other factors, in addition

to air voids and Marshall stability, such as durability, water resistance, and asphalt film thickness when developing the mix design.

- D. After the job mix formula is established, mixtures for the project shall conform to the following tolerances which may fall outside of the specified master range:

Percent by Weight or
Volume as Applicable

Passing 1-3/4" sieve, retained on 7/8" sieve	± 5
Passing 7/8" sieve, retained on 5/8" sieve	± 5
Passing 5/8" sieve, retained on 3/8" sieve	± 5
Passing 3/8" sieve, retained on No.4 sieve	± 5
Passing No.4 sieve, retained on No.10 sieve	± 5
Total retained on No.10 sieve	± 5
Passing No.10 sieve, retained on No.40 sieve	± 3
Passing No.40 sieve, retained on No.80 sieve	± 3
Passing No.80 sieve, retained on No.200 sieve	± 3
Passing No.200 sieve	± 3

Asphaltic Material ± 0.05 by wt or 1.2 by vol.

Mixing Temperature ± 20° F

- E. Asphaltic mixture shall be tested in accordance with TxDOT Test Method Tex-200-4 (Part I or Part III) and shall have the following laboratory values:

	Surface Course	Base Course
Density: Minimum	95%	95%
Maximum	98%	99%
Optimum	96.5%	96.5%
Stability (Hveem)		
Minimum	30%	30%
Maximum	45%	45%
Stability (Marshall – 75 Blow Briquette)	1500 lbs	1500 lbs.

Voids	3 - 7%	4 - 7%
Voids Filled With Asphalt	75 - 85%	65 - 80%
Sand Equivalent	40	40

2.08 EQUIPMENT:

- A. All equipment for the handling of all material, mixing, and placing of HMAC shall be in accordance with the provisions of TxDOT Item 340.

2.09 STOCKPILING, STORAGE, PROPORTIONING AND MIXING:

- A. Stockpiling, storage proportioning and mixing operations shall be in accordance with the Provisions of TxDOT Item 340.

PART 3 - EXECUTION

3.01 WEATHER AND TEMPERATURE LIMITATIONS:

- A. Asphaltic mixture, when placed with a spreading and finishing machine, or the tack coat shall not be placed when the air temperature is 50° F and falling, but may be placed when the air temperature is 40° F and rising.
- B. Asphaltic mixture, when placed with a motor grader, shall not be placed when the air temperature is 60° F and falling, but may be placed when the air temperature is 50° F and rising.
- C. Mat thicknesses of 1 inch or less shall not be placed when the temperature on which the mat is to be laid is below 50° F.
- D. No tack coat or asphaltic mixture shall be placed when the humidity, general weather conditions and temperature and moisture condition of the base, in the opinion of the ENGINEER, are unsuitable.

- E. If, after being discharged from the mixer and prior to placing, the temperature of the asphaltic mixture is 50° F or more below the temperature established by the ENGINEER, all or any part of the load may be rejected and payment will not be made for the rejected material.

3.02 EQUIPMENT:

A. Hauling Equipment:

1. Trucks used for hauling asphaltic mixtures shall have tight, clean, smooth metal beds that have been thinly coated with a minimal amount of paraffin oil, lime slurry, tine solution or other approved material to prevent mixture adhesion to the bed.
2. The dispatching of hauling equipment shall be arranged so that all material delivered may be placed and all rolling completed during daylight hours, unless otherwise directed by the ENGINEER.
3. All trucks shall be equipped with a cover of canvas, or other suitable material to protect the mixture from weather or on hauls where the temperature of the mixture will fall below specified level. Use of covers will be as directed by the ENGINEER.

B. Rollers:

1. Pneumatic Tire Roller. This roller shall consist of not less than seven pneumatic tire wheels, running on axles in such manner that the rear group of tires shall cover the entire gap between adjacent tires of the forward group; mounted in a rigid frame; and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such manner that the roller may be turned within a minimum circle. The tire shall afford surface contact pressures up to 90 pounds per square inch or more. The roller shall be so constructed as to operate in both a forward and a reverse direction with suitable provisions for moistening the surface of the tires while operating; and shall be approved by the ENGINEER.
2. Two Axle Tandem Roller. This roller shall be an acceptable power-driven, steel-wheel, tandem roller weighing not less than eight tons. It must operate in

forward and reverse directions; contain provision for moistening the surface of the wheels while in motion; and shall be approved by the ENGINEER.

3. Three Wheel Roller. This roller shall be an acceptable power- driven, all steel, three wheel roller weighing not less than 10 tons. It must operate in forward and reverse directions; contain provisions for moistening the surface of the wheel while in motion; and shall be approved by the ENGINEER.
4. Vibratory Steel Wheel Roller. If approved for use by the OWNER, this roller shall have a minimum weight of six tons. The compactor shall be equipped with amplitude and frequency controls and shall be specifically designed to compact the material on which it is used. It shall be operated in accordance with the manufacturer's recommendations.

C. Straight Edges:

1. The CONTRACTOR shall provide an acceptable 16-foot straight-edge for surface testing. Satisfactory templates shall be provided as required by the ENGINEER.

D. Spreading and Finishing Machine:

1. Bituminous pavers shall be self-contained, power-propelled units, provided with an activated screed or a strike-off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thickness shown on the plans.
2. The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. Design will be such that no part of the truck weight will be supported by the paver.
3. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture. When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture. The screed shall be adjustable for both height and crown and shall be equipped with a controlled heating device.

4. The bituminous paver shall be equipped with an automatic leveling device controlled from an external guide. The initial pass for each course shall be made using a paver equipped with a 40-foot minimum external reference, except that these requirements will not apply when asphalt concrete is placed adjacent to portland cement concrete pavement. Subsequent passes may utilize the matching device of one foot minimum length riding on the adjacent lay.

3.03 CONSTRUCTION METHODS:

A. Spreading and Finishing:

1. The asphalt concrete mixture shall be laid on the approved surface, spread and struck off to the grade and elevation established. It shall be spread and compacted in layers as shown on the plans or as directed by the ENGINEER. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.
2. The ENGINEER will determine a minimum placement temperature within a range from 220° F to 300° F which will produce the required density. The established placement temperature, which is measured immediately behind the laydown machine, shall not vary more than 20° F.
3. A conventional paver or suitable equipment approved by the ENGINEER may be used to place asphalt concrete material on shoulders depressed from the traveled lanes in order to establish a uniform typical section. Approval of the equipment used will be based upon the results obtained.
4. The asphalt concrete may be dumped from the hauling vehicles directly into the paving machine or it may be dumped upon the surface being paved and subsequently loaded into the paving machine; however, no asphaltic concrete shall be dumped from the hauling vehicles at a distance greater than 250 feet in front of the paving machine. When asphaltic concrete is dumped first upon the surface being paved, the loading equipment shall be self-supporting and shall not exert any vertical load on the paving machine. Substantially all of the asphaltic concrete dumped shall be picked up and loaded into the paving machine.

5. To achieve, as far as practicable, a continuous operation, the speed of the paving machine shall be coordinated with the production of the plant. Sufficient hauling equipment shall be available to insure continuous operation.
6. The control system shall control the elevation of the screed at each end by controlling the elevation of one end directly and the other indirectly either through controlling the transverse slope or alternately when directed, by controlling the elevation of each end independently, including any screed attachment used for widening, etc. Failure of the control system to function properly shall be cause for the suspension of the asphaltic concrete operations.
7. When dumping directly into the paving machine from trucks, care shall be taken to avoid jarring the machine or moving it out of alignment.
8. All courses of asphaltic concrete shall be placed and finished by means of self-propelled paving machines except under certain conditions or at certain locations where the ENGINEER deems the use of self-propelled, paving machines impracticable.
9. Self-propelled paving machines shall spread the asphaltic concrete without segregation or tearing within the specified tolerances, true to the line, grade, and crown indicated on the plans. Pavers shall be equipped with hoppers and augers which will place the asphaltic concrete evenly in front of adjustable screeds without segregation. Screeds shall include any strike-off device operated by tamping or vibrating action which is effective without tearing, shoving or gouging the asphaltic concrete and which produces a finished surface of an even and uniform texture for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required.
10. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked, fluted and compacted with hand tools. For such areas the mixture shall be dumped, spread and screed to give the required compacted thickness.

B. Compaction:

1. Rolling with the 3-wheel and tandem roller shall start longitudinally at the sides and proceed toward the center of the surface course, overlapping on successive trips by at least half the width of the rear wheels.
2. Alternate trips of the roller shall be slightly different in length.
3. Rolling with a pneumatic tired roller shall be as directed by the ENGINEER.
4. Rolling shall continue with no further compression can be obtained and all roller marks are eliminated.
5. The motion of the roller shall be slow enough at all times to avoid displacement of asphaltic materials. If displacement occurs, it shall be corrected immediately by use of rakes and fresh asphaltic mixtures, where required.
6. The roller shall not be allowed to stand on the surface course when it has not been fully compacted and allowed to cool.
7. To prevent adhesion of the surface course to the roller, the wheels shall be kept thoroughly moistened with water; however, excess water shall not be allowed.
8. All precautions shall be taken to prevent dripping of gasoline, oil, grease, or other foreign substances on the surface or base courses during rolling operations or while rollers are standing.
9. With the approval of the ENGINEER, a vibratory steel wheeled roller may be substituted for the 3-wheel roller and tandem roller.
10. Along forms, curbs, headers, walls and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or with mechanical tampers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.
11. Any mixture that becomes loose, broken, mixed with dirt, segregated, or is in any way defective shall be removed and replaced with fresh hot bituminous mixture, which shall be compacted to conform to the surrounding area. Any area showing excess or deficiency of bituminous material shall be corrected immediately as directed by the ENGINEER.

C. In-Place Density:

1. In-place density shall be required for all mixtures except thin irregular depth leveling courses.
2. Each course, after final compaction, shall have a density of not less than 95 percent of the density developed in the laboratory test method outlined in TxDOT Bulletin C-14.
3. Density shall be determined with a portable nuclear test device in conformity with ASTM D-2950.76.
4. Calibration of the portable nuclear device will be established by the ENGINEER from cut pavement samples tested in accordance with AASHTO T-166 (weight, volume method). The density readings of the cut pavement samples determined in accordance with AASHTO T-166 (weight, volume method), and the density readings of the pavement samples determined by the portable nuclear test device in conformity with ASTM D 2950 will be correlated by the ENGINEER.
5. Other methods of determining in-place density may be used as deemed necessary by the ENGINEER.
6. It is intended that acceptance density testing will be done while the bituminous mixture is hot enough to permit further compaction if necessary. If the density of an acceptance section does not meet the specified requirements, the CONTRACTOR shall continue the compaction effort until the optimum density is obtained. Rolling for any compactive effort will not be allowed when the temperature of the mix is below 175° F unless authorized in writing by the ENGINEER. Rerolling the paved surface after it has initially cooled will not be allowed.
7. If in-place density tests of the mixture produce a value lower than specified and in the opinion of the ENGINEER is not due to a change in the quality of the material, production may proceed with subsequent changes in the mix and/or construction procedures until in-place density equals or exceeds the specified density.
8. In-place density tests will be provided by the ENGINEER unless otherwise specified.

D. Joints:

1. Placing of the asphalt concrete shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by the ENGINEER.
2. When plant mix bituminous pavement is placed over plant mix bituminous treated base or when plant mixed seal coat is placed over plant mix bituminous pavement, longitudinal joints shall be staggered at least 6 inches with relation to the longitudinal joints of the underlying course.
3. Transverse joints shall have a two foot or 12:1 minimum taper. Longitudinal joints shall have a one foot or 6:1 minimum taper. All transverse tapers shall be cut and squared off prior to commencing new work. Tapered longitudinal joints from previous operations shall be cleaned and tack coated if directed by the ENGINEER. All joints shall be completely bonded. The surface of each course at all joints shall be smooth and shall not show any deviations in excess of 3/16 of an inch when tested with a 10-foot straightedge in any direction.
4. When paving under traffic, the CONTRACTOR shall plan his daily surfacing operations on a schedule which will result in not more than one (1) day's operation of exposed longitudinal joints. The longitudinal joints shall not have a height greater than two (2) inches and shall not be left exposed longer than 24 hours.

E. Surface Tolerance:

1. Upon completion, the pavement shall be true to grade and cross section.
Except at intersections or any changes of grade, when a 16 foot straight edge is laid on the finished surface parallel to the centerline of the roadway, the surface shall not vary from the edge of the straight edge more than 1/16-inch per foot. Areas that are not within this tolerance shall be brought to grade immediately following the initial rolling. After the completion of final rolling, the smoothness of the course shall be checked, and the irregularities that exceed the specified tolerances or that retain water on the surface shall be corrected by removing the defective work and replacing with new material as directed by the ENGINEER at the expense of the CONTRACTOR.

F. Manholes and Valve Covers:

1. Manhole frames and valve covers shall be adjusted prior to placing the surface course.

G. Compacted Thickness of HMAC Surface and Base Courses:

1. Surface Courses. The compacted thickness or depth of the asphaltic concrete surface course shall be as shown on the plans. Where the plans require a depth or thickness of the surface course greater than two inches compacted depth, same shall be placed in multiple courses of equal depth, each of which shall not exceed two inches compacted depth. If, in the opinion of the ENGINEER, an additional tack coat is considered necessary between any of the multiple courses, it shall be applied at the rate as directed.
2. Base Courses. The compacted thickness or depth of each base course shall be as shown on the plans. Where the plans require a depth or thickness of the course greater than 4 inches, same shall be accomplished by constructing multiple lifts of approximately equal depth, each of which shall not exceed these maximum compacted depths. If, in the opinion of the ENGINEER, an additional tack coat is considered necessary between any of the multiple lifts, it shall be applied as hereinbefore specified and at the rate as directed.

H. Pavement Thickness Tests:

1. Pavement Thickness Test. Upon completion of the work and before final acceptance and final payment shall be made, pavement thickness test shall be made by the ENGINEER or his authorized representative unless otherwise specified in the special provisions or in the plans. The number and location of tests shall be at the discretion of the OWNER. The cost for the initial pavement thickness test shall be at the expense of the ENGINEER. In the event a deficiency in the thickness of pavement is revealed during normal testing operations, subsequent tests necessary to isolate the deficiency shall be at the CONTRACTOR's expense.

I. Price Adjustment for Roadway Density

1. The payment of the unit price will be adjusted for roadway density as outlined in the following table. The adjustment will be applied on a lot by lot basis for each lift. The adjustment will be based on the average of five density tests. The price

adjustment will be applied to the entire asphalt concrete mix which includes the HMAC aggregate, the asphalt cement and anti-stripping compound, if used.

2.

Average Density % of Lab Density	Percent of Contract Price To Be Paid
Above 95%	100%
94.0 to 94.99	96%
93.0 to 93.99	91%
92.0 to 92.99	85%
Less than 92.00	*

* This lot shall be removed and replaced to meet specification requirements as ordered by the ENGINEER. In lieu thereof, the CONTRACTOR and the ENGINEER may agree in writing that for practical purposes, the lot shall not be removed and will be paid for at 50% of the contract price.

PART 4 - MEASUREMENT AND PAYMENT

4.01 INCIDENTAL WORK:

- A. Prime coat, anti-stripping compound, where used, and tack coat shall not be measured for direct payment, but shall be considered as subsidiary work pertaining to the placing of asphaltic mixtures of the contract price.

4.02 MEASUREMENT:

- A. Hot-mix asphalt concrete material shall be measured by the ton of 2,000 pounds or by the square yard of the type or types used in the completed and accepted work, as shown on the HMAC Solicitation Bid Sheet.
- B. Weight shall be determined by a certified scale approved by the OWNER and recorded serially numbered weight tickets, identifying the vehicle and presented to the ENGINEER's representative on the job.

4.03 PAYMENT:

- A. Work performed and materials furnished, as prescribed by this item, measured as provided herein, shall be paid at the unit bid price per ton or square yard for the type or types of hot mix asphalt concrete pavement shown on the proposal.
- B. Unit bid price shall be payment in full for quarrying; furnishing all materials; for all heating; mixing; hauling; cleaning existing base course or pavement; placing asphaltic mixtures; rolling and finishing; and for all labor, tools, equipment and incidentals necessary to complete the work, including the work and materials involved in the application of prime coat and tack coat.

*** * * END OF SECTION * * ***

SECTION 02580 - STORM SEWER APPURTENANCES

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

- A. This work shall consist of furnishing and installing appurtenances except manholes, for storm sewers in accordance with details on the plans and as specified herein as directed by the ENGINEER.
- B. The various types of structures and appurtenances such as inlets, headwalls, energy dissipators, etc. are designated on the plans by letters or by numbers indicating the particular design of each. Each type shall be constructed in accordance with the details indicated and to the depth required by the profiles and schedules given.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. The construction plans will specify the size and material for the pipe between the storm sewer main and the storm water collection structure.
- B. The various types of storm inlets and their relation to curb and gutter, or valley gutter are shown on the Standard Detail Drawings. Construction plans will identify the type to be constructed.
- C. Grating size, material, and configuration shall conform to the Standard Detail Drawings.

2.02 MATERIALS:

- A. Concrete
 - 1. Concrete for cast in place miscellaneous structures shall be Class A concrete when used with precast pipe sewer construction and Class C concrete when used with monolithic pipe sewer construction.

2. Concrete for precast structures shall be 4000 psi and comply with the applicable requirements of ASTM C 478.

B. Mortar:

1. Mortar shall be composed of 1 part Portland Cement and 2 parts clean, sharp mortar sand suitably graded for the purpose by conforming in other respects to the provisions of Section 03300 for fine aggregate.
2. Hydrated lime or lime putty may be added to the mix, but in no case shall it exceed 10 percent by weight of the total dry mix.

C. Reinforcement:

Reinforcing Steel shall conform to Section 03330.

D. Brick:

1. Bricks shall be of first quality, sound, hard-burned brick. Shale bricks, if used, shall be homogeneous, thoroughly and uniformly burned.
2. Bricks shall not absorb more than 17 percent of water by weight submerged in water for 24 hours, having been in a completely dry state prior to placing in water.
3. Clay brick shall conform to the requirements of ASTM C 62, Grade SW. concrete brick meeting the requirements of ASTM C 55, Grade A, shall be acceptable.

E. Concrete Block:

Concrete blocks when indicated shall conform to ASTM C 139.

F. Frames, Grates, Rings and Covers:

Frames, grates, rings and covers shall conform to Section 02571.

G. Miscellaneous Items:

Cast iron for supports, steps and inlet units shall conform to the shape and dimensions indicated. The casting shall be clean and perfect, free from sand or blow holes or other defects. Cast iron casting shall meet the requirements of ASTM A 48, Class 30. Steel for temporary covers when used with Stage Construction shall be adequate for the loads imposed.

PART 3 - EXECUTION

3.01 INSTALLATION OF DRAINAGE FACILITIES:

- A. Trenching, backfilling, and compaction for the connecting pipe between the storm sewer main and the storm inlet shall conform to the specifications contained in Section 02221. Pipe shall be installed in accordance with Section 02571.
- B. All pipe and structures shall be installed per location and elevations, as shown on the construction plans. If during the course of installation, an underground obstruction (i.e., existing utility line) the work shall stop and the ENGINEER shall be immediately notified so that the problem can be resolved.
- C. Direct connection to storm sewer main will be permitted if the main is a minimum of 36 inches in diameter (I.D.) and the connecting line is not greater than 12-inches (I.D.). If storm sewer mains are 48 inches (I.D.) or larger, the connecting line diameter may be increased to 18 inches (I.D.). For connecting line sized greater than those specified above, the connecting to the main will be made into a manhole or by inserting into the main a factory constructed wye. Connection to the main will comply with the Standard Detail Drawings.
- D. Removal of curb and gutter, and sidewalk for installation of a storm inlet shall be made at a scored or full depth joint.
- E. No width greater than 1/2 inch will be permitted between the inlet grate and the roadside portion of the inlet frame.

- F. Private drainage facility installations, which are to be constructed under the authorization of "Drainage Facilities within Public Right-of-Way," shall comply with the Standard Detail Drawings and appropriate sections of this publication.
- G. The construction inlets shall be done as soon as is practicable after sewer lines into the inlet are complete. All sewers shall be cut neatly at the inside face of the walls of the inlet and pointed up with mortar.
- H. Bases for cast in place inlets may be placed prior to or at the CONTRACTOR'S option after the sewer is constructed.
- I. The inverts passing out or through an inlet shall be shaped and grout across the floor of the inlet as indicated. This shaping may be accomplished by adding shaping mortar or concrete after the base is cast or by placing the required additional material with the base.
- J. All miscellaneous structures shall be completed in accordance with the details indicated. Backfilling to original ground elevation shall be in accordance with the provisions of the appropriate items and as directed by the ENGINEER.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

- A. Pavement removal and replacement will be measured by the square yard.
- B. Trenching, backfilling and compaction will not be measured or paid, but will be considered incidental to other items.
- C. Frame, grates, rings and covers will not be measured or paid, but will be considered incidental to other items.
- D. Connecting pipe shall be measured by the linear foot along centerline of pipe from the main side wall of the inlet to the centerline of the main.
- E. Storm sewer inlets shall be measured per each for the type and size specified.

- F. All miscellaneous structures satisfactorily completed in accordance with the plan and specifications will be measured as complete units per each.

4.02 PAYMENT:

- A. The accepted quantities of pavement removal and replacement shall be paid for at the unit bid price per square yard per type of replacement paving material.
- B. The accepted quantities of connecting pipe shall be paid at the unit bid price per linear foot per type and size of pipe, and shall include pipe in place and all necessary jointing materials.
- C. The accepted quantities of storm inlets will be paid at the unit price per each per type of storm inlet, and shall include: structure, grating, excavation, backfilling and compaction, and curb removal and replacement.
- D. The accepted quantities of special complete structures shall be paid at the unit bid price per each.
- E. Compensation, whether by contract pay item or incidental work will be for furnishing all material, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

*** * * END OF SECTION * * ***

SECTION 02584 -PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This work shall consist of furnishing and applying paint on pavement, curb and sidewalk surfaces, in the form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other detail pavement markings, in accordance with the details as shown or as prescribed by the Resident Engineer. Conform to the Texas Manual on Uniform Traffic Control Devices published by the Texas Department of Transportation for details not shown.

1.02 SUBMITTALS

- A. In accordance with Section 01340, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish Manufacturer's Certificates and Data certifying that the following materials conform to the requirements specified.
- B. Paint.

1.03 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
TT-P-1952D Paint, Traffic Black, and Airfield Marking, Waterborne
- C. Master Painters Institute (MPI):
Approved Product List - 2016

PART 2 - PRODUCTS

2.01 PAINT

Paint for marking pavement (parking lot and zone marking) shall conform to MPI No. 97, color as shown. Paint for obliterating existing markings shall conform to Fed. Spec. TT-P-1952D. Paint shall be in containers of at least 18 L (5 gallons). A certificate shall accompany each batch of paint stating compliance with the applicable publication.

~~2.02 REFLECTIVE GLASS BEADS~~

~~—Beads shall conform to Fed. Spec. TT B 1325C, Type I, Gradation A. When used in regions of high humidity, coat beads with silicone or other suitable waterproofing material to assure free flow. Furnish the glass beads in containers suitable for handling and strong enough to prevent loss during shipment. A certificate shall accompany each batch of beads stating compliance with this section.~~

2.03 PAINT APPLICATOR

Apply all marking by approved mechanical equipment. The equipment shall provide constant agitation of paint and travel at controlled speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in the case of skip lines. The equipment shall have manual control to apply continuous lines of varying length and marking widths as shown. Provide pneumatic spray guns for hand application of paint in areas where a mobile paint applicator cannot be used. // If the equipment does not have a glass bead dispenser, use a separate piece of equipment. Adjust and synchronize the equipment with the paint applicator so that the reflective beads are distributed uniformly on the paint lines within ten seconds without any waste. // An experienced technician that is thoroughly familiar with equipment, materials, and marking layouts shall control all painting equipment and operations.

2.04 SANDBLASTING EQUIPMENT

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall furnish not less than 0.08 m³/s (150 cfm) of air at a pressure of not less than 625 kPa (90 psi) at each nozzle used.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Thoroughly clean all surfaces to be marked before application of paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals as directed by the Resident Engineer. The application of paint conforming to Fed. Spec. TT-P-1952D is an option to removal of existing

paint markings on asphalt pavement. Apply the black paint in as many coats as necessary to completely obliterate the existing markings. Where oil or grease are present on old pavements to be marked, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint. Pavement marking shall follow as closely as practicable after the surface has been cleaned and dried, but do not begin any marking until the Resident Engineer has inspected the surface and gives permission to proceed. The Contractor shall establish control points for marking and provide templates to control paint application by type and color at necessary intervals. The Contractor is responsible to preserve and apply marking in conformance with the established control points.

3.02 APPLICATION

Apply uniformly painted pavement marking of required color(s), length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces in conformance with the details as shown and established control points. The length and width of lines shall conform within a tolerance of plus or minus 75 mm (3 inches) and plus or minus 3 mm (1/8 inch), respectively, in the case of skip markings. The length of intervals shall not exceed the line length tolerance. Temperature of the surface to be painted and the atmosphere shall be above 10°C (50°F) and less than 35°C (95°F). Apply the paint at a wet film thickness of 0.4 mm (0.015 inch). Apply paint in one coat. At the direction of the Resident Engineer, markings showing light spots may receive additional coats. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic. If there is a deficiency in drying of the marking, discontinue paint operations until cause of the slow drying is determined and corrected. Remove and replace marking that is applied at less than minimum material rates; deviates from true alignment; exceeds stipulated length and width tolerances; or shows light spots, smears, or other deficiencies or irregularities. Use carefully controlled sand blasting, approved grinding equipment, or other approved method to remove marking so that the surface to which the marking was applied will not be damaged.

3.03 PROTECTION

Conduct operations in such a manner that necessary traffic can move without hindrance. Protect the newly painted markings so that, insofar as possible, the tires of passing vehicles will not pick up paint. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic. Efface and replace damaged portions of markings at no additional cost to the Government.

3.04 DETAIL PAVEMENT MARKING

Use Detail Pavement Markings, exclusive of actual traffic lane marking, at exit and entrance islands and turnouts, on curbs, at crosswalks, at parking bays, and at such other locations as shown. Show the International Handicapped Symbol at indicated parking spaces. Apply paint for the symbol using a suitable template that will provide a pavement marking with true, sharp edges and ends.

3.05 TEMPORARY PAVEMENT MARKING

When shown or directed by the Resident Engineer, apply Temporary Pavement Markings of the color(s), width(s) and length(s) shown or directed. After the temporary marking has served its purpose and when so ordered by the Resident Engineer, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that the surface to which the marking was applied will not be damaged. As an option, an approved preformed pressure sensitive, adhesive tape type of temporary pavement marking of the required color(s), width(s) and length(s) may be furnished and used in lieu of temporary painted marking. The Contractor shall be fully responsible for the continued durability and effectiveness of such marking during the period for which its use is required. Remove any unsatisfactory tape type marking and replace with painted markings at no additional cost to the Government.

3.06 FINAL CLEAN-UP

Remove all debris, rubbish and excess material from the Station.

--- E N D ---

SECTION 02660 - WATER LINES

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2241(1988) Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).

ASTM D 2564(1988) Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B301 (1987) Liquid Chlorine.

AWWA C110 (1987) Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In., for Water and Other Liquids.

AWWA C500 (1986) Gate Valves for Water and Sewage Systems.

AWWA C651 (1986) Disinfecting Water Mains.

AWWA C900 (1981; Errata) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. through 12 In. for Water.

1.1.1 Piping for Water Distribution Lines 3 Inches or Larger

Piping for water distribution lines 3 inches or larger shall be ductile iron, Polyvinyl Chloride (PVC) plastic, or reinforced concrete, unless otherwise shown or specified.

1.1.2 Excavation, Trenching, and Backfilling for Water Lines

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02221 TRENCH EXCAVATION, BACKFILL AND COMPACTION, except as modified herein.

PART 2 - PRODUCTS

2.1 MATERIALS

Materials shall conform to the respective specifications and other requirements specified below.

2.1.1 Pipe

2.1.1.1 Polyvinyl Chloride (PVC) Plastic Pipe

- a. Pipe 4-Inch through 12-Inch Diameter: Pipe, couplings and fittings 4-inch through 12-inch diameter shall conform to the requirements of AWWA C900, Class 150, CIOD pipe dimensions only, elastomeric-gasket joint only, unless otherwise shown or specified.
- b. For pipe 4-inch through 12-inch diameter, fittings and specials shall be cast iron, bell end in accordance with AWWA C110, 150 psi pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or may be fittings and specials of the same material as the pipe with elastomeric gaskets, all in conformance with the requirements of AWWA C900. Fittings shall be for bell and spigot pipe or plain end pipe, or as applicable.

2.1.2 Valves

2.1.2.1 Gate Valves

Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

Valves 3 inches and larger shall be iron body, bronze mounted, and shall conform to AWWA C500. Flanges shall not be buried. An approved pit shall be provided for all flanged connections.

2.1.2.2 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float.

2.1.3 Valve Boxes

Valve boxes shall be cast iron. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16-inch. The word "WATER" shall be cast in the cover. The boxes shall be of such length as will be adapted, without full extension, to the depth of cover required over the pipe at the valve location.

2.1.4 Fire Hydrants (See Detail Sheet)

2.1.4.1 Disinfection

Chlorinating materials shall conform to the following: Chlorine, Liquid: AWWA B301.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the water-line materials be dropped or dumped into the trench. Water shall be kept out of the trench until joining is completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored.

3.1.1.1 Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions.

3.2 HYDROSTATIC TESTS

3.2.1 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 200 psi. Joints showing visible leakage shall be replaced. Cracked or defective pipe, joints, fittings, hydrants and valves, discovered in consequence of this pressure test shall be removed and replaced.

3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to 200 psi pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = 0.0001351 N D (P \text{ raised to } 1/2 \text{ power})$$

In which L equals the allowable leakage in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test, in psi gauge.

3.3 DISINFECTION

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by AWWA C651.

End of Section

SECTION 02665 - WATER SYSTEMS

PART I - GENERAL

1.01 SECTION INCLUDES:

- A. Water mains including valves, valve boxes, fire hydrants, blocking, fittings and other appurtenances.

1.02 REFERENCES:

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM DI 784 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
 - 2. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SOR-PR).
 - 3. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- B. American Water Works Association (AWWA):
 - 1. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
 - 2. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 Inches through 48 Inches
 - 3. AWWA C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds
 - 4. AWWA C 1 53 - Ductile Iron Compact Fittings, 3 inches through 16 inches
 - 5. AWWA C502 - Dry-Barrel Fire Hydrants.
 - 6. AWWA C509 - Resilient Seated Gate Valves, for Water and Sewerage Systems.
 - 7. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
 - 8. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water.

1.03 SUBMITTALS:

- A. Product Data: Manufacturer's product data sheets on fire hydrants, valves, and valve boxes.

1.04 PROJECT CONDITIONS:

- A. Perform no pipe work in fill areas until embankment or fill has been completed to at least 2 ft. above top of pipe and has been properly compacted.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE:

- A. PVC Water Pipe (4-inch through 12-inch): AWWA C900, pressure class 150.
- B. PVC Water Pipe (smaller than 4-inch): ASTM D1784 and ASTM D1785 or ASTM D2241.
- C. PVC water pipe shall bear NSF seal of approval and shall have a minimum water pressure rating of 200 psi.

2.02 DUCTILE IRON PIPE:

- A. Type: AWWA C151, Class 52.
- B. Wrapping: Buried pipe wrapped with 8 mil polyethylene encasement, AWWA C105.

2.03 FITTINGS:

- A. Buried Fittings (size 4-inch through 12-inch): Ductile iron compact type with push-on joints, ANSI A21.53/AWWA C153, or standard fittings, AWWA C110. Use mechanical joints with retainer glands where required for complete system.
- B. Buried Fittings (smaller than 4 inches): Schedule 40 PVC, ASTM D2466, NSF approved and sealed or marked for potable water use.
- C. Rating: Fittings working pressure rated to 250 psi.
- D. Wrapping: Buried ductile iron fittings wrapped with 8-mil polyethylene encasement, AWWA C105.

2.04 GATE VALVES:

- A. Gate Valves 4-inch through 12-Inch Size for Buried Service.
 - 1. Type: Solid wedge, resilient seat type.
 - 2. Standard: Except as otherwise specified, AWWA C509.
 - 3. Working Pressure: Rated to 250 psi minimum.
 - 4. Stem: Non-rising stem with O-ring valve packing and 2-inch square nut.
 - 5. Joints: Push-on joints except as specified otherwise.
 - 6. Opening: Counterclockwise.
 - 7. Finish: Ferrous surfaces of valve interior epoxy coated, AWWA C550.
 - 8. Wrapping: Wrap valve body with 8 mil polyethylene encasement in a manner which will not interfere with valve operation.

2.05 FIRE HYDRANTS:

- A. Quality: AWWA C502, and as modified by these Specifications.
- B. Type: Compression-type shutoff closing with pressure, collision safety construction and dry top designed for 250 psi working pressure. Fabricate working parts from bronze.
- C. Equip barrel with a bronze 6-inch inlet connection having a self-centering drain valve. Provide connection with two 2-1/2 inch inside diameter hose nozzles and a 4-1/2 inch connection. Use National Standard threads at connections.
- D. Equip nozzles with nozzle caps securely fit and with cap gaskets of rubber. Other hydrant gaskets may be of rubber composition, lead or impregnated fiber composition. Attach nozzle caps to the barrel with chains not less than 1/8-inch diameter.
- E. Provide a hydrant with bury length (the distance from the bottom of inlet line to ground line) as shown on Drawings.
- F. Design barrel joint connecting upper and lower hydrant sections so that hydrant shutoff valve will remain closed and reasonably tight against leakage in the event of an impact resulting in damage or breaking of hydrant above or near ground level. Provide the joint with a breakable bolt flange or breakable coupling that will include a minimum of eight bolts. Provide valve stem with a breakable stem coupling opposite breakaway barrel.
- G. Provide valve stem with a bronze sleeve and suitable seals and a travel stop. Do not expose operating threads to water. Lubricate threads fully when opening and closing shutoff valve from lubricating reservoir sealed top and bottom. Equip valve stem with a thrust bearing or lubricated thrust collar to minimize operating torque.
- H. Furnish a valve stem which opens counterclockwise.
- I. Provide a valve stem operating nut that is nonrising, pentagonal shape, with 1-1/2 inch from point to flat and depth of 1-1/4 inch.
- J. Operating parts, including valve seat, shall be removable through barrel, without digging.
- K. Paint fire hydrants with one coat of red oxide primer and two finishing coats of alkyd paint red color for barrels and white color for bonnet.

2.06 VALVE BOXES:

- A. Qualities: Cast iron valve boxes for buried valves, 2-section adjustable screw type, suitable for depth of cover over pipe as shown, with base, top section and cover.

1. Size: At least 5 inches in diameter, 3/16 inch thick, with suitable cast iron bases and covers.
2. Coatings: Coat valve boxes, bases and covers by dipping in hot bituminous varnish.
3. Cover: Locking type covers. Identify covers with casting, WATER.

B. Source: Mueller H-10360.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Staking of waterline shall be provided by owner.
- B. Prior to installing valves or fire hydrants, remove foreign matter from within the valves. Inspect the valves in open and close position to verify that parts are in satisfactory working condition.
- C. All pipe materials and installation procedures shall conform to the requirements of Texas Natural Resource Conservation Commission (TNRCC).

3.02 SETTING VALVES, VALVE BOXES AND FIRE HYDRANTS:

- A. Install valves, valve boxes and fire hydrants where shown on Drawings. Set valves and fire hydrants plumb and as detailed on Drawings. Center valve boxes on valves. Locate valves away from roads or streets. Carefully tamp earth around each valve box for a minimum radius of 4 feet or to undisturbed trench face if less than 4 feet.
- B. Place a concrete thrust block opposite pipe connections, set against vertical face of trench to prevent hydrant from blowing off line. If character of soil is such that fire hydrant cannot be securely wedged in this manner, provide bridle rods and rod collars of not less than 3/4 inch stock protected by a coat of acid-resisting paint.
- C. Place at least 5 cubic feet of gravel or crushed stone around base of fire hydrant to ensure drainage. Do not block drain holes. Compact backfill thoroughly around hydrant to grade line.

3.03 PIPE INSTALLATION:

- A. Preparation:
 1. Do not lay pipe in water, or when trench or weather are unsuitable for work. Keep water out of trench until jointing is complete and bedding is placed to top of pipe. When work is not in progress, close ends of pipe and fittings securely so that no trench water, earth or other substance will enter pipes or fittings.

2. Keep inside of pipe free from foreign matter during operations by plugging or other approved method.
3. Place pipe so that full length of each section rests solidly upon pipe bed, with recesses excavated to accommodate bells and joints. Take up and relay pipe when grade or joint is disturbed after laying.
4. Locate no joints closer than 9 feet from sanitary sewer cross-overs.
5. Where pipe ends are left for future connections, install valves, plugs or caps and thrust blocking, as shown.
6. Handle pipe and accessories so that pipe placed in trench is sound and undamaged. Take particular care not to injure pipe coating when applicable. Do not place other pipe or anything else inside of pipe or fitting after coating has been applied.
7. Cut neatly, using approved type mechanical cutter without damaging pipe. Use wheel cutters when practicable.
8. Before installation, inspect pipe for defects and tap with a light hammer to detect cracks. Replace sections of pipe found to be defective, damaged or unsound, before or after laying.
9. Wrap ductile iron pipe, fittings and accessories with 8 mil polyethylene film, AWWA C105, with edges overlapped and securely taped with duct tape to prevent contact between pipe and surrounding bedding. Repair punctures with duct tape to restore the protective continuous wrap before backfilling.

B. Pipe Bedding and Backfill: See Typical Detail Sheets

C. Placing and Laying:

1. Bury water lines and fire hydrants leads as shown on Drawings.
2. Do not exceed pipe manufacturer's recommendations for deflections from straight line or grade as required by vertical curves, horizontal curves, or offsets. If alignment requires deflections in excess of these limitations, furnish special bends or sufficient number of shorter lengths of pipe to provide angular deflections within limits set or approved.

D. Joints:

1. Install mechanical joints in accordance with manufacturer's recommendations.
2. Make push-on joints in accordance with manufacturer's recommendations.

E. Anchorage of Fittings - Thrust Block: Anchor tees, bends and plugged, valved or capped ends of lines of water mains with concrete thrust blocks as necessary and as shown on Drawings. Place blocks so that the joints will be accessible for inspection and repair.

3.04 SERVICE CONNECTIONS:

- A. Provide water service leads and include corporation and meter stops and meter vault installed as shown.

- B. Service Connections:
 - 1. One inch and smaller: Corporation stops. Only AWWA threads will be allowed.
 - 2. Up to 2 inches: Service clamps. Furnish a malleable iron galvanized service clamp with 250 psi working pressure and include a neoprene gasket cemented in place.
 - 3. Larger than 2 inches: Pipe fittings.
- C. Make service connections in accordance with manufacturers recommendations.
- D. Connections shall be located no closer than one foot from fitting or pipe joint.

3.05 STERILIZATION:

- A. After completion of hydrostatic tests, flush and sterilize water mains in accordance with TNRCC AWWA C651 , utilizing chlorinating and procedures reviewed by Engineer.
 - 1. Disinfect the water distribution system using chlorine or chlorine compounds added to the water resulting in 25 ppm (parts per million) chlorine.
 - 2. After the water containing this amount of chlorine has been in contact with the pipe and appurtenances at least 24 hours, replace the chlorine treated water with water to be transported normally.
- B. Before beginning sterilization, remove dirt and foreign matter from water mains by a thorough flushing with clean water.
- C. Provide erosion control devices necessary to prevent soil erosion as a result of flushing or draining water lines.

3.06 FIELD QUALITY CONTROL TESTING:

- A. Perform hydrostatic tests and bacteriological tests on new water lines and lowered/relocated water lines.
- B. Hydrostatic Tests:
 - 1. General:
 - a. After pipe has been laid and initial backfill and blocking completed, test water lines hydrostatically to a test pressure of 150 psi. Achieve test pressure with compressed air.
 - b. Provide connections, pumps, gauges, meters and other equipment necessary for performance of tests.
 - 2. Procedures:

- a. Before applying specified pressure test, expel all air from the pipe by filling each valved section of pipe with water. Provide taps necessary to expel trapped air.
 - b. Examine all piping, flings, valves and joints during testing. Fully operate each valve in the test section during testing.
 - c. Test each section for a minimum of 2 hours when joints are exposed, 8 hours when joints are covered.
 - d. Test pipe lines in lengths between valves or plugs of not more than 1000 feet
3. Maximum Allowable Leakage: Not to exceed 12 gallons per inch of pipe diameter per mile of pipe per 24 hours, except replace joints regardless of total leakage quantity where visible leaks occur at exposed joints and where leaks are evident at the surface of joints that are covered.
 4. Replace defective material with sound material, and repeat test procedures until approved is obtained.
- C. Bacteriological Tests: After sterilizing and flushing mains, obtain services of an approved laboratory to gather representative samples and conduct bacteriological tests in accordance with AWWA C651. Test results shall meet TNRCC. Make necessary corrections, repeat sterilization and flushing procedures, and retest affected lines if test results are not acceptable. Repeat this procedure until satisfactory test results are obtained.

END OF SECTION

SECTION 02720 STORM SEWER

PART I - GENERAL

1.01 SECTION INCLUDES:

- A. Material and installation of storm sewer pipe and appurtenances, including headwalls.

1.02 RELATED SECTIONS:

- A. Section 02221 – EXCAVATION, TRENCHING, AND BACKFILLING AND COMPACTION

1.03 REFERENCES:

- A. ASTM C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
- B. Texas Department of Transportation (TXDOT) 2004 Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges.

1.04 SUBMITTALS:

- A. Pipe Certification: Manufacture's certification that pipe meets the requirements of these specifications.

PART 2 - PRODUCTS

2.01 STORM SEWER PIPE:

- A. Reinforced Concrete Pipe: Provide reinforced concrete pipe which conforms with ASTM C76, Class III

2.02 CONCRETE PIPE JOINT MATERIAL:.

- A. Cold Compound Joints: For concrete pipe sections carrying rainfall runoff, furnish pipe joint material (Talcote No. 0.52, Gulf States No. GS 702, or Ram-Nek flexible) plastic gasket manufactured by the K. T. Snyder Company, Inc.) meeting the requirements of the TxDOT Standard Specification for Construction and Maintenance of Highways, Streets and Bridges, Item 464.2 paragraph I.2. Apply a primer of the type recommended by the manufacturer of the compound used.

PART 3 – EXECUTION

3.01 EXCAVATION, BACKFILLING AND COMPACTION:

- A. Trenching and backfilling shall be in accordance with Section 02221 and details.

3.02 PIPE INSTALLATION:

- A. Pipe Sewers and Culverts: Do not place pipe until the excavation has been completed, the bottom of the trench shaped, proper bedding material placed, and the line and grade have been obtained. Lay pipe accurately to line and grade in a straight line with spigot or tongue end of the pipe pointing in the direction of flow. Layout pipes together and match them so that when laid, the pipe will form a sewer or culvert with a smooth and uniform invert except where there is a pipe size change, in which case, the crowns of the larger and smaller pipes shall be at the same elevation and a concrete collar used to make the connection, unless otherwise shown.

3.03 CONCRETE PIPE CULVERT JOINT INSTALLATION:

- A. Cold Compound Joints.
 - 1. Tongue and Groove Pipe. Completely coat both ends of the pipe with primer. Coat pipe only when the pipe is clean and dry. Allow the primer to dry before the pipe is laid. Pipe 24 inches and larger must be primed at the factory. After pipe has been set to proper line and grade in the trench, trowel or otherwise apply to the groove end of the pipe a 1/2-inch-thick layer of compound. Cover two-thirds of the joint face around the entire circumference. Next shove home the tongue end of the next pipe with sufficient pressure to make a tight joint. Take care to avoid leaving ridges of compound projecting into the pipe. Make necessary adjustments in the quality, and consistency of the compound, as directed by the Owner.
 - 2. Positioning. Joints made with cold compound may be pulled home by means of a suitable winch or other suitable power equipment or a come-along. Do not use a bar stuck into the ground for positioning joints on pipe larger than 10 inches. A bar may be used to push home the joints in pipe 10 inches and smaller, provided the joints are pushed all the way home. Positioning joints multiplied by the laying length per joint must equal the actual length of sewer in any given section. Pull pipe home in a straight line with all parts of the pipe on line and grade. Do not permit horizontal or vertical movement of the pipe during or after the pulling operation. Pull or push home rubber gasket joints by any suitable means that will provide adequate pressure to ensure proper assembly of the joint. Use special care to ensure that the joints are positioned in accordance with the published instructions of the

manufacturer. Do not mortar the outside of joints. Do not use backhoe to drive pipe to make-up pipe joints.

3.04 HEADWALL, MANHOLE AND INLET INSTALLATION:

- A. Construct all headwalls to line and grade and at locations shown. Construct in accordance with TXDOT 2004 Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges. Neatly cut off all pipe leads at the appropriate face of the headwall, manhole or inlet wall and finish with mortar.

END OF SECTION

SECTION 02829 GATE OPERATOR

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electric gate operators.
 - 1. DoorKing Model 9150.
- B. Parking gates and operators.
- C. Sensors and controls.

1.2 RELATED SECTIONS

- A. Division 2 Electric Gate Operators & Access Control System
- B. Division 3 Cast-in-Place Concrete: Concrete mounting pads.
- C. Division 5 Wrought Iron Fence and Gates
- D. Division 16 Requirements for electrical connections.

1.3 REFERENCES

- A. Underwriters Laboratories (UL): UL 325 – Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- B. Underwriters Laboratories (UL): UL 991 – Standard for Tests for Safety Related Controls Employing Solid-State Devices.
- C. American Society Testing Materials (ASTM): ASTM F2200 – Standard Specification for Automated Vehicular Gate Construction.
- D. National Electrical Manufacturers Association (NEMA): NEMA ICS 6 – Industrial Control Systems: Enclosures.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300 – Administrative Requirements.
- B. Product Data: Manufacturers data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements.
 - 3. Installation methods.
- C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, edge connections, and accessories.
 - 1. Operation, installation, and maintenance manuals including wire diagrams.
 - 2. Risers, layouts, and special wiring diagrams showing any changes to standard drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials and products in strict compliance with manufacturer's instructions and industry standards.
- B. Store products indoors in manufacturer's original containers and packaging with labels clearly identifying product name and manufacturer. Protect from damage.

SECTION 02829 GATE OPERATOR

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Substantial transformation and final assembly shall occur in the United States of America per Section 1605 of the ARRA-09.
- B. Installer Qualifications: Installation performed by factory authorized dealer contractor specifically trained in gate operator systems of the type found within this section.
 - 1. Provide documentation of maintenance and repair service availability for emergency conditions.
 - 2. Provide quarterly maintenance for one year following Substantial Completion of the Project.

1.7 WARRANTY

- A. Manufacturers standard five (5) year warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: DoorKing, Inc.; 120 S. Glasgow Ave; Inglewood, CA 90301; Toll-Free Tel: 800-826-7493; Tel: 310-645-0023; Fax: 310-641-1586; Email: ghendrix@doorking.com; Web: doorking.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01631 – Product Requirements.

2.2 SLIDING GATE OPERATORS

- A. Microprocessor based solid-state control board interacting with card readers, RF transmitters, access control systems, ticket machines, other activating devices as required, external devices (photo-eyes, contact edges) for entrapment protection and vehicle (loop) sensing systems. Control board shall include built-in close timer (1-25 seconds), built-in ports for two (2) plug-in loop detectors, partial open input, programming switches to set various operating modes, inherent magnetic pulse obstruction sensing reverse system. System shall employ Fail-Safe operation upon primary (AC) power outage.
 - 1. Compliance: Compliant to UL 325, UL 991 and CSA C22.2 No. 247 and listed by Intertek Testing Laboratories NA, Inc. (ETL), a Nationally Recognized Testing Laboratory.
 - a. This model is intended for use in Class I, II, III and IV vehicular slide gate applications.
 - 2. Warranty: Five (5) year manufacturer's standard warranty.
 - 3. Maximum Gate Length:
 - a. 45-feet with 1 HP motor.
 - 4. Maximum Gate Weight:
 - a. 1500 Lbs. with 1 HP motor.
 - 5. Operator speed: approximately 11-inches per second.
 - 6. Enclosure: 12 gage, 0.108 inch (2.6 mm) G90 hot-dipped galvanized steel, finished with polyester powdercoat, exterior grade semi-gloss texture gray.
 - 7. Configuration: Left or right hand mount; front, center or rear mounting configurations.
 - 8. Mounting: Pad or post mount.
 - 9. Electrical Power Requirements: 120V.
 - a. 120V requires DoorKing High Voltage Kit.
 - 10. Motor: Continuous Duty Motor.
 - a. 1 HP
 - 11. Dead Bolt Lock: Solenoid dead bolt engages if an attempt is made to force the gate open.

SECTION 02829 GATE OPERATOR

12. Fail-Safe Operation: Upon loss of primary (AC) power, system shall automatically be transferred to a fail-safe mode allowing the gate to be pushed open without the use of special knowledge, keys or other releasing mechanisms.
13. Primary Reduction: Adjustable clutch, single cog belt drive train.
14. Pulling Medium: #40 roller chain
15. Magnetic Limit Switches: Automatic setting with no mechanical switches to set, wear out or break.
16. Operating Switches: Built-in power (on-off), reset and operating switches.
17. Entrapment Protection
 - a. Photo-electric eye (non-contact sensor).
 - b. Sensing edge (contact sensor).
18. Accessories: Provide the optional accessories listed below.
 - a. Base Plate – for post mount applications.
 - b. Chain tray kit – to support roller chain on long gates.
 - c. Plug-in 6' loop detectors.
 - d. Electric reversing edge – reverses direction of gate on contact with an obstruction.
 - e. Photo-electric beams – reverses direction of gate if the light beam is obstructed.
19. Provide an SOS System and 1400 Fire Department Padlock.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. It is preferred that this product be installed by a qualified technician who is certified by the Institute of Door Dealer Education and Accreditation (IDEA) as a Certified Automatic Gate Operator Installer (CAGOI).
- B. Model 9150 shall be mounted, firmly secured, plumb and level, as required.
- C. Wiring shall be uniform and in accordance with national electric codes and manufacturer's instructions.
- D. All splices shall be in easily accessible junction boxes or on terminal boards.
- E. All cable runs in all junction boxes shall be tagged and identified.
- F. Coordinate all work with other effected trades and contractors.

3.2 SYSTEM INITIALIZING AND PROGRAMMING

- A. System shall be turned on and adjustment made to meet requirements of specifications and on-site conditions.
- B. System shall function as specified.

3.3 SYSTEM TEST PROCEDURES

- A. System shall be completely tested to assure that all components and accessories are hooked-up and in working order.
- B. System shall be pre-tested by contractor and certified to function in accordance with plans and specifications.
- C. System shall be tested in presence of owner's representative.

3.4 OWNER INSTRUCTIONS

- A. Installation contractor shall conduct up to (1) hour of instruction in use and operation of the system to designated owner representatives, within (30) days of acceptance.
- B. Installation contractor shall conduct up to (1) hour of technical training, in troubleshooting and service of the system, to designated owner representatives within (90) days of system acceptance.

SECTION 02829 GATE OPERATOR

3.5 MANUALS AND DRAWINGS

- A. Contractor shall provide owner with (2) copies of standard factory prepared operation, installation and maintenance manuals. Manuals shall include typical wiring diagrams.
- B. Contractor shall provide owner with (2) copies of any risers, layouts, and special wiring diagrams showing any changes to standard drawings, if required on project.

3.6 MAINTENANCE

- A. The manufacturer recommends periodic maintenance at one (1), three (3) and 12 month intervals as described in the installation and maintenance manual.
- B. External reversing devices should be checked at least once a month.

END OF SECTION

SECTION 02831
CHAIN LINK FENCES AND GATES

PART I GENERAL

1.01 SECTION INCLUDES

Provide chain link fences and gates units controlled by single source including erection accessories, fittings, and fastenings as indicated on Drawings. Refer to architectural building plans for fencing attached to building.

1.02 RELATED SECTIONS

- A. Construction Drawings.
- B. Manufacturer's technical data and installation requirements.
- C. Division 3 Concrete.

1.03 REFERENCES

- A. ANSI/ASTM A123 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
- B. ANSI/ASTM F567 - Installation of Chain-Link Fence.
- C. ASTM A116 - Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.
- D. ASTM A120 - Pipe, Steel, Black and Hot-Dipped zinc Coated (Galvanized) welded and seamless, for Ordinary Uses.
- E. ASTM A121 - Zinc-Coated (Galvanized) Steel Barbed Wire.
- F. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- G. ASTM A392 - Zinc-Coated Steel Chain-Link Fence Fabric.
- H. ASTM A428 - Weight of Coating on Aluminum-Coated Iron or Steel Articles.
- I. ASTM A491 - Aluminum-Coated Steel Chain Link Fence Fabric.
- J. ASTM A569 - Steel, Carbon (0.15 Maximum Percent), Hot- Rolled Sheet and Strip Commercial Quality.
- K. ASTM A585 - Aluminum Coated Steel Barbed Wire.
- L. ASTM C94 - Ready-mixed Concrete.
- M. ASTM F573 - Residential Zinc-Coated Steel Chain Link Fence Fabric.
- N. ASTM F668 - Polyvinyl Chloride (PVC) Coated Steel Chain Link Fence Fabric.
- O. Chain Link Fence Manufacturers Institute (CLFMI) - Product Manual.
- P. FS RR-F-191 - Fencing, Wire and Post Metal (and Gates, Chain Link Fence Fabric, and Accessories).

1.04 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of property perimeter posts relative to property lines and easements.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following:

- 1. Allied Tube and Conduit Corp.
- 2. Anchor Fence, Inc.
- 3. United States Steel

2.02 MATERIALS

- A. Fabric:

- 1. No. 9 ga. (0.148") finished size galvanized steel wires, 2" mesh, with both top and bottom selvages twisted and barbed.
- 2. Furnish one-piece fabric widths for fencing.

- B. Barbed Wire (where noted on drawings)

- 1. Barbed wire descriptions in "Steel Barbed Wire" Galvanized-Steel Barbed Wire" paragraphs below are examples; revise to suit Project. If retaining this article, coordinate with components for barbed wire installation, including barbed wire arms in "Fittings" Article.
- 2. Steel Barbed Wire: ASTM A 121, three-strand barbed wire, 0.099-inch- (2.51-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, four-point round barbs spaced not more than 5 inches (127 mm) o.c.
 - a. Aluminum Coating: Type A.
 - b. Zinc Coating: Type Z, Class 3.

- B. End, Corner, and Pull Posts: Galvanized steel, minimum sizes and weights as follows:

- 1. Up to 6'-0" Fabric Height: 2.375 OD steel pipe, 3.65 lbs./lin. ft. or 2.25"x 1.875" H-sections, 2.64 lbs./lin. ft.
- 2. Over 6'-0" Fabric Height: 2.875" OD pipe, 5.79 lbs./lin. ft., or 3.5"x3.5" roll-formed sections, 4.85 lbs./lin. ft.

- C. Line Posts: Galvanized steel, minimum sizes and weights as f follows:

- 1. Up to 6'-0" Fabric Height: 1.90" OD steel pipe, 2.70 lbs./lin. ft. or 1.875"x 1.625" C-sections, 2.28 lbs./lin. ft.
- 2. 6'-0" to 8'-0" Fabric Height: 2.375" OD steel pipe, 3.65 lbs./lin. ft. or 2.25"x 1.875" H-sections, 2.64 lbs./lin. ft.

3. Over 8'-0" Fabric Height: 2.875" OD steel pipe, 5.79 lbs./lin. ft. or 2.25"x 1.875", H-sections, 3.26 lbs./lin. ft.
- D. Gate Posts: Galvanized steel, posts for supporting single gate leaf, or one leaf of double gate installation, for nominal gate widths as follows:
 1. Up to 6' -0": 3.5" x 3.5" roll-formed section, 4.85 lbs./lin. ft., or 2.875 OD pipe, 5.79 lbs./lin. ft.
 2. Over 6' -0" to 13' -0": 4.000", OD pipe, 9.11 lbs./lin. ft.
- E. Top Rail: Rails: 1.66", OD pipe, 2.27 lbs./ft. or 1.625"x 1.25", roll-formed sections, 1.35 lbs./ft.; galvanized steel, manufacturer's longest lengths.
- F. Couplings: Expansion type, approximately 6" long, for each joint.
- G. Attaching Devices: Provide means for attaching top rail securely to each gate corner, pull and end post.
- H. Sleeves: Galvanized steel pipe not less than 6" long and with inside diameter not less than ½" greater than outside diameter of pipe. Provide steel plate closure welded to bottom of sleeve of width and length not less than 1" greater than outside diameter of sleeve.
- I. Tension Wire: 7 gage galvanized steel, coated coil spring wire, located at bottom of fabric.
- J. Wire Ties: 11 ga. galvanized steel
- K. Post Brace Assembly: Manufacturer's standard adjustable brace at end of gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.
- L. Post Tops: Galvanized steel, weathertight closure cap for each tubular post. Furnish caps with openings to permit passage of top rail.
- M. Stretcher Bars: Galvanized steel, one piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretch bar for each gate and end post, and two for each corner and pull post.
- N. Stretch Bar Bands: Manufacturer's standard.
- O. Gate Cross-bracing: 3/80 diameter galvanized steel adjustable length truss rods.
- P. Portland Cement: ASTM C 150.
- Q. Aggregates: ASTM C 33.
- R. Water: Clean.
- S. Non-shrink, non-Metallic Grout: Premixed, factory- packaged, noncorrosive nonstaining, nongaseous, exterior grout complying with CE CRD-C621.
- T. Swinging Gate Hardware:

1. Hinges: Size and material to suit gate size, non- lift-off type, offset to permit 180 degree gate opening. Provide 1-1/2" pair of hinges for each leaf over 6'-0" nominal height.
 2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
- U. Double Gates Hardware: Provide gate stops for double gates, consisting of mushroom type of flush plate with anchors set in concrete, to engage center drop rod or plunger bar. Include locking device and padlock eye as integral part of latch, using one padlock for locking both gate leaves.
- V. Sliding Gate Hardware: Provide manufacturer's standard heavy-duty track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories as required.

PART 3 EXECUTION

3.01 GATE FABRICATION

- A. Fabricate swing gate perimeter frames of 1.90" OD pipe, galvanized steel. Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Space frame members maximum of 8'-0", apart.
- B. Assemble gate frames by welding or special fittings and rivets, for rigid connections. Install same fabric as for fence with stretcher bars at vertical edges. Install diagonal cross-bracing on gates as required to ensure rigid frame without sag or twist. Bars may be used at top and bottom edges. Attach stretchers to gate frame at 15" o.c. maximum.
- C. Attach hardware to provide security against removal or breakage.

3.02 FINISH

- A. Fabric Finish: Galvanized, ASTM A 392, Class I, with not less than 1.2 oz. zinc/sq. ft. of surface.
- B. Framing: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 oz. zinc/sq. ft. of surface.
- C. Hardware and Accessories: Galvanized, ASTM A 153 with zinc weights in accordance with industry standards.

3.03 CONCRETE MIXING

Mix materials to obtain concrete with minimum 28-day compressive strength of 2,500 psi; in maximum size aggregate, maximum 3" slump, and 2-4% entrained air.

3.04 INSTALLATION

- A. Comply with recommended procedures and instructions of fencing manufacturer. Provide secure, aligned installation with line posts spaced at 10'-0" o.c. maximum.
- B. Grade Set Posts: Drill or hand excavate using post hole digger in firm undisturbed or compacted soil.

- C. Excavate hole for each post to minimum diameter recommended by fence manufacturer but not less than four times the largest cross-section of post. Excavate hole depths not less than 12" diameter by 36" minimum below finish grade surface.
- D. Center and align posts in holes with bottom of posts 3" above bottom of excavation.
- E. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Extend concrete footing 2" above grade and trowel to crown to shed water.
- F. Sleeve Set Posts: Anchor posts by means of pipe sleeves preset and anchored into concrete. After posts, have been inserted into sleeves, fill annular space between post and sleeve solid with nonshrink, non-metallic grout, mixed and placed to comply with grout manufacturer's directions.
- G. Top Rails: Run rail continuously, bending to form radius for curved runs. Provide expansion couplings as recommended by manufacturer.
- H. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.
- I. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- J. Tension wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings spaced 24" o.c.
- K. Fabric: Leave approximately 2" between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.
- L. Stretcher Bars: Secure at end, corner, pull, and gate posts by threading through or clamping to fabric at 4" o.c., and secure to posts with metal bands spaced at 15" o.c.
- M. Tie Wires:
 - 1. Use U-shaped wire, conforming with diameter of pipe to which attached, clasping pipe and fabric firmly when ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.
 - 2. Tie fabric to line posts with wire ties spaced 12" o.c. Tie fabric to rails and braces with wire ties spaced 24" o.c. Tie fabric to tension wires with hog rings spaced 24" o.c.
 - 3. Manufacturer's standard procedure will be accepted if of equal strength and durability.
- N. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- P. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubrication.

END OF SECTION

SECTION 02846 –SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

Provide traffic control signs complying with U.S. Department of Transportation, Federal Highway Administration's Manual "Uniform Traffic Control Devices", local codes, and as specified. See Drawings for type, location, and quantity of signs required.

1.02 Related requirements

A. Construction drawings.

B. MANUFACTURER'S MOUNTING INSTRUCTIONS.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

SIGNS TO BE EQUIVALENT TO THOSE MANUFACTURED BY SA-SO, INC., GRAND PRAIRIE, TX.

2.02 SIGNS

TO BE PAINTED WITH REFLECTIVE BAKED-ENAMEL FINISH WITH FOLLOWING COLORS:

A. "STOP" SIGNS: (R1-1) 24"X24", OCTAGON, REFLECTORIZED COPY AND BORDER.

B. "SPEED LIMIT" SIGNS: (R2-1) 18"X24", BLACK LEGEND ON WHITE BACKGROUND.

C. "HANDICAPPED SYMBOL" SIGNS: (R7-SERIES) 18"X24", WHITE LEGEND ON BLUE BACKGROUND.

D. "NO PARKING, FIRE LANE" SIGNS: (R7-SERIES) 12"X18", RED LETTERS ON WHITE BACKGROUND.

E. "KEEP RIGHT" SIGNS: (R4-7A) 18"X24", BLACK LETTERS AND SYMBOL ON WHITE BACKGROUND.

F. "DO NOT ENTER" SIGNS: (R5-1) HIGHWAY DEPT. STANDARD RED AND WHITE SIGN EXCEPT 24"X24" SIZE.

G. MISCELLANEOUS SIGNS: PER UNIFORM TRAFFIC CONTROL DEVICE MANUAL RECOMMENDATIONS.

2.03 POSTS

CHANNEL GALVANIZED POSTS WITH GALVANIZED SIGN-MOUNTING HARDWARE FOR EACH SIGN.

PART 3 - EXECUTION

SET SIGN POSTS VERTICAL AND PLUMB WITH BOTTOM OF SIGN AT 5' ABOVE FINISH GRADE.
MOUNT SIGNS IN

ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

---END OF SECTION 02846---

**SECTION 03001 – CONCRETE FORM WORK, REINFORCEMENT, AND PLACEMENT OF CONCRETE
(CIVIL)**

1. General Labor:
Work under this Section includes furnishing all labor for setting forms, trenching for beams, placement of moisture barrier, placement of reinforcement steel, placement and finishing of concrete slabs, walks and curbs shown, and removal of all forms.
2. Contractor will supply all materials including concrete, forms, stakes, bracing, nails, 6 mil poly vapor barrier, bar ties, tie wire, half bricks, any required expansion material, keyways, etc. New or like new forms and shall be used. Provide curing compound.
3. Formwork:
 - a. Conform to shape and dimensions shown on plan; maintain grade, square and level; proper bracing, clean and tight. Tolerance within 1/8" in 10'-0".
 - b. Provide for inserts, templates, and set anchor bolts furnished by others.
 - c. If existing structures are encountered, such as old concrete beams, which interfere with proper placement of this work, Owner will pay for labor required when approved by the Architect.
 - d. All forms shall be new or like new.
4. Reinforcement:
 - a. Accurately bend and place all bars. Use metal chairs.
 - b. Insure adequate cover on all steel
 - c. Place mesh in center of flatwork, lap one full mesh. (also concrete earth retainers.
 - d. Refer to Contract Drawings and details for detailed requirements.
 - e. Comply with requirements of ACI 315 manual for reinforced concrete structures.
5. Concrete:
All concrete shall be provided to achieve a minimum strength of 3,000 psi after 28 days. Utilize Portland cement, ASTM C-150 type I or III, 5 sacks per cubic yard; coarse aggregate, ASTM C-33, graded 1/4" to 1-1/2". No fly ash or calcium chloride permitted. Admixtures only with approval of engineer. Slump maximum 6".

6. Placement of Concrete:
 - a. Furnish adequate labor to expeditiously place and finish all concrete for any given section as required by the Architect.
 - b. Thoroughly work concrete between and around reinforcement. Vibrate to secure complete filling and to minimize honeycomb.
 - c. Place concrete under good weather conditions; avoid heating (40° and rising). Comply with ACI 305 & 306 for requirements for hot and cold weather placement.
 - e. Finishing - Walks:
 - (1) Power float to level with cross slope of 1/4" per ft. for drainage.
 - (2) Wash and broom as approved by Architect.
 - f. Rub concrete faces immediately after forms removed to eliminate honeycomb.
 - g. For each 50 C.Y. of concrete placement, any concrete pour over 10 c.y. take 1 set of 4 cylinders. One specimen to be tested at 28 days and one specimen retained in reserve for later testing, if required. All testing shall be by independent lab approved by the Owner. Owner to pay for all testing.
 - h. For repair of defective surfaces, consult with the Architect before doing repairs.

END OF SECTION

SECTION 03100

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formwork for cast-in place concrete.
 - 2. Shoring, bracing, and anchorage.
 - 3. Architectural form liners.
 - 4. Form accessories.
 - 5. Form stripping.
- B. Related Sections:
 - 1. Section 03200 - Concrete Reinforcement.
 - 2. Section 03300 - Cast-in-Place Concrete.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 - Specifications for Structural Concrete.
 - 3. ACI 318 - Building Code Requirements for Structural Concrete.
 - 4. ACI 347 - Guide to Formwork for Concrete.
- B. American Forest and Paper Association:
 - 1. AF&PA - National Design Specifications for Wood Construction.
- C. The Engineered Wood Association:
 - 1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
- D. ASTM International:
 - 1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - 2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- E. West Coast Lumber Inspection Bureau:
 - 1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.3 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.4 PERFORMANCE REQUIREMENTS

- A. Vapor Retarder Permeance: Maximum 1 perm perms when tested in accordance with ASTM E96, Procedure A.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347 ACI 301 ACI 318.
- B. For wood products furnished for work of this Section, comply with AF&PA.
- C. Perform Work in accordance with State Municipality of Highways Public Work's standard.

1.6 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

- A. Form Materials: At discretion of Contractor.

2.2 FORMWORK ACCESSORIES

- A. Vapor Retarder: Where indicated on Drawings, 10 mil thick polyethylene sheet manufacture by:
 - 1. Stego Wrap Class A: by Stego Industries LLC (887) 464-7834
 - 2. Griffolyn by Reef Industries (800) 231-6074
 - 3. VaporBlock 10 by Raven Industries (800) 635-3456
 - 4. Perminator Vapor – May by W.R. Meadows (800) 342-5976
 - 5. Or Equivalent

- B. Bituminous Joint Filler: ASTM D1751.
- C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.
- D. Water Stops: Rubber Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, inch wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

***** OR *****

- E. Waterstop: Flexible strip of bentonite waterproofing compound in coil form for joints in concrete construction.
 - 1. Colloid Environmental Technologies Company Model.
 - 2. TC MiraDRi Model.
 - 3. Paramount Technical Products Model.
 - 4. Substitutions: Section 01600 - Product Requirements Not Permitted.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.
- C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.2 INSTALLATION

- A. Earth Forms:
 - 1. Earth forms are not permitted.
- B. Formwork - General:
 - 1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
 - 2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
 - 3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.

4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
 5. Complete wedging and bracing before placing concrete.
- C. Forms for Smooth Finish Concrete:
1. Use steel, plywood or lined board forms.
 2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
 3. Install form lining with close-fitting square joints between separate sheets without springing into place.
 4. Use full size sheets of form lines and plywood wherever possible.
 5. Tape joints to prevent protrusions in concrete.
 6. Use care in forming and stripping wood forms to protect corners and edges.
 7. Level and continue horizontal joints.
 8. Keep wood forms wet until stripped.
- D. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301 ACI 318.
- E. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- F. Obtain Architect/Engineer's approval before framing openings in structural members not indicated on Drawings.
- G. Install fillet and chamfer strips on external corners of beams joists columns and.
- H. Install void forms in accordance with manufacturer's recommendations.
1. SureVoid Products, Inc., Englewood, CO (800) 458-5444.
- I. Do not reuse wood formwork more than times for concrete surfaces to be exposed to view. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply

form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Install formed openings for items to be embedded in or passing through concrete work.
- B. Locate and set in place items required to be cast directly into concrete.
- C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
- G. Form Ties:
 - 1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
 - 2. Place ties at least 1 inch away from finished surface of concrete.
 - 3. Leave inner rods in concrete when forms are stripped.
 - 4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.
- H. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.
- I. Construction Joints:
 - 1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
 - 2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
 - 3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
 - 4. Arrange joints in continuous line straight, true and sharp.
- J. Openings for Items Passing Through Concrete:
 - 1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
 - 2. Coordinate work to avoid cutting and patching of concrete after placement.

3. Perform cutting and repairing of concrete required as result of failure to provide required openings.
- K. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
 2. Slope slabs to drain where required or as shown on Drawings.
 3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.
- L. Scream Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
 2. Staking through membrane is not be permitted.
- M. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
 2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.6 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Architect/Engineer.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301 ACI 318.

***** OR *****

- B. Camber slabs and beams 1/4 inch per 10 feet in accordance with ACI 301 ACI 318.

3.8 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements 01700 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- C. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.
- D. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reinforcing bars.
 - 2. Welded wire fabric.
 - 3. Reinforcement accessories.
- B. Related Sections:
 - 1. Section 03100 - Concrete Forms and Accessories.
 - 2. Section 03300 - Cast-in-Place Concrete.
 - 3. Section 03350 - Concrete Finishing: Reinforcement for concrete floor toppings.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 318 - Building Code Requirements for Structural Concrete.
 - 3. ACI 530.1 - Specifications for Masonry Structures.
 - 4. ACI SP-66 - ACI Detailing Manual.
- B. ASTM International:
 - 1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 - 3. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 - 4. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
 - 5. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 6. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
 - 7. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - 8. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
 - 9. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

10. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
11. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
12. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
13. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.

C. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:

1. CRSI - Manual of Standard Practice.
2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices and.
- C. Certificates: Submit AWS qualification certificate for welders employed on the Work.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
 1. Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI - Manual of Standard Practice ACI 301 ACI 318.
- B. Prepare shop drawings in accordance with ACI SP-66.
- C. Perform Work in accordance with State Municipality of Highways Public Work's standard.

1.5 QUALIFICATIONS

- A. Welders: AWS qualified within previous 12 months.

1.6 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.

- B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Deformed and Plain Reinforcement: ASTM A615/A615M; 60 ksi yield strength, steel bars, unfinished galvanized finish epoxy coated finish.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type, epoxy coated.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel Plastic tipped steel Stainless steel type; size and shape to meet Project conditions.
- D. Reinforcing Splicing Devices: Exothermic welding type; full tension and compression; sized to fit joined reinforcing.

***** OR *****

- E. Reinforcing Splicing Devices: Mechanical set screw swaged threaded type; full tension and compression; sized to fit joined reinforcing.
- F. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.3 FABRICATION

- A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice ACI 318 applicable code.
- B. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks, and seismic hooks as indicated on Drawings.
- C. Form reinforcement bends with minimum diameters in accordance with ACI 318 applicable code.
- D. Fabricate column reinforcement with offset bends at reinforcement splices.

- E. Form spiral column reinforcement from minimum 3/8 inch diameter continuous plain deformed bar or wire.
- F. Form ties and stirrups from the following:
 - 1. For bars No. 10 and Smaller: No. 3 deformed bars deformed wire.
 - 2. For bars No. 11 and Larger: No. 4 deformed bars deformed wire.
- G. Weld reinforcement in accordance with AWS D1.4.
- H. Galvanized Epoxy-Coated Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI.
- I. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Architect/Engineer.

2.4 SHOP FINISHING

- A. Galvanized Finish for Steel Bars: ASTM A767/A767M, Class I II, hot dip galvanized after fabrication.
- B. Epoxy Coated Finish for Steel Bars: ASTM A775/A775M ASTM A934/A934M.
- C. Epoxy Coated Finish for Steel Wire: ASTM A884/A884M; Class A using ASTM A775/A775M ASTM A934/A934M.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
 - 1. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.
- B. Do not displace or damage vapor retarder.
- C. Accommodate placement of formed openings.
- D. Space reinforcement bars with minimum clear spacing in accordance with ACI 318 of one bar diameter, but not less than 1 inch.
 - 1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.

- E. Maintain concrete cover around reinforcement in accordance with ACI 318 applicable code as follows:

Footings and Concrete Formed Against Earth		3 inches
Concrete exposed to earth or weather	No. 6 bars and larger	2 inches
	No. 5 bars and smaller	1-1/2 inches
Supported Slabs, Walls, and Joists	No. 14 bars and larger	1-1/2 inches
	No. 11 bars and smaller	3/4 inches
Beams and Columns		1-1/2 inches
Shell and Folded Plate Members	No. 6 bars and larger	3/4 inches
	No. 5 bars and smaller	1/2 inches

3.2 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

Reinforcement Depth	Depth Tolerance	Concrete Cover Tolerance
Greater than 8 inches	plus or minus 3/8 inch	minus 3/8 inch
Less than 8 inches	plus or minus 1/2 inch	minus 1/2 inch

- C. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.3 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements 01700 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Field inspection and testing will be performed by Owner's testing laboratory in accordance with ACI 318 applicable code.
- C. Perform field inspection and testing in accordance with ACI 318 applicable code.
- D. Provide free access to Work and cooperate with appointed firm.
- E. Reinforcement Inspection:

1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
2. Welding: Inspect welds in accordance with AWS D1.1.
3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706/A706M.
5. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318 applicable code.
6. Periodic Weld Inspection: Other welded connections.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE (CIVIL)

PART I - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
Precast concrete is specified in other Division 3 Sections.

1.03 SUBMITTALS

- A. Submit the following in accordance with Conditions of Contract and Division I Specifications Sections.
- B. Shop drawings for reinforcement, prepared for fabrication, bending and placement of concrete reinforcement. Comply with ACI SP-66 (88), "ACI Detailing Manual" showing bar schedules stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:

ACI 318, "Building Code Requirements for Reinforced Concrete."

Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

PART 2 - PRODUCTS

2.01 FORM MATERIALS

2018.14

M GARCIA ENGINEERING, LLC

CAST IN PLACE CONCRETE
(CIVIL)
03300- 1/15

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

Use plywood complying with U.S. Product Standard PS-I "B-B (Concrete Form) Plywood, Class 1, Exterior grade or better, mill-oiled and edge-sealed, with each piece bearing legible edges and one side for tight fit.

- A. Forms for Cylindrical Columns and Supports: Metal, fiberglass-reinforced plastic, or paper for fiber tubes. Provide paper or fiber tubes of laminated plies with water-resistant adhesive and wax-impregnated exterior for weather and moisture protection. units with sufficient wall thickness to resist wet concrete loads without deformation.
- B. Form Coatings: Provide commercial formulation form-release coating compounds with a maximum of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- C. Form Ties: Temporary-fabricated, adjustable-length removable or snap-off metal ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to exposed surface.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar-type supports complying with CRSI specifications.
- C. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
- D. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I for general use unless otherwise noted on Plans.
- B. Normal Weight Aggregates: ASTM C 33 and as herein specified. Provide aggregates from a single source for exposed concrete.
- C. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
- D. Lightweight Aggregate: ASTM C 330.
- E. Water: Drinkable.
- F. Admixtures General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.
- G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer be compatible with other required admixtures.
- H. Products: Subject to compliance with requirements, provide one of the following:
 - "Air-Tite," Cormix
 - "Air Mix" or "Pen--Air," Euclid Chemical Co.
 - "Darex AEA" or "Daravair," W.R. Grace & Co.
 - "MB-VR" or "Micro-Air," Master Builders, Inc.
 - "Sealtight AEA," W.R. Meadows, Inc.
 - "Sika AER," Sika Corp.
- I. Water-Reducing Admixture: ASTM C 494, Type A.
- J. Products: Subject to compliance with requirements, provide one of the following:
 - "PSI N," Cormix.
 - "Eucon WR-75," Euclid Chemical Co.
 - "WRDA," W.R. Grace & Co.
 - "Pozzolith Normal" or "Polyheed," Master Builders, Inc.
 - "Prokrete-N," Prokrete Industries.
 - "Plastocrete 161," Sika Corp.

- K. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G.
- L. Products: Subject to compliance with requirements, provide one of the following:
- "PSI Super," Cormix.
 - "Eucon 37," Euclid Chemical Co.
 - "WRDA 19: or "Daracem," W.R. Grace & Co.
 - "PSP," Prokrete Industries.
 - "Sikament 300," Sika Corp.

2.04 RELATED MATERIALS

- A. Preformed Plastic Waterstops: Federal Specification SS-S-210A.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
- Synco-Flex Products, Inc.
- A.. Location of Waterstops: Waterstops shall be provided in all construction and expansion points as shown on the plans.
- B. Waterstops shall also be provided in all construction joints not shown on the plans as follows:
- 1. All construction joints in structures confining liquids up to a point one foot above maximum water level.
 - 2. All structures enclosing dry areas at least one foot below finish grade.
- C. Granular Base: Evenly graded mixture of fine and course aggregates to provide, when compacted, a smooth and even surface below slabs on grade.
- D. Sand Cushion: Clean, manufactured or natural sand.
- E. Vapor Retarder: Provide vapor retarder cover over prepared base material under all slabs on grade for buildings.

- F. Use only materials that are resistant to deterioration when tested in accordance with ASTM E 154, as follows:
- Polyethylene sheet not less than 8 mils thick.
- G. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type 1, Class A. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.
- H. Available products: Subject to compliance with requirements, projects that may be incorporated in the work include, but are not limited to, the following:
- "Spartan-Cote," The Burke Co.
"Hardtop," Cormix.
"Eucocure," Euclid Chemical Co.
"Masterkure," Master Builders, Inc.
"CS-309," W.R. Meadows, Inc.
"LR-151," Prokrete Industries.
"Kure-N-Seal," Sonneborn-Rexnord.
"Stontop CS2," Stonhard, Inc.
- I. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.
- J. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to the following:
- "Burke Epoxy M.V.," The Burke Co.
"Euco Epoxy System #452 or #620," Euclid Chemical Co.
"Sikadur 32 Hi-Mod," Sika Corp.

2.05 CONCRETE MIXING

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as specified.

When air temperature between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 GENERAL

- A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.02 FORMS

- A. General: Design, erect, support, brace, and maintain form-work to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustictions, regrets, cliamfers, blocking, screeds, bulkheads, anchorages and insets, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

Fabricate Forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.

Provide temporary openings where interior area of Form-work is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to Form- to prevent loss of concrete mortar. Locate temporary openings in Form- at inconspicuous locations.

Chamfer all exposed corners and edges using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Provisions for Other Trades: Provide openings in concrete framework to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before concrete placement to prevent mortar leaks and maintain proper alignment.

3.03 VAPOR RETARDER/BARRIER INSTALLATION

- A. General: Following leveling and tamping of granular base for slabs on grade, place vapor retarder/barrier sheeting with longest dimension parallel with direction of pour.

Lap joints 6 inches.

3.04 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Engineer.

Place reinforcement to obtain at least minimum coverage's for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.05 JOINTS

- A. Construction Joints: Locate install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Engineer.

Provide keyways at least 1- 1/2 inches deep in construction joints in walls and slabs and between walls and footings.

Accepted bulkheads designed for this purpose may be used for slabs.

Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated. Do not continue reinforcement through sides of strip placements.

Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

- B. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to

Form-n continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Field-fabricate joints in waterstops in accordance with manufacturer's printed instructions.

- C. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

Joint filler and sealant materials are specified in Division 7 Sections of these specifications.

- D. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8 inch wide by 1/4 slab depth or inserts 1/4 inch wide by 1/4 of slab depth, unless otherwise indicated.

Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

If joint pattern not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

Joint sealant material is specified in Division 7 Sections of these Specifications.

3.06 INSTALLATION OF EMBEDDED ITEMS

D. General: Set and build into work anchorage devices and other embedded items required or other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

E. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.07 PREPARATION OF FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before reinforcement is placed.

Do not allow excess form-n-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.08 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.

B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location.

C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers of deeper than 24

inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

D. Placing, Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into comers,

Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement.

E. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a

concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade containing frozen materials.

Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

- F. Hot-Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Engineer.

3.09 FINISH OR FORMED SURFACES

- A. Rough From Finish: For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

3.10 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

After placing slabs, plane surface to tolerances for floor flatness (Ff) of 15 and floor levelness (F l) to 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other inishes as hereinafter specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sanbed terrazzo; and as other wise indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of (Ff) 18 - F] 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surface to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20 - Ff 17. Grind smooth surface defects that would telegraph through applied floor covering system.

- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with this-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

- E. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen concrete surface by brooming with fiver-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.11 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture

loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

- B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

Provide moisture curing by one of the following methods.

Keep concrete surface continuously wet by covering with water.

Use continuous water-fog spray.

Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

Provide moisture-cover curing as follows:

Cover concrete surfaces with moisture-retarding cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by water proof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and water proof tape.

Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:

Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen as disappeared). Apply

uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied to concrete.

3.12 SHORES AND SUPPORTS

- A. General: Comply with ACI 347 for shoring and reshoring in multistory construction, and as herein specified.

Extend shoring from ground to roof for structures 4 stories or less, unless otherwise permitted.

Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.13 REMOVAL OF FORMS

- A. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.14 REUSE OF FORMS

- A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged formfacing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar

parts of the work, may be removed after cumulatively curing at not less than 50 de F (10 de C) for 48 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces except as acceptable to Engineer.

3.15 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with comers, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
- D. Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as schedules. Maintain accurate location of reinforcing steel during concrete placement.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete for the following:
 - 1. Building frame members.
 - 2. Shear walls.
 - 3. Foundation walls.
 - 4. Supported slabs.
 - 5. Slabs on grade.
 - 6. Control, expansion and contraction joint devices.
- B. Related Sections:
 - 1. Section 03100 - Concrete Forms and Accessories: Formwork and accessories. Placement of joint device joint device anchors in formwork.
 - 2. Section 03200 - Concrete Reinforcement.
 - 3. Section 03350 - Concrete Finishing.
 - 4. Section 03390 - Concrete Curing.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 305 - Hot Weather Concreting.
 - 3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
 - 4. ACI 308.1 - Standard Specification for Curing Concrete.
 - 5. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ASTM International:
 - 1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 3. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 4. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 5. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 - 6. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 - 7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.

8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
10. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
14. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
17. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
18. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
19. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
20. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
21. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
22. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
23. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
24. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
25. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
26. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
27. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
28. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
29. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
30. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
31. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
32. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

- 33. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
- 34. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 PERFORMANCE REQUIREMENTS

- A. Vapor Retarder Permeance: Maximum 1 perm when tested in accordance with ASTM E96, Procedure A.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on joint devices, attachment accessories, admixtures.
- C. Design Data:
 - 1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
 - a. Hot and cold weather concrete work.
 - b. Air entrained concrete work.
 - 2. Identify mix ingredients and proportions, including admixtures.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 ACI 318.
- B. Conform to ACI 305 when concreting during hot weather.
- C. Conform to ACI 306.1 when concreting during cold weather.
- D. Acquire cement and aggregate from one source for Work.

1.6 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal Type IA - Air Entraining Type II - Moderate Type IIA - Air Entraining Type III - High Early Strength Type IIIA - Air Entraining Type IV - Low Heat of Hydration Type V - Sulfate Resistant Portland type; manufactured by; ASTM C595, list appropriate blend and cement type.
- B. Normal Weight Aggregates: ASTM C33.
 - 1. Coarse Aggregate Maximum Size: inches In accordance with ACI 318. Water: ACI 318; potable, without deleterious amounts of chloride ions with maximum percent of water soluble chloride ions by weight of cement.

2.2 ADMIXTURES

- A. Furnish materials in accordance with State Municipality of Highways Public Work's standards.
- B. Air Entrainment: ASTM C260.
- C. Chemical: ASTM C494/C494M Type A - Water Reducing Type B - Retarding Type C - Accelerating Type D - Water Reducing and Retarding Type E - Water Reducing and Accelerating Type F - Water Reducing, High Range Type G - Water Reducing, High Range and Retarding.
- D. Fly Ash Calcined Pozzolan: ASTM C618 Class.
- E. Silica Fume: ASTM C1240.
- F. Slag: ASTM C989; Grade 80 100 120; ground granulated blast furnace slag.
- G. Plasticizing: ASTM C1017/C1017M Type I, plasticizing Type II, plasticizing and retarding.

2.3 ACCESSORIES

- A. Bonding Agent: Polymer resin emulsion Polyvinyl Acetate Latex emulsion Two component modified epoxy resin Non-solvent two component polysulfide epoxy Mineral filled polysulfide polymer epoxy Mineral filled polysulfide polymer epoxy resin Polyamid cured epoxy.
- B. Vapor Retarder: ASTM E1745 Class A B C; 10 mil thick polyethylene film fabric reinforced plastic film; type recommended for below grade application. Furnish joint tape recommended by manufacturer.

- C. Non-Shrink Grout: ASTM C1107, Grade A B C; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type A: ASTM D1751 ASTM D994; Asphalt impregnated fiberboard or felt, 1/4 inch thick; tongue and groove profile.

***** OR *****

- B. Joint Filler Type B: ASTM D1752; Closed cell polyvinyl chloride molded vinyl foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.

***** OR *****

- C. Joint Filler Type C: ASTM D1752; Premolded sponge rubber fully compressible with recovery rate of minimum 95 percent.
- D. Construction Joint Devices: Integral galvanized steel extruded plastic; inch thick, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge; manufactured by.
- E. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient elastomeric vinyl neoprene filler strip with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum vinyl cover plate, of longest manufactured length at each location, flush recessed mounted; color as selected; manufactured by.
- F. Sealant: ASTM D6690, Type I.

2.5 CONCRETE MIX

- A. Select proportions for normal weight concrete in accordance with ACI 301 Method 1
- B. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Architect/Engineer.
 - 1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
 - 2. Do not use calcium chloride nor admixtures containing calcium chloride.
 - 3. Use set retarding admixtures during hot weather.
 - 4. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing or deicing chemicals.

- 5. For concrete exposed to deicing chemicals, limit fly ash, pozzolans, silica fume, and slag content as required by applicable code.
- C. Average Compressive Strength Reduction: Not permitted.
- D. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94/C94M ASTM C685/C685M.
- E. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- C. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- D. Remove water from areas receiving concrete before concrete is placed.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301 ACI 318.
- B. Notify testing laboratory and Architect/Engineer minimum 24 hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and are not disturbed during concrete placement.

- D. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 6 inches and seal watertight by adhesive applied between overlapping edges and ends taping edges and ends.
- E. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.
- F. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- G. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.
- H. Install joint covers in one piece longest practical length, when adjacent construction activity is complete.
- I. Apply sealants in joint devices in accordance with Section 07900.
- J. Deposit concrete at final position. Prevent segregation of mix.
- K. Place concrete in continuous operation for each panel or section determined by predetermined joints.
- L. Consolidate concrete.
- M. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- N. Place concrete continuously between predetermined expansion, control, and construction joints.
- O. Do not interrupt successive placement; do not permit cold joints to occur.
- P. Place floor slabs in checkerboard or saw cut pattern indicated.
- Q. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- R. Screed floors and slabs on grade level, maintaining surface flatness of F_f of 20 maximum 1/4 inch in 10 ft.

3.4 CONCRETE FINISHING

- A. Provide formed concrete surfaces to be left exposed concrete walls columns beams joists with smooth rubbed sand float sack rubbed finish as Scheduled in this section.

- B. Finish concrete floor surfaces in accordance with ACI 301 ACI 318.
- C. Wood float surfaces receiving quarry tile ceramic tile terrazzo with full bed setting system.
- D. Steel trowel surfaces receiving carpeting resilient flooring seamless flooring thin set quarry tile thin set ceramic tile.
- E. Steel trowel surfaces which are indicated to be exposed.
- F. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8 1/4 inch per foot nominal as indicated on drawings.

3.5 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
 - 1. Protect concrete footings from freezing for minimum 5 days.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Cure concrete in accordance with ACI 308.1
- D. Cure floor surfaces in accordance with ACI 301 ACI 318.
- E. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 7 days.
- F. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3.6 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Requirements 01700 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform field inspection and testing in accordance with ACI 318 applicable code.
- C. Provide free access to Work and cooperate with appointed firm.
- D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- E. Concrete Inspections:
 - 1. Continuous Placement Inspection: Inspect for proper installation procedures.

2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.
- F. Strength Test Samples:
1. Sampling Procedures: ASTM C172.
 2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured field cured.
 3. Sample concrete and make one set of three cylinders for every 150 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area for slabs and walls.
 4. When volume of concrete for any class of concrete would provide less than 3 sets of cylinders, take samples from three randomly selected batches, or from every batch when less than 3 batches are used.
 5. Make one additional cylinder during cold weather concreting, and field cure.
- G. Field Testing:
1. Slump Test Method: ASTM C143/C143M.
 2. Air Content Test Method: ASTM C173/C173M ASTM C231.
 3. Temperature Test Method: ASTM C1064/C1064M.
 4. Measure slump and temperature for each compressive strength concrete sample.
 5. Measure air content in air entrained concrete for each compressive strength concrete sample.
- H. Cylinder Compressive Strength Testing:
1. Test Method: ASTM C39.
 2. Test Acceptance: In accordance with ACI 318 applicable code.
 3. Test one cylinder at 7 days.
 4. Test two cylinders at 28 days.
 5. Dispose remaining cylinders when testing is not required.
- I. Core Compressive Strength Testing:
1. Sampling and Testing Procedures: ASTM C42/C42M.
 2. Test Acceptance: In accordance with ACI 318 applicable code.
 3. Drill three cores for each failed strength test from concrete represented by failed strength test.
- J. Water Soluble Chloride Ion Concentration Test Method: ASTM C1218; tested at 28 days.
1. Maximum Concentration: As permitted by applicable code.
- K. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.7 PATCHING

- A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.

- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.
- C. Patch imperfections as directed by Architect/Engineer in accordance with ACI 301 ACI 318.

3.8 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by Architect/Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION

SECTION 03350

CONCRETE FINISHING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Finishing concrete floors [and floor toppings].
 - 2. Floor surface treatment.
- B. Related Sections:
 - 1. Section 03300 - Cast-in-Place Concrete: [Prepared concrete floors ready to receive finish;] [control and formed expansion and contraction joints and joint devices].
 - 2. Section 03360 - Concrete Finishes: Exposed aggregate finish.
 - 3. Section 03390 - Concrete Curing.
 - 4. Section 05810 - Expansion Joint Cover Assemblies.
 - 5. Section 07900 - Joint Sealers.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.
- B. ASTM International:
 - 1. ASTM E1155 - Standard Test Method for Determining Floor Flatness and of Levelness Using the F-number System.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on concrete hardener, sealer, curing compounds curing papers and slip resistant treatment, compatibilities, and limitations.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit data on maintenance renewal of applied coatings.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and ACI 302.1.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Deliver materials in manufacturer's packaging including application instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.

1.8 COMPOUNDS - HARDENERS AND SEALERS

- A. Chemical Hardener: Magnesium fluorosilicate and zinc fluorosilicate blend

PART 2 EXECUTION

2.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify floor surfaces are acceptable to receive the Work of this section.

2.2 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.
- B. Wood float surfaces receiving quarry tile, ceramic tile, and cementitious terrazzo with full bed setting system.
- C. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set quarry tile, and thin set ceramic tile.
- D. Steel trowel surfaces which are scheduled to be exposed.

2.3 TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Measure for F(F) and F(L) tolerances for floors in accordance with ASTM E1155, within 48 hours after slab installation.

- C. Finish concrete to achieve the following tolerances:
 - 1. Under Glazed Tile on Setting Bed: F(F) 35 and F(L) 20.
 - 2. Under Resilient Finishes: F(F) 75 and F(L) 50.
 - 3. Exposed to View and Foot Traffic: F(F) 75 and F(L) 40.
 - 4. Correct slab surface when actual F(F) or F(L) number for floor installation measures less than required.
- D. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

END OF SECTION

SECTION 03390

CONCRETE CURING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes initial and final curing of horizontal and vertical concrete surfaces.
- B. Related Sections:
 - 1. Section 03300 - Cast-In-Place Concrete.
 - 2. Section 03350 - Concrete Finishing.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.
 - 3. ACI 308.1 - Standard Specification for Curing Concrete.
 - 4. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ASTM International:
 - 1. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
 - 2. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 3. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - 4. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on curing compounds.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 ACI 302.1 ACI 318.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Membrane Curing Compound Type 1
- B. Water: Potable, not detrimental to concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces are ready to be cured.

3.2 INSTALLATION - HORIZONTAL SURFACES

- A. Cure concrete in accordance with ACI 308.1.
- B. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.

***** [OR] *****

- C. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

***** [OR] *****

- D. Absorptive Mat: Spread cotton fabric over floor slab areas. Spray with water until mats are saturated, and maintain in saturated condition for 7 days.

***** [OR] *****

- E. Absorptive Mat: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place for 7 days.

END OF SECTION

SECTION 03600

GROUT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Portland cement grout.
 - 2. Rapid curing epoxy grout.
 - 3. Non-shrink cementitious grout.
- B. Related Sections:
 - 1. Section 03300 - Cast-in-Place Concrete.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 318 - Building Code Requirements for Structural Concrete.
- B. American Society of Testing and Materials:
 - 1. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 2. ASTM C40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
 - 3. ASTM C150 - Standard Specification for Portland Cement.
 - 4. ASTM C191 - Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
 - 5. ASTM C307 - Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
 - 6. ASTM C531 - Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - 7. ASTM C579 - Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, monolithic Surfacing and Polymer Concretes.
 - 8. ASTM C827 - Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
- C. U. S. Army Corps of Engineers Concrete Research Division (CRD):
 - 1. CRD C621 - Non-Shrink Grout.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT GROUT MATERIALS

- A. Portland Cement: ASTM C150, Type I and II.
- B. Water:
1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:
 - a. Corrosion of steel.
 - b. Volume change increasing shrinkage cracking.
 - c. Efflorescence.
 - d. Excess air entraining.
- C. Fine Aggregate:
1. Washed natural sand.
 2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
 3. Free from injurious amounts of organic impurities as determined by ASTM C40.
- D. Mix:
1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 RAPID CURING EPOXY GROUT

- A. Rapid Curing Epoxy Grout: High strength, three component epoxy grout formulated with thermosetting resins and inert fillers. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids and alkalies.

Compressive Strength	ASTM C579	12,000 psi at 7 days
Tensile Strength	ASTM C307	2,000 psi minimum
Coefficient of Expansion	ASTM C531	30×10^{-6} in per degree F
Shrinkage	ASTM C827	None

2.3 NON-SHRINK CEMENTITIOUS GROUT

- A. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Type D non-shrink grout:

Property	Test	Time	Result
Setting Time	ASTM C191	Initial	2 hours (Approx)
		Final	3 hours (Approx)

Expansion			0.10% - 0.4% Maximum
Compressive Strength	CRD-C621	1 day	4,000 psi
		7 days	7,000 psi
		28 days	10,000 psi to 10,800 psi

2.4 FORMWORK

- A. Refer to Section 03100 for formwork requirements.

2.5 CURING

- A. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or with use of wet burlap method.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.
- B. Rough concrete lightly, but not enough to interfere with placement of grout.
- C. Remove foreign materials from metal surfaces in contact with grout.
- D. Align, level and maintain final positioning of components to be grouted.
- E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.2 MIXING

- A. Portland Cement Grout:
1. Use proportions of 2 parts sand and 1 part cement, measured by volume.
 2. Prepare grout with water to obtain consistency to permit placing and packing.
 3. Mix water and grout in two steps; pre-mix using approximately 2/3 of water; after partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing 2 to 3 minutes.
 4. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
 5. Do not add additional water after grout has been mixed.
 6. Capable of developing minimum compressive strength of 2400 psi in 48 hours and 7000 psi in 28 days.

***** [OR] *****

3.3 PLACING GROUT

- A. Place grout material quickly and continuously.
- B. Do not use pneumatic-pressure or dry-packing methods.
- C. Apply grout from one side only to avoid entrapping air.
- D. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.
- E. Thoroughly compact final installation and eliminate air pockets.
- F. Do not remove leveling shims for at least 48 hours after grout has been placed.

3.4 CURING

- A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. After grout has attained its initial set, keep damp for minimum of 3 days.

3.5 FIELD QUALITY CONTROL

- A. Submit proposed mix design of each class of grout to inspection and testing firm for review prior to commencement of Work.
- B. Tests of grout components may be performed to ensure conformance with specified requirements.

END OF SECTION

SECTION 04065

MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes mortar and grout for masonry.
- B. Related Sections:
 - 1. Section 04810 - Unit Masonry Assemblies: Installation of mortar and grout.
 - 2. Section 04820 - Reinforced Unit Masonry Assemblies: Installation of mortar and grout.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 530 - Building Code Requirements for Masonry Structures.
 - 2. ACI 530.1 - Specifications for Masonry Structures.
- B. ASTM International:
 - 1. ASTM C5 - Standard Specification for Quicklime for Structural Purposes.
 - 2. ASTM C91 - Standard Specification for Masonry Cement.
 - 3. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 - 4. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
 - 5. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
 - 6. ASTM C150 - Standard Specification for Portland Cement.
 - 7. ASTM C199 - Standard Test Method for Pier Test for Refractory Mortars.
 - 8. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
 - 9. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
 - 10. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
 - 11. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
 - 12. ASTM C476 - Standard Specification for Grout for Masonry.
 - 13. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
 - 14. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - 15. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
 - 16. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry.
 - 17. ASTM C1314 - Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.

18. ASTM C1329 - Standard Specification for Mortar Cement.
19. ASTM C1357 - Standard Test Method for Evaluating Masonry Bond Strength.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal requirements.
- B. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
- C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Portland Cement: ASTM C150, Type I
- B. Calcium chloride is not permitted.

2.2 MIXES

- A. Mortar Mixes:
 1. Extended Life Mortar: ASTM C1142, Type RS
 2. At exterior conditions, provide integral water repellent mortar admixture "Krete" by Krete Industries or Blocktite by Euclid Chemicals.
- B. Mortar Mixing:
 1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
 2. Achieve uniformly damp sand immediately before mixing process.
 3. Re-temper only within two hours of mixing.

4. Integral water repellent admixture mix as per manufacturer recommendations.
- C. Grout Mixes:
 1. Grout for Non-Structural Masonry: 3,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 grout.
 2. Grout for Structural Masonry: 3,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 grout.
 3. Application:
 - a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
 - b. Fine Grout: For grouting other spaces.
- D. Grout Mixing:
 1. Mix grout in accordance with ASTM C94/C94M, modified to use ingredients complying with ASTM C476.
 2. Add admixtures; mix uniformly.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Request inspection of spaces to be grouted.

3.2 INSTALLATION

- A. Install mortar and grout in accordance with ACI 530.1 Specifications for Masonry Structures.

3.3 FIELD QUALITY CONTROL

- A. Establishing Mortar Mix: In accordance with ASTM C270.
- B. Testing Frequency: One set of specified tests for every 5,000 sf of completed wall area.
- C. Testing of Mortar Mix: In accordance with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength.
- D. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength, and in accordance with ASTM C143/C143M for slump.
- E. Test compressive strength of mortar and masonry to ASTM C1314; test in accordance with masonry unit sections specified.

END OF SECTION

SECTION 04820

REINFORCED UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes concrete masonry units, reinforcement, anchorage, and accessories.
- B. Related Sections:
 - 1. Section 04065 - Masonry Mortar and Grout: Mortar and grout.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 530 - Building Code Requirements for Masonry Structures.
 - 2. ACI 530.1 - Specifications for Masonry Structures.
- B. ASTM International:
 - 1. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - 3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 4. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.
 - 5. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 6. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 7. ASTM A951 - Standard Specification for Masonry Joint Reinforcement.
 - 8. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
 - 9. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 - 10. ASTM C27 - Standard Classification of Fireclay and High-Alumina Refractory Brick.
 - 11. ASTM C34 - Standard Specification for Structural Clay Load-Bearing Wall Tile.
 - 12. ASTM C55 - Standard Specification for Concrete Brick.
 - 13. ASTM C56 - Standard Specification for Structural Clay Non-Load-Bearing Tile.
 - 14. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).

15. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
16. ASTM C73 - Standard Specification for Calcium Silicate Face Brick (Sand-Lime Brick).
17. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
18. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
19. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
20. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.
21. ASTM C212 - Standard Specification for Structural Clay Facing Tile.
22. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
23. ASTM C315 - Standard Specification for Clay Flue Linings.
24. ASTM C530 - Standard Specification for Structural Clay Non-Loadbearing Screen Tile.
25. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
26. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
27. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
28. ASTM C1261 - Standard Specification for Firebox Brick for Residential Fireplaces.
29. ASTM C1283 - Standard Practice for Installing Clay Flue Lining.
30. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
31. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
32. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

C. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 PERFORMANCE REQUIREMENTS

A. Concrete Masonry Compressive Strength (f_m): 2,000 psi;

1. Concrete Masonry Units: 1900 psi minimum net area compressive strength.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal requirements.
- B. Shop Drawings: Indicate bars sizes, spacings, locations, reinforcement quantities, bending and cutting schedules, supporting and spacing devices for reinforcement.
- C. Product Data:
 - 1. Submit data for masonry units and fabricated wire reinforcement.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
- C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90; normal weight.
- B. At exterior conditions, provide integral colored CMU units, color selected by architect. Units shall be manufactured with integral water repellent "Krete block".

2.2 ACCESSORIES

- A. Single Wythe Joint Reinforcement: ASTM A951; ladder type; 0.148 inch diameter side rods with 0.148 inch diameter cross ties.
- B. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars.

- C. Anchor Rods: ASTM A307; Grade C; J-shaped or L-shaped; complete with washers and heavy hex nuts; sized for minimum 15 inch embedment.
 - 1. Hot-Dipped Galvanizing: ASTM A153/A153M.
 - 2. Mechanical Galvanizing: ASTM B695; Class 55.
- D. Mortar and Grout: As specified in Section 04065.
- E. Joint Filler: Closed cell rubber; oversized 50 percent to joint width; self expanding.

2.3 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Test brick efflorescence in accordance with ASTM C67. Brick rated greater than “slightly effloresced” is not acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify field conditions are acceptable and are ready to receive work.
- C. Verify items provided by other sections of work are properly sized and located.
- D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other Sections.
- B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.
- C. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

3.3 INSTALLATION

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

- C. Coursing of Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.

- D. Placing And Bonding:
 - 1. Lay solid masonry units in full bed of mortar, with full head joints.
 - 2. Lay hollow masonry units with face shell bedding on head and bed joints.
 - 3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
 - 4. Remove excess mortar as Work progresses.
 - 5. Interlock intersections and external corners.
 - 6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
 - 7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
 - 8. Isolate masonry from vertical structural framing members with movement joint .
 - 9. Isolate top of masonry from horizontal structural framing members and slabs or decks.

- E. Joint Reinforcement And Anchorage:
 - 1. Install horizontal joint reinforcement 16 inches oc.
 - 2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
 - 3. Place joint reinforcement continuous in first and second joint below top of walls.
 - 4. Lap joint reinforcement ends minimum 6 inches.
 - 5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
 - 6. Embed anchors embedded in concrete attached to structural steel members. Embed anchorages in every sixth brick.

- F. Lintels:
 - 1. Install precast concrete lintels over openings.
 - 2. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled or indicated.
 - 3. Openings Up To 42 inches Wide: Reinforce openings as indicated on Drawings.
 - 4. Openings From 42 inches Up To 78 inches Wide: Reinforce openings as indicated on Drawings.
 - 5. Openings Over 78 inches: Reinforce openings as indicated on Drawings.
 - 6. Do not splice reinforcing bars.
 - 7. Support and secure reinforcing bars from displacement.
 - 8. Place and consolidate grout fill without displacing reinforcing.
 - 9. Allow masonry lintels to attain specified strength before removing temporary supports.
 - 10. Maintain minimum 8 inches bearing on each side of opening.

- G. Grouted Components:
 - 1. Reinforce bond beam with 1, No. 5 bar.
 - 2. Reinforce pilaster with 1, No. 6 bar in each cell.
 - 3. Lap splices bar diameters required by code.
 - 4. Support and secure reinforcing bars from displacement.
 - 5. Place and consolidate grout fill without displacing reinforcing.
 - 6. At bearing locations, fill masonry cores with grout for minimum 12 inches either side of opening.
- H. Reinforced Masonry:
 - 1. Lay masonry units with cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
 - 2. Place reinforcing, reinforcement bars, and grout as indicated on Drawings.
 - 3. Splice reinforcement in accordance with Section 03200.
 - 4. Support and secure reinforcement from displacement.
 - 5. Place and consolidate grout fill without displacing reinforcing.
 - 6. Place grout in accordance with ACI 530.1 Specification for Masonry Structures.
- I. Control And Expansion Joints:
 - 1. Install control and expansion joints at the following maximum spacings, unless otherwise indicated on Drawings:
 - a. Exterior Walls: 20 feet on center and within 10 feet on one side of each interior and exterior corner.
 - b. Interior Walls: 30 feet on center.
 - c. At changes in wall height.
 - 2. Do not continue horizontal joint reinforcement through control and expansion joints.
 - 3. Install preformed control joint device in continuous lengths. Seal butt and corner joints.
 - 4. Size control joint in accordance with Section 07900 for sealant performance.
 - 5. Form expansion joint by omitting mortar and cutting unit to form open space.
- J. Cutting And Fitting:
 - 1. Obtain Architect/Engineer's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.4 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation From Alignment of Pilasters: 1/4 inch.
- C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

- E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- G. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.
- I. Maximum Variation for Steel Reinforcement:
 - 1. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.
 - 2. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
 - 3. Plus or minus 1 inch when distance is between 8 and 24 inches.
 - 4. Plus or minus 1-1/4 inch when distance is greater than 24 inches.
 - 5. Plus or minus 2 inches from location along face of wall.

3.5 FIELD QUALITY CONTROL

- A. Concrete Masonry Units: Test each type in accordance with ASTM C140.

3.6 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with cleaning solution.
- E. Use non-metallic tools in cleaning operations.

3.7 PROTECTION OF FINISHED WORK

- A. Section 01700 - Execution Requirements: Requirements for protecting finished Work.
- B. Protect exposed external corners subject to damage.
- C. Protect base of walls from mud and mortar splatter.
- D. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

- E. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when work is not in progress.

END OF SECTION

SECTION 05120
STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural shapes.
 - 2. Channels and angles.
 - 3. Hollow structural sections.
 - 4. Structural pipe.
 - 5. Structural plates and bars.
 - 6. Fasteners, connectors, and anchors.
- B. Related Sections:
 - 1. Section 03600 - Grout: Grout for setting base plates.
 - 2. Section 05210 - Steel Joists.
 - 3. Section 05312 - Steel Roof Deck

1.2 REFERENCES

- A. American Institute of Steel Construction:
 - 1. AISC Code of Standard Practice for Steel Buildings and Bridges.
 - 2. AISC Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings.
 - 3. AISC Load and Resistance Factor Design Specification for Single-Angle Members.
 - 4. AISC Seismic Provisions for Structural Steel Buildings.
 - 5. AISC Specification for Allowable Stress Design of Single-Angle Members.
 - 6. AISC Specification for the Design of Steel Hollow Structural Sections.
 - 7. AISC Specification for Structural Steel Buildings Allowable Stress Design, and Plastic Design.
- B. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 3. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - 4. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 5. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

6. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
7. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
8. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
9. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
10. ASTM A449 - Standard Specification for Quenched and Tempered Steel Bolts and Studs.
11. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
15. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
16. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
17. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
18. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4-in. (100-mm) Thick.
19. ASTM A618 - Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.
20. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
21. ASTM A847 - Standard Specification for Cold-Formed Welded and Seamless High Strength, Low Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance.
22. ASTM A852/A852M - Standard Specification for Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi (485 MPa) Minimum Yield Strength to 4 in. (100 mm) Thick.
23. ASTM A913/A913M - Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST).
24. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
25. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
26. ASTM E94 - Standard Guide for Radiographic Examination.
27. ASTM E164 - Standard Practice for Ultrasonic Contact Examination of Weldments.

28. ASTM E165 - Standard Test Method for Liquid Penetrant Examination.
29. ASTM E709 - Standard Guide for Magnetic Particle Examination.
30. ASTM F436 - Standard Specification for Hardened Steel Washers.
31. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
32. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
33. ASTM F1852 - Standard Specification for Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

C. American Welding Society:

1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.

D. Research Council on Structural Connections:

1. RCSC - Specification for Structural Joints Using ASTM A325 or A490 Bolts.

E. SSPC: The Society for Protective Coatings:

1. SSPC - Steel Structures Painting Manual.
2. SSPC Paint 15 - Steel Joist Shop Paint.
3. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
4. SSPC SP 3 - Power Tool Cleaning.
5. SSPC SP 6 - Commercial Blast Cleaning.
6. SSPC SP 10 - Near-White Blast Cleaning.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Connections.
3. Cambers
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:

1. AISC Code of Standard Practice for Steel Buildings and Bridges.
2. AISC Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings.
3. AISC Specification for the Design of Steel Hollow Structural Sections.

4. AISC Load and Resistance Factor Design Specification for Single-Angle Members.
5. RCSC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
6. ASCE 19.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

- A. Structural W-Shapes: ASTM A572/A572M; Grade 50
- B. Structural M-Shapes: ASTM A572/A572M; Grade 50
- C. Structural T-Shapes: Cut from structural W-shapes.
- D. Channels and Angles: ASTM A36/A36M.
- E. Round Hollow Structural Sections: ASTM A500, Grade C
- F. Square and Rectangular Hollow Structural Sections: ASTM A500, Grade C.
- G. Structural Plates and Bars: ASTM A36/A36M.

2.2 FASTENERS, CONNECTORS, AND ANCHORS

- A. Bolts: ASTM A307; Grade A or B.
- B. High Strength Bolts: ASTM A325; Type 1 or ASTM A490; Type 1.
- C. Nuts: ASTM A563 heavy hex type.
- D. Washers: ASTM F436; Type 1, circular Furnish clipped washers where space limitations require.
- E. Threaded Rods: ASTM A307; Grade A.
- F. Forged Structural Steel Hardware:
 1. Clevises and Turnbuckles: ASTM A108; Grade 1085.
 2. Eye Nuts and Eye Bolts: ASTM A108; Grade 1030.
 3. Sleeve Nuts: ASTM A108; Grade 1018.
 4. Rod Ends, Yoke Ends and Pins, Cotter Pins, and Coupling Nuts: Carbon steel.

2.3 WELDING MATERIALS

- A. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 FABRICATION

- A. Fabricate connections for bolt, nut, and washer connectors.
- B. Develop required camber for members.

2.5 FINISH

- A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed.

2.6 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01400 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Shop test bolted and welded connections as specified for field quality control tests.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify bearing surfaces are at correct elevation.
- C. Verify anchors rods are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

- A. Furnish templates for installation of anchor rods and embedments in concrete and masonry work.

3.3 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
- B. Field weld components and shear connectors indicated on Drawings.
- C. Field connect members with threaded fasteners; tighten to snug tight for bearing type connections.
- D. Do not field cut or alter structural members without approval of Architect/Engineer.

- E. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

- A. Shim bearing plates and equipment supports to proper elevation, snug tighten anchor bolts.
- B. Fill void under bearing surface with grout. Install and pack grout to remove air pockets.
- C. Moist cure grout.
- D. Remove forms after grout is set. Trim grout edges to form smooth surface, splayed 45 degrees.
- E. Tighten anchor bolts after grout has cured for a minimum of 3 days.

3.5 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- C. Maximum Offset From Alignment: 1/4 inch.

3.6 FIELD QUALITY CONTROL

- A. Bolted Connections: Inspect in accordance with AISC specifications.
 - 1. Visually inspect all bolted connections.
 - 2. For Direct Tension Indicators, comply with requirements of ASTM F959. Verify that gaps are less than gaps specified in Table 2.
- B. Welding: Inspect welds in accordance with AWS D1.1.
 - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 - 2. Visually inspect all welds.
 - 3. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.
 - 4. Liquid Penetrant Inspection: ASTM E165.
- C. Correct defective bolted connections and welds.

END OF SECTION

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes load bearing formed steel stud exterior wall, interior wall; and formed steel purlin, framing and bridging.
- B. Related Sections:
 - 1. Section 05311 - Steel Floor Deck: Metal floor decking supported by wall stud metal framing.
 - 2. Section 05312 - Steel Roof Deck: Metal roof decking supported by wall stud metal framing.
 - 3. Section 06112 - Framing and Sheathing.
 - 4. Section 09111 - Non-Load-Bearing Metal Framing System.

1.2 REFERENCES

- A. American Iron and Steel Institute:
 - 1. AISI General - Standard for Cold-Formed Steel Framing - General Provisions.
 - 2. AISI Header - Standard for Cold-Formed Steel Framing - Header Design.
 - 3. AISI NASPEC - North American Specification for Design of Cold-Formed Steel Structural Members.
 - 4. AISI - Residential Steel Framing Manual.
- B. ASTM International:
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 3. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
 - 4. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

5. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 6. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
 7. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
- C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.
 2. AWS D1.3 - Structural Welding Code - Sheet Steel.
- D. National Association of Architectural Metal Manufacturers:
1. NAAMM ML/SFA 540 - Lightweight Steel Framing Systems Manual.
- E. SSPC: The Society for Protective Coatings:
1. SSPC Paint 15 - Steel Joist Shop Paint.
 2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
- F. Steel Stud Manufacturers Association:
1. SSMA - Product Technical Information.

1.3 SYSTEM DESCRIPTION

- A. Size components to withstand design loads as follows:
1. Vertical Assembly: 25 psf positive and 30 psf negative.
 2. Horizontal Assembly: 20 psf live loads.
- B. Maximum Allowable Deflection: 1: 360 of span.
- C. Wall System:
1. Design to AISI NASPEC, AISC General, and AISC Header.
 2. Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 3. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.4 PERFORMANCE REQUIREMENTS

- A. Select stud thickness to resist minimum 5 psf uniform load and maximum 1/360 deflection.

1.5 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal requirements.
- B. Shop Drawings:
 - 1. Indicate component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related Work.
 - 2. Indicate stud, floor joist, ceiling joist, roof joist, roof rafter, roof truss, and layout.
 - 3. Submit calculations for loadings and stresses of specially fabricated framing, and roof trusses, under Professional engineer's seal.
- C. Product Data: Submit data on standard framing members; describe materials and finish, product criteria, and limitations.
- D. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

1.6 QUALITY ASSURANCE

- A. Calculate structural properties of framing members in accordance with AISI NASPEC.
- B. Furnish framing materials in accordance with SSMA - Product Technical Information.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
 - 1. Current member of Steel Stud Manufacturers Association.
- B. Installer: Company specializing in performing Work of this section with minimum 3 years documented experience or as approved by manufacturer.
- C. Design structural elements under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.

1.8 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.

PART 2 PRODUCTS

2.1 COLD-FORMED METAL FRAMING

- A. Manufacturers:
 - 1. Clark Steel Framing Systems
 - 2. Harrison Manufacturing Co.
 - 3. Marino\Ware
 - 4. Unimast Incorporated
 - 5. Dietrich Metal Framing
 - 6. Substitutions: Section 01600 - Product Requirements
- B. Cold-Formed Metal Framing: ASTM C955.

2.2 FRAMING COMPONENTS

- A. Steel Sheet: ASTM A1003/A1003M; Structural Grade, Type H
 - 1. Grade: ST50H.

2.3 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined by performance requirements specified.
- B. Plates, Gussets, Clips: Formed sheet steel, thickness determined by performance requirements specified.
- C. Touch-Up Paint: Match shop primer and finish paint.

2.4 FASTENERS

- A. Self-drilling, Self-tapping Screws, Bolts, Nuts, and Washers: Steel, hot dip galvanized.
- B. Anchorage Devices: Power actuated, drilled expansion bolts, and screws with sleeves.

- C. Welding: In conformance with AWS D1.1 and AWS D1.3.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces and building framing components are ready to receive Work.
- C. Verify rough-in utilities are in proper location.

3.2 ERECTION OF STUDS

- A. Align floor and ceiling tracks; locate to partition layout. Secure in place with fasteners by welding at maximum 24 inches oc.
- B. Place studs at 16 inches oc; not more than 2 inches from abutting walls and at each side of openings.
- C. Construct corners using minimum three studs. Double stud wall openings, door jambs, and window jambs.
- D. Erect load bearing studs one piece full length. Splicing of studs is not permitted.
- E. Erect load bearing studs, brace, and reinforce to develop full strength, to achieve design requirements.
- F. Fully seat axial loaded studs in receiving tracks maximum 1/16 inch gap between stud and track web).
- G. Install intermediate studs above and below openings to align with wall stud spacing.
- H. Install studs with deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- I. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

- J. Touch-up field welds and damaged metallic coatings surfaces with primer to match shop coating.

3.3 ERECTION OF JOISTS PURLINS

- A. Install framing components.
- B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.
- C. Set purlins parallel and level, with lateral bracing and bridging.
- D. Locate joist end bearing directly over load bearing studs or install load distributing member to top of stud track.
- E. Touch-up field welds and damaged metallic coatings surfaces with primer to match shop coating.

END OF SECTION

SECTION 05501
WROUGHT IRON FENCE

PART 1.01: MATERIALS

- A. **STEEL**: All steel material for the fence and gate system shall conform to the requirements of ASTM A-787 and ASTM A653 with minimum yield strength of 50,000 psi. All components are galvanized inside and out for superior rust protection.
- B. **CAST IRON**: All iron components are made of ductile iron for superior strength (versus standard grey iron) shall be prepared for painting as described under section 09900 Painting Specifications.

PART 1.02 FENCE PANELS

- A. **HORIZONTAL RAILS**: Rail members will be constructed of 1" x 1" x 1/8" (11 gauge) square tubing. Number of rails per-piece will vary by panel style.
- B. **PICKETS**: Material for the pickets will be 1/2" x 1/2" x 18-gauge square tubing.
- C. **PICKET SPACING** Standard pickets will have a 3.875" air gap in-between.
- D. **POSTS**: Posts shall be a minimum of 2" x 2" x 11-gauge square tubing.

PART 1.03 WALK GATES

- A. **FRAME**: All walk gates will match fence panel styles and be framed with 1.5" x 1.5" x 14-gauge square tubing mitered and welded.
- B. **HORIZONTAL RAILS**: Rail members will be constructed of 1" x 1" x 1/8" (11 gauge) square tubing.
- C. **PICKETS**: Material for the pickets will be 1/2" x 1/2" x 18-gauge square tubing.
- D. **PICKET SPACING**: Standard pickets will have a 3.875" air gap in-between.

PART 1.04 DRIVEWAY GATES

- A. **FRAME**: Gates will match fence panel style and be framed with 2" x 2" x 11-gauge square tubing mitered and welded.
- B. **HORIZONTAL RAILS**: Rail members will be constructed of 1" x 1" x 1/8" (11 gauge) square tubing.
- C. **PICKETS**: Material for the pickets will be 1/2" x 1/2" x 18-gauge square tubing.
- D. **PICKET SPACING**: Standard pickets will have a 3.875" air gap in-between.
- E. **POSTS**: Posts shall be a minimum of 4" x 4" x 7-gauge square tubing.

PART 1.05 POSTS AND STANDARD HARDWARE

- A. **STANDARD STEEL POSTS**: All posts used for hanging fence panels and walks gates will be 11 gauge and offered in a 2", 2.5", 3" and 4" square tube size. Lengths include 5', 6', 7', 8', and 9' with availability varying by post diameter.

SECTION 05501
WROUGHT IRON FENCE

- B. **GATE POSTS:** All heavy-duty estate gate posts will be 3/16" thick (7 gauge) and offered in a 4" and 6" square tube size. Available in 8' and 9' lengths.
- C. **POST CAPS:** All post caps are comprised of sand-cast ductile iron. Offered in standard and ball style to match all available post sizes.
- D. **WELD-ON BARREL HINGES:** Used for walk gates and drive gates. Offered in 600lbs. a 5" size (5/8" shank) for walk gates and 1000lbs. 7" size (3/4" shank) for drive gates. Welded to steel posts and frames.

FENCE FABRICATION

PART 2.01 – ASSEMBLY

- A. **RAILS:** All horizontal rails will be cold rolled and punched at approximately 4 1/2" on center to provide an air gap of 3.875".
- B. **PICKET TO RAIL WELDING:** All items will be firmly positioned square in a jig fixture and MIG welded with the use of an inert shielding gas to reduce splatter and insure good penetration. Each picket will be welded on at least two sides at the juncture of every rail. All weld spots are then coated in a zinc rich primer for extra rust protection.
- C. **PICKET SPACING:** Standard pickets will have a 3.875" air gap in-between.
- D. **FINIAL TO PICKET WELDING:** Finials will be placed on top of pickets and then MIG welded on all four sides with the use of an inert shielding gas to reduce splatter and insure good penetration. All welds are then cleaned for appearance and coated in a zinc rich primer for extra rust protection.
- E. **WALK AND DRIVE GATES:** All Gate frames are miter cut in the corners and MIG welded with the use of an inert shielding gas to reduce splatter and insure good penetration. Using gate jigs, the picket and rail components are then MIG welded to the frame. All welds are then cleaned for appearance and coated in a zinc rich primer for extra rust protection.

WROUGHT IRON FENCE FINISHING

PART 3.01 – FINISHING

- A. **CLEANING:** All finished pieces are inspected for weld spatter and wire brushed accordingly. The inspected pieces then go through a 4-stage pretreatment and wash cycle to remove any impurities from handling and the manufacturing process.
- B. Refer to Section 09900 Painting specifications.

END OF SECTION

SECTION 07210
METAL BUILDING ROOF AND WALL INSULATION LINER SYSTEM

PART I - GENERAL

- A. Acceptable Liner System is Skyliner® FP or Skyliner® Insulation System from Bay Insulation Systems, a tested, high-performance insulation system. System achieves performance 2015 Energy Code R value of R-11 + R-19 LS for metal roof building construction and R-19 LS for walls. System is provided complete, from one source (Bay Insulation Systems) and includes banding, clips, adhesive, fasteners, fabric, insulation, layout drawings and installation manual. Skyliner® FP System meets OSHA duty to have fall protection standard 29 CFR – 1926.501. This system also conforms to and complies with testing protocol for CFR 1926.501 (b)(4); CFR 1926.502(4)(1) CFR 1926.502 (i)(2); and CFR 1926.502.
- B. NAIMA 202-96(R) (Rev 2000) certified fiberglass insulation will fill purlin cavity (or wall cavity) and consist of 1- non-faced layer of R-19 between purlins and second layer over purlins of R-13. Nominal 1" x 3" extruded polystyrene thermal blocks will be applied to the top of the purlins for double layer applications (minimum R value 3.0). Thermal break tape will be applied to top of purlin (roof) or outside of girts -(walls) for single-layer applications. (Sky Hook™ (82 pcs/box) or Insul Hold HD (coils) required for walls.) Fabric will be 1 bay in width and attach underneath the purlin (inside girt), secured by a banding grid. Safety banding (roof) will be installed parallel to each frame and 16" from the frame, secured by safety clips. The installed roof or wall system provides a continuous vapor retarder.

PART II PRODUCTS – SYSTEM COMPONENTS

A. FABRIC

- a. Bright White Material, Sky Blue Backing – light reflectance value – 84
- b. Fabric Description: Woven, HPDE Scrim premium, low-permeance vapor retarder for thermal insulation. Coated both sides (1.2 mil average) bright white or colored polyethylene film.
 1. Fabric supplied in full bay widths and custom lengths – Produced to fit large building areas with minimum field seaming required.
 2. Can be supplied perforated.
- c. Shipped folded and rolled onto a core for quick deployment on support grid.
 1. Core ID 3" (76.2mm) or 4" (101.6mm)
- d. Vapor retardant – .02 perm rating
- e. Chemical resistance
 1. HDPE – excellent chemical resistance. It is not attacked by strong acids or strong bases and is resistant to gentle oxidants and reducing agents.
 2. HDPE with coating has excellent chemical resistance, superior strength, and long-term durability.
- f. Tear Strength Warp 35 lb, 222 n/weft 45 lb 200 n (ASTM D2261-96)
- g. Tensile (Strip) Strength Warp 100 lb/in (877) weft 90 lb/in (799) (ASTM D5034-95)
- h. Tensile (grab) warp 136 lb 605 n/ weft 126 lb 559 n
- i. Mullen burst 245 psi 1690 kPa (ASTM D3786-01)
- j. Accelerated UV Weathering – >50% strength retention after 2000 hrs; exposure @ .77W/m²/nm, or 1200 hrs exposure @ 1.35 W/m²/nm
- k. Thermal Stability – 20°F No cracks or delamination; 15°F No cracks or delamination. Weight 3.2 oz/yd² (108g/m²) +/- 10%
- l. Flame Spread – 0; Smoke Developed: 28 UL 723 (ASTM E-84)
- m. Fungi Resistance – No Growth (ATCC#’s 9642, 6205, 11797, 11730, and 9643)
- n. Weight – 4.3 oz/yd² (149g/m²) +/- 5%

SECTION 07210

METAL BUILDING ROOF AND WALL INSULATION LINER SYSTEM

- o. Thickness – Nominal 9 mil (0.22mm)
- p. Sound Absorption – NRC= .70

B. FALL PROTECTION

- a. OSHA 29 CFR 1926.502C4i – Standard for leading-edge fall protection. The Drop test shall consist of a 400 lb (180 kg) bag of sand 30 + or - 2" (76 + or - 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42" (1.1 m) above that level.
- b. OSHA 1926.501 – Duty to have Fall Protection
- c. OSHA 1926.501 (b)(4) – Holes
- d. OSHA 1926.502(i)(2) All other covers shall be capable of supporting, without failure, at least twice the weight of employees , equipment and materials that may be imposed on the cover at any one time.
- e. OSHA 1926.502 – fall protection criteria and practices
- f. 40 CFR 1926.754(e)(i) – covering roof and floor openings

C. BANDING

- a. 1" x .023 continuous length white metal banding

D. FASTENERS & CLIPS

- a. Safety Clip System includes exclusive offset clip + fastener + banding – 16" either side of each frame.
(Required for fall protection installation.)
- b. Tek 2 and Tek 4.5 (supplied with system)

E. ADHESIVE

- a. Skyliner 514 Macroplast brush or spray adhesive (Avetone; Heptone)
- b. Skyliner double faced tape

F. INSULATION

Meets Standard NAIMA 202-96 (R) (Rev 2000) certified flexible fiberglass insulation for use in metal buildings.
(Installed in One or Two Layers.)

G. SYSTEM STANDARDS

- a. ASTM C991 – Standard for flexible fibrous glass insulation for metal buildings.
- b. ASTM C 1136 – Standard specification for flexible, low permeance vapor retarders for thermal insulation.
- c. ASTM E 84 – Standard for surface burning characteristics of building materials.
- d. ASTM E 96 – Standard test method for water vapor transmission of materials in sheet form.
- e. ASTM E 2178-13 -- Standard test method for air permeance of metal buildings.
- f. NAIMA 202-96(R) (Rev 2000) –Standard for flexible fiberglass insulation for use in metal buildings.
- g. NFPA 255 – Standard method of test for surface burning characteristics of building materials.

SECTION 07210
METAL BUILDING ROOF AND WALL INSULATION LINER SYSTEM

H. MANUFACTURER WILL PROVIDE

- a. Install Manual
- b. Certification Sheets
- c. Fabric Shop Drawings
- d. Product Warranty

I. ACCEPTABLE MANUFACTURERS

- a. Bay Insulation Systems
- b. Owens Corning
- c. CertainTeed
- d. Knauf Insulation
- e. Johns Manville

J. WARRANTIES

- a. Fabric – limited 10-year material
- b. Insulation – 1-year material
- c. System – limited 10-year material

PART III – INSTALLATIONMANUALS PROVIDED

- A. New Buildings Fall Protection (FP)
- B. Existing Buildings
- C. Walls
- D. Specialty Buildings – Ice Arenas, etc.

END OF SECTION

SECTION 07413
METAL ROOF & WALL PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Exposed fastener metal roof panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

- A. Division 07 Section ["Thermal Insulation"] ["Roof Insulation"] for thermal insulation installed under metal panels.
- B. Division 07 Section "Metal Roof & Wall Panels" for factory-formed metal roof & wall panels.
- C. Division 07 Section "[Joint Sealants](#)" for field-applied [Joint Sealants](#).
- D. Division 13 Metal Building Systems.

1.3 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:
 - 1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
 - 2. AAMA 809.2 - Voluntary Specification Non-Drying Sealants.
- B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM): www.astm.org:
 - 1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 3. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. ASTM C 645 - Specification for Nonstructural Steel Framing Members.
 - 5. ASTM C 754 - Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - 6. ASTM C 920 - Specification for Elastomeric [Joint Sealants](#).
 - 7. ASTM D 1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
 - 8. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 - 9. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
 - 10. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
 - 11. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
 - 12. ASTM E 1980 - Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

D. **FM Global (FM):** www.fmglobal.com:

1. ANSI/FM 4471 - Approval Standard for Class 1 Panel Roofs.

E. **International Accreditation Service (IAS):**

1. IAS AC 472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, Part B.

F. **Underwriters Laboratories, Inc. (UL):** www.ul.com:

1. UL 580 - Tests for Uplift Resistance of Roof Assemblies

G. **US Environmental Protection Agency:** www.energystar.gov/index.cfm:

1. Energy Star Reflective Roof Products.

1.4 **ADMINISTRATIVE REQUIREMENTS**

A. **Preinstallation Meeting:** Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.
3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.5 **QUALITY ASSURANCE**

A. **Manufacturer/Source:** Provide metal roof panel assembly and accessories from a single manufacturer providing fixed-base roll forming, and accredited under IAS AC 472 Part B.

B. **Manufacturer Qualifications:** Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.

1. **Approval of Comparable Products:** Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements.
 - b. Samples of each component.
 - c. Sample submittal from similar project.
 - d. Project references: Minimum of five installations not less than five years old, with Owner and Architect contact information.
 - e. Sample warranty.
 - f. IAS AC 472 certificate.
2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
3. Approved manufacturers must meet separate requirements of Submittals Article.

C. **Installer Qualifications:** Experienced Installer with minimum of five years experience with successfully completed projects of a similar nature and scope.

SECTION 07413
METAL ROOF & WALL PANELS

1. Installer's Field Supervisor: Experienced mechanic, able to communicate with Owner, Architect, and installers, supervising work on site whenever work is underway.

D. **Buy American Compliance:** Materials provided under work of this Section shall comply with the following requirements:

1. Buy American Act of 1933 BAA-41 U.S.C §§ 10a – 10d.
2. Buy American provisions of Section 1605 of the American Recovery and Reinvestment Act of 2009 (ARRA).

1.6 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products.
- B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, roof accessories, lightning arresting equipment, and special details. Make distinctions between factory and field assembled work.
 1. Indicate points of supporting structure that must coordinate with metal panel system installation.
 2. Include data indicating compliance with performance requirements.
 3. Include structural data indicating compliance with requirements of authorities having jurisdiction.
- C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification: Provide 12-inch- (305 mm-) long section of each metal panel profile. Provide color chip verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicating compliance of products with requirements, witnessed by a professional engineer.
- B. Qualification Information: For Installer firm and Installer's field supervisor.
- C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC 472.
- D. **Buy American Certification:** Manufacturers' letters of compliance acceptable to authorities having jurisdiction, indicating that products comply with requirements.
- E. Manufacturer's Warranty: Sample copy of manufacturer's standard warranty.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's Warranty: Executed copy of manufacturer's standard warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.

SECTION 07413
METAL ROOF & WALL PANELS

1. Deliver, unload, store, and erect metal panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
2. Store in accordance with Manufacturer's written instructions. Provide wood collars for stacking and handling in the field.

1.10 COORDINATION

- A. Coordinate sizes, profiles, and locations of roof curbs and other roof-mounted equipment and roof penetrations, based upon sizes of actual selected equipment.

1.11 WARRANTY

- A. Special Weathertightness Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail to remain weathertight, including leaks, [without monetary limitation] [up to cost limitation of seven dollars (\$7.00) per square foot of covered area] [up to cost limitation of fourteen dollars (\$14.00) per square foot of covered area] within [5] years from date of Substantial Completion.
- B. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within [25] years from date of Substantial Completion, including:
- C. Roofing Contractor Warranty: Roofing contractor shall provide a 2-year materials and labor warranty from date of Substantial Completion.

1. **Fluoropolymer Two-Coat System:**

- a. Color fading in excess of [5] [10] Hunter units per ASTM D 2244.
- b. Chalking in excess of No. [8] [6] rating per ASTM D 4214.
- c. Failure of adhesion, peeling, checking, or cracking.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: **MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.;** Houston TX. Tel: (877)713-6224; Email: info@mbci.com; Web: www.mbci.com.

1. Provide basis of design product, or comparable product approved by Architect prior to bid.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide metal roof panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.
- B. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.
- C. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated:

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1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of [1/120] [1/180] [1/240] of the span with no evidence of failure.

D. **Wind Uplift Resistance:** Comply with UL 580 for wind-uplift class [UL-90].

E. **FM Approvals Listing:** Comply with FM Approvals 4471 as part of a panel roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 construction. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: [Class 1A-90] .
2. Hail Resistance Rating: 1-SH.

F. **Air Infiltration:** ASTM E 1680: Maximum [0.006 cfm/sq. ft. (0.030 L/s per sq. m) at 6.24 lbf/sq. ft. (300 Pa)] static-air-pressure difference.

G. **Water Penetration:** ASTM E 1646: No uncontrolled water penetration at a static pressure of 20 lbf/sq. ft. (958 Pa).

2.3 METAL PANEL MATERIALS

A. **Aluminum-Zinc Alloy-Coated Steel Sheet:** ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A 755/A 755M.

B. **Aluminum-Zinc Alloy-Coated Steel Sheet:** ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ55 (Grade 340, Coating Class AZM165) unpainted Galvalume Plus coating.

2.4 METAL ROOF & WALL PANELS

A. Mechanically Seamed, Concealed Fastener, Trapezoidal Seam Metal Roof Panels: Structural metal roof panel consisting of formed metal sheet with raised trapezoidal ribs at panel edges, installed by lapping and mechanically interconnecting edges of adjacent panels, and attaching panels to supports using concealed clips and fasteners in a weathertight installation.

1. **Basis of Design:** MBCI, Double-Lok Roof Panel, www.mbc.com/pbr.html.
2. **Coverage Width:** 36 inches (914 mm).
3. **Major Rib Spacing:** 24 inches (610 mm) on center.
4. **Panel Seam Height:** 3 inches (76 mm).
5. **Nominal Coated Thickness:** [0.028 inch/24 gage 0.71 mm]
6. **Joint Type:** Double folded
7. **Panel Surface:** [Smooth with minor ribs in pan]
8. **Exterior Finish:** Unpainted exposed Galvalume Plus Coating.
9. **Light Transmitting Roof Panels:** Manufacturer's standard UV-resistant translucent panel, 24 inch (610 mm) wide, white, with haze value of not less than 90 percent when measured per ASTM D 1003.

B. **Large Tapered-Rib-Profile, Exposed Fastener Metal Wall Panels:** Structural metal roof panel consisting of formed metal sheet with trapezoidal major ribs with intermediate stiffening ribs symmetrically placed between major ribs, installed by lapping edges of adjacent panels

1. **Basis of Design:** MBCI, PBR Wall Panel, www.mbc.com/pbr.html.
2. **Coverage Width:** 36 inches (914 mm).

3. **Major Rib Spacing: 12 inches (305 mm) on center.**
4. **Rib Height: 1-1/4 inch (31.8 mm).**
5. **Nominal Coated Thickness: [0.028 inch/24 gage 0.71 mm]**
6. **Panel Surface: [Smooth]**
7. **Exterior Finish: MBCI Signature 300.**

2.5 METAL ROOF PANEL FLASHING, TRIMS & ACCESSORIES

- A. General: Provide complete metal roof panel assembly incorporating ridge, eave, rake, valley, and parapet trims, copings, fascias, gutters and downspouts, and miscellaneous flashings, in [manufacturer's standard profiles] [profiles as indicated]. Provide required fasteners, closure strips, support plates, and sealants as indicated in manufacturer's written instructions. Colors shall be with MBCI Signature 300 colors as selected by architect.
- B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.
- C. Accessories:
 1. Pipe flashing.
 2. Roof curbs.
 3. Roof Vents.
 4. Source: By metal building system manufacturer.
 5. Type: 12 inches x 10 feet (305 mm x 3.05 m) ridge gravity. Include operable dampers.
 5. Finish: Unpainted Galvalume®
- D. Two Piece Floating Clips: ASTM C 645, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.
- E. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by roof panel manufacturer.
 1. Exposed Fasteners: Long life fasteners with EPDM or neoprene gaskets, with heads matching color of metal panels by means of factory-applied coating.
- F. Joint Sealers: Manufacturer's standard or recommended liquid and preformed sealers and tapes, and as follows:
 1. Tape Sealers: Manufacturer's standard non-curing butyl tape, AAMA 809.2.
 2. Exposed Joint Sealants: Urethane, single component, ASTM C 920.
- G. **Steel Sheet Miscellaneous Framing Components:** ASTM C 645, with ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized zinc coating.
- H. **Roof Accessories:** Approved by metal roof panel manufacturer, for requirements for mechanical curbs, equipment supports, roof hatches, heat and smoke vents, ventilators, and preformed flashing sleeves, roof jacks.

2.6 FABRICATION

- A. General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Panel Lengths: Form panels in continuous lengths for full length of detailed runs, except where otherwise indicated on approved shop drawings.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings. Form from materials matching metal panel substrate and finish.

2.7 FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Metal roof accessories noted on part 2.5 shall be colored with MBCI Signature 300 colors as selected by architect.
- B. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621[[meeting solar reflectance index requirements](#)].
 - 1. Basis of Design: MBCI, Signature 300.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine metal panel system substrate and supports with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panel installation.
 - 1. Inspect metal panel support substrate to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable supports at recommended spacing to match installation requirements of metal panels.
 - 2. Panel Support Tolerances: Confirm that panel supports are within tolerances acceptable to metal panel system manufacturer but not greater than the following:
 - a. 1/4 inch (6 mm) in 20 foot (6.1 m) in any direction.
 - b. 3/8 inch (9 mm) over any single roof plane.
- B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with metal roof panel system installation.

3.2 PREPARATION

- A. **Miscellaneous Supports:** Install sub-framing, girts, furring, and other miscellaneous panel support members according to ASTM C 754 and manufacturer's written instructions.
- B. Flashings: Install flashings to be installed as part of this trade.

3.3 METAL PANEL INSTALLATION

- A. Exposed Fastener Metal Roof Panels: Install weathertight metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal roof panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and

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distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.

- B. Panel Sealants: Install manufacturer's recommended tape sealant at panel sidelaps and endlaps.
- C. Panel Fastening: Attach panels to supports using screws, fasteners, and sealants recommended by manufacturer and indicated on approved shop drawings.
 - 1. Fasten metal panels to supports at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.
 - 2. Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.
 - 3. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

3.4 ACCESSORY INSTALLATION

- A. General: Install metal panel trim, flashing, and accessories using recommended fasteners and joint sealers, with positive anchorage to building, and with weather tight mounting. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
 - 2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
 - 3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.
- B. Joint Sealers: Install joint sealers where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions.
 - 1. Prepare joints and apply sealants per requirements of Division 07 Section "[Joint Sealants](#)."
- C. Remove temporary protective films immediately in accordance with metal roof panel manufacturer's instructions. Clean finished surfaces as recommended by metal roof panel manufacturer.
- D. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07920
JOINT SEALERS FOR METAL WALL PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Polyurethane Sealants B.
- Tape Mastic Sealants C.
- Non-skinning Sealants D.
- Silicone Sealants
- E. Acrylic Sealants

1.2 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA)
 - 1. AAMA 800-10 - Voluntary Specifications and Test Methods for Sealants
- B. ASTM International (ASTM)
 - 1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 792 - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 3. ASTM C 639 - Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
 - 4. ASTM C 661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
 - 5. ASTM C 681 - Standard Test Method for Volatility of Oil- and Resin-Based, Knife-Grade, Channel Glazing Compounds
 - 6. ASTM C 711 - Standard Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants
 - 7. ASTM C 794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
 - 8. ASTM C 908 - Standard Test Method for Yield Strength of Preformed Tape Sealants
 - 9. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants
 - 10. ASTM D 56 - Standard Test Method for Flash Point by Tag Closed Cup Tester
 - 11. ASTM D 217 - Standard Test Methods for Cone Penetration of Lubricating Grease
 - 12. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
 - 13. ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
 - 14. ASTM D 925 - Standard Test Methods for Rubber Property—Staining of Surfaces (Contact, Migration, and Diffusion)
 - 15. ASTM D 2452 - Standard Test Method for Extrudability of Oil- and Resin-Base Caulking Compounds
 - 16. ASTM D 2453 - Standard Test Method for Shrinkage and Tenacity of Oil- and Resin- Base Caulking Compounds
 - 17. ASTM D 1475 - Standard Test Method For Density of Liquid Coatings, Inks, and Related Products
 - 18. ASTM D 2202 - Standard Test Method for Slump of Sealants
 - 19. ASTM D 2203 - Standard Test Method for Staining from Sealants

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- 20. ASTM G 154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
- C. Interim Federal Specifications (FS)
 - 1. FS TT-S-00230C - Sealing Compound: Elastomeric Type, Single Component
 - 2. FS TT-C-1796A – Caulking Compounds, Metal Seam and Wood Seam
 - 3. FS TT-S-001543A – Sealing Compounds: Silicone Rubber Base (For Caulking, Sealing, and Glazing in Buildings and Other Structures)
- D. South Coast Air Quality Management District (SCAQMD)
 - 1. Rule 1168 – Adhesive and Sealant Applications
- E. Underwriter’s Laboratories
 - 1. UL 580 - Tests for Uplift Resistance of Roof Assemblies

1.3 SUBMITTALS

- A. Material Safety Data Sheets (MSDS): Provide in accordance with 29 CFR 1910.1200, Hazard Communication
- B. Product Test Reports: Reports of tests required by this section performed by a qualified testing agency, indicating that the sealants comply with the requirements.
- C. Buy American Compliance: Provide documentation that the products provided in this section comply with the following requirements:
 - 1. Buy American provisions of Section 1605 of the American Recovery and Reinvestment Act of 2009 (ARRA).
- D. VOC Content: Provide documentation of the Volatile Organic Content (VOC) in accordance with SCAQMD Rule 1168
- E. USDA Approval: Provide documentation that the product is approved for use in meat and poultry processing areas by the USDA for the following types of sealants:
 - 1. Polyurethane
 - 2. Tape Mastic
 - 3. Non-skinning Sealant

1.4 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within 5 years of installation.

PART 2 - PRODUCTS

2.1 GENERAL MATERIAL REQUIREMENTS

- A. Substrate Requirements: When testing is required on a substrate, the material used shall be either ASTM A653 G-90 or ASTM A792 AZ50 and tests shall be conducted with each of the following coatings:
 - 1. Bare (No coating)

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2. Acrylic (Galvalume Plus)
3. Polyester
4. Siliconized Polyester
5. Polyvinylidene Fluoride Resin (PVDF)

2.2 POLYURETHANE SEALANT

- A. General: Provide Sealants that meet the following specifications:
1. ASTM C 920, Type S, Grade NS, Class 25, Use: NT, A, M, G and O paintable sealant
 2. AAMA 808.3
 3. FS TT-S-00230C, Type II, Class A
- B. Color: The sealant shall be in the following colors:
1. White
 2. Gray
 3. Bronze
 4. Almond
- C. Physical Properties: The sealant shall have the following additional physical properties:
1. Peel Adhesion: All panels shall have at least a 90% cohesive failure of at least 15 lb/in when tested in accordance with ASTM C 794.
 2. Tensile Strength: Sealant shall have a tensile maximum of 300 psi and an elongation of 500-600% when tested in accordance with ASTM D 412.
 3. Sag: There shall be no sag when tested in accordance with ASTM C 639.
 4. Hardness: Shore "A" hardness on all three samples shall not exceed 40 when tested in accordance with ASTM C 661
 5. Service Temperature Range: -40 degrees Fahrenheit to 200 degrees Fahrenheit.
 6. Water Resistance: There shall be no presence of voids, cracks, separation or breakdown of the compound when tested in accordance with AAMA 800-10, Section 2.11.1.
 7. Flash Point: No less than 145 degrees Fahrenheit when tested in accordance with ASTM D 56.
 8. Shelf Life: The compound shall have a shelf life of 9 months or more when stored at or below 80 degrees.
 9. Skin Time: The compound shall have a skin time of 2-4 hours
 10. Cure Time: The compound shall have a cure time of 24-48 hours
 11. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

2.3 TAPE MASTIC SEALANT

- A. General: Provide Sealants that meet the following specifications:
1. AAMA 804.3
 2. AAMA 807.3
 3. FS TT-C-1796A, Type II, Class B
 4. Approved by Underwriters Laboratories for use in roof deck constructions classified under UL-518 Class 90
- B. Color: Gray
- C. Physical Properties: The sealant shall have the following additional physical properties:
1. Specific Gravity: 1.4 or higher when tested in accordance with ASTM D 792

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2. Tensile Adhesive Strength: 20 psi or higher when tested in accordance with ASTM C 908
3. Elongation: 1000% or higher when tested in accordance with ASTM C 908
4. Cone Penetration: The sealant shall meet the following conditions when tested in accordance with ASTM D 217 with a 300g cone in 5 seconds:
 - a. 8.5 – 100 mm at 77 degrees Fahrenheit
 - b. 125-135 mm at 120 degrees Fahrenheit
 - c. 45-55 mm at Zero degrees Fahrenheit
5. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

2.4 NON-SKINNING SEALANT

A. General: Provide sealants that meet the following specifications:

1. AAMA 809.2
2. FS TT-C-1796A, Type 1, Class A B.

Color: White

C. Physical Properties: The sealant shall have the following additional physical properties:

1. Extrudability: The sealant shall deposit in 30 to 50 seconds through a 0.104" orifice at 50 psi pressure in accordance with ASTM D 2452
2. Total Solids: At least 85% by weight when determined in accordance with ASTM C 681
3. Volume Shrinkage: Less than 15% when determined in accordance with ASTM D 2453
4. Weight per U.S. Gallon: 10.75 lbs. +/- 0.25 lbs. when determined in accordance with ASTM D 1475
5. Vehicle Bleed out: There shall be no visible exudation of vehicle from sealant after 21 days at 158 degrees Fahrenheit on the test panel
6. Flexibility: There shall be no loss of adhesion at -60 degrees Fahrenheit when tested in accordance with ASTM C 711
7. Sag: 0.20 in max, full button when tested in accordance with ASTM D 2202
8. Staining: Sealant will not stain a painted test panel when tested in accordance with ASTM D 925, Method A
9. UV Resistance: There shall be no cracking, bleeding, or loss of elasticity after 1,000 hours of QUV exposure in accordance with ASTM G 154.
10. Wet Flammability: No less than 110 degree Fahrenheit flash point when determined in accordance with ASTM D 56
11. Coverage: Each gallon of sealant shall provide the following minimum coverage:
 - a. 1,500 lineal feet with 1/8 in bead
 - b. 690 lineal feet with 3/16 in bead
 - c. 390 lineal feet with 1/4 in bead.
12. Shelf Life: 18 months minimum in unopened container when stored at or below 90 degrees Fahrenheit.
13. Drying time: Non-skinning, remains permanently soft and tacky
14. Engageability: Sealant will easily engage and transfer to male joint at 10 degrees Fahrenheit
15. Service Temperature Range: -60 degrees Fahrenheit to 200 degrees Fahrenheit
16. Application Temperature Range: 10 degrees Fahrenheit to 120 degrees Fahrenheit
17. Non-Reactive: Will not darken, etch, or leave salt deposits on the test panel after two years
18. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

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2.5 SILICONE SEALANT

A. General: Provide sealants that meet the following specifications:

1. ASTM C 920, Type S, Grade NS, Class 25
2. AAMA 802.3, Type I and II
3. AAMA 805.2 Group C
4. AAMA 808.3
5. FS TT-S-001543A, Class A
6. FS TT-S-00230C, Class A B.

Color: Clear

C. Physical Properties: The sealant shall have the following additional physical properties:

1. Mechanical Properties: The sealant shall have the following mechanical properties as determined by ASTM D 412:
 - a. Tensile Strength: 150 psi minimum (Method A)
 - b. Modulus at 100% Elongation: 35 psi minimum
 - c. Elongation: 400% minimum
 - d. Recovery: 100%
2. Hardness: Maximum Shore A hardness of 15 when determined in accordance with ASTM C 661
3. Tack-free Time: 1/4 in dia. bead at 77 degrees Fahrenheit, 50% relative humidity, 10-15 minutes
4. Cure Time: 1/4 in dia. bead at 77 degrees Fahrenheit, 50% relative humidity, 10-12 hours
5. Service Temperature: -60 degrees Fahrenheit to 300 degrees Fahrenheit
6. Shelf Life: 9 months when stored in unopened original containers at 80 degrees Fahrenheit or less
7. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

2.6 ACRYLIC SEALANT

A. Color:

1. Clear
2. White
3. Gray

B. Physical Properties:

1. Percent Solids:
 - a. Colors: 75% minimum determined in accordance with ASTM D 1475
 - b. Clear: 70% minimum determined in accordance with ASTM D 1475
2. Peel Adhesion: All panels shall have at least a 90% cohesive failure of at least 5 lb./in when tested in accordance with ASTM C 794
3. Weight per U.S. Gallon: 8.7 lbs. +/- 0.25 lbs. when determined in accordance with ASTM D 1475
4. Viscosity: The sealant shall meet the following conditions when tested in accordance with ASTM D 2452 with a 20g cone with a 0.104 in orifice at 60 psi at 77 degrees Fahrenheit in the indicated time:
 - a. Colors: 40-60 seconds
 - b. Clear: 35-45 seconds
5. Elongation: 200% minimum when tested in accordance with ASTM D 412

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6. Hardness: Maximum Shore A hardness of 55 when determined in accordance with ASTM C 661
7. Flash Point: No less than the following when tested in accordance with ASTM D 56 a.
 - Colors: 52 degrees Fahrenheit
 - b. Clear: 40 degrees Fahrenheit
8. Slump: 0.10" maximum when tested in accordance with ASTM D 2202
9. Vehicle Migration: No vehicle migration from the sealant edge when tested in accordance with ASTM D 2203 as modified by Section 2.8.1 of AAMA 800-10
10. Paintability: Compatible with Alkyds, enamels and lacquers post-solvent release
11. Service Temperature Range: Zero degrees Fahrenheit to 180 degrees Fahrenheit
12. Shelf Life: 18 months when stored in original, unopened containers at or below 80 degrees Fahrenheit

PART 3 – EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 1. Remove laitance and form-release agents from concrete.
 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

- D. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- E. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- F. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- G. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- H. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

END OF SECTION

SECTION 07951

CAULKING

PART 1: GENERAL:

1.01 DESCRIPTION:

- A. **WORK INCLUDED:** Throughout the project, caulk and seal all joints where shown on the Drawings and elsewhere as required to provide a positive barrier against passage of air and passage of moisture.

1.02 QUALITY ASSURANCE:

- A. **Qualifications of Installers:**
1. Proper caulking and proper installation of sealants require that installer be thoroughly trained and experienced in the necessary skills and thoroughly familiar with the specified requirements.
 2. For caulking and installation of sealants throughout the work, use only personnel who have been specifically trained in such procedures and who are completely familiar with the joint details shown on the Drawings and the installation requirements called for in this Section.

1.03 SUBMITTALS:

- A. **General:** Comply with provisions of Section 01300.
- B. **Manufacturer's Data:** Submit:
1. A complete materials list showing all items proposed to be furnished and installed under this Section.
 2. Sufficient data to demonstrate that all such materials meet or exceed the specified requirements.
- C. **Samples:** Accompanying the submittal required in Paragraph "B" submit samples of each sealant, each backing material, each primer, and each bond breaker proposed to be used.

1.04 PRODUCT HANDLING:

- A. **Delivery and Storage:** Deliver all materials of this Section to the jobsite in the original unopened containers with all labels intact and legible at time of use. Store only under conditions recommended by the manufacturers. Do not retain on the jobsite any material which has exceeded the shelf life recommended by its manufacturer.
- B. **Protection:** Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.
- C. **Replacements:** In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2: PRODUCTS:

2.01 CAULKING:

- A. **General:** Except as otherwise approved by the Architect, in writing, use only the type of caulking described in this Article.

B. Caulking Materials:

1. Around Fixed Glass "Storefront" Aluminum Frames use silicone based caulking in color matching the aluminum. This caulking furnished and installed by "storefront" aluminum installer.
2. Around Windows: (if any) Use DAP Acrylic Latex Caulk with Silicone, in color to match window color or approved equal.
3. Around Exterior Door Frames: Use DAP Acrylic Latex Caulk with silicone in "Clear" color or approved equal.
4. Miscellaneous Exterior Connections Between Dissimilar Materials: Use DAP Acrylic Latex Caulk with silicone in "Clear" color unless another standard color of the manufacturer would be more suitable.
5. Exterior Masonry Control Joints: Use Dow Corning 790 sealant or approved equal. Prime where required by manufacturer. Provide foam backer rod approved for use by sealant manufacturer.
6. Interior Caulking: Use DAP Acrylic Latex Caulk with silicone or approved equal. Color as selected from manufacturer's standard colors.
7. Caulking Joints Not Otherwise Specified: Use DAP Acrylic Latex Caulk with silicone or approved equal.
8. FIRE RATED WALLS AND NON-FIRE RATED WALLS: Top-of-walls, shall be sealed on both sides of wall with fire rated sealants: CP606, CP 672 firestop spray, Firestop joint Spray CFS-SP WB with respective UL No. as recommended by Hilti Company.
9. Fire rated wall penetrations shall be: FS-one intumescent fire stop sealant with respective UL No. recommended by Hilti Company.
10. Smoke and acoustical walls sealant shall be: CP506 Sealant, CP 572 Spray by Hilti.
11. Exterior/Interior of Masonry Walls Dow Corning 790 silicone sealant.

C. Prime:

1. In accordance with sealant manufacturer recommendations.

PART 3: EXECUTION:

3.01 INSPECTION:

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until satisfactory conditions have been corrected.

3.02 PREPARATION:

A. All Surfaces:

1. All surfaces in contact with caulking shall be dry, sound, and well brushed and wiped free from dust, and oil or grease.
2. Use solvent, where necessary, to remove oil and grease, wiping the surfaces with clean rags.
3. Remove all mortar from the joint cavity.
4. Where backstop is required, insert the approved backup material in the joint cavity to the depth required.

3.03 INSTALLATION OF SEALANTS:

- A. General: Prior to start of installation in each joint, verify the joint type, and verify that the required proportion of width of joint to depth of joint has been secured.

SECTION 07951
CAULKING

- B. Equipment: Apply sealant under pressure with hand or power-actuated gun or other appropriate means. Guns shall have nozzle of proper size and shall provide sufficient pressure to completely fill joints as designed.
- C. Masking: Thoroughly and completely mask all joints where the appearance of sealant on adjacent surfaces would be objectionable.
- D. Installation of Sealant: Install the sealant in strict accordance with the manufacturer's recommendations thoroughly filling all joints to the recommended depth.
- E. Tooling: Tool all joints to the profile recommended by the caulking manufacturer or as shown by details in the Drawings.
- F. Cleaning Up:
 - 1. Remove masking tape immediately after joints have been tooled.
 - 2. Clean adjacent surfaces free from sealant as the installation progresses. Use solvent or cleaning agent as recommended by the sealant manufacturer.

END OF SECTION

SECTION 08360
SECTIONAL OVERHEAD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel Sectional Overhead Doors.
- B. Operating Hardware, tracks, and support.

1.2 RELATED SECTIONS

- A. Division 4 - Unit Masonry Assemblies: Prepared opening in masonry. Execution requirements for placement of anchors in masonry wall construction.
- B. Division 5 - Metal Fabrications: Steel frame and supports.
- C. Division 6 - Wood Blocking and Curbing: Rough wood framing and blocking for door opening.
- D. Division 7 - Joint Sealers: Perimeter sealant and backup materials.
- E. Division 8 - Door Hardware: Cylinder locks.
- F. Division 9 - Paints and Coatings: Field painting.

1.3 REFERENCES

- A. ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.
 - 1. Design pressure refer to structural engineering drawings.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- 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. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Operation and Maintenance Data.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened labeled packaging until ready for installation.
- B. Protect materials from exposure to moisture until ready for installation.
- C. Store materials in a dry, ventilated weathertight location.

1.8 PROJECT CONDITIONS

- A. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: sales@overheaddoor.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01631.

2.2 SECTIONAL STEEL OVERHEAD DOORS

- A. Sectional Overhead Steel Doors: 430 Series Steel Doors by Overhead Door Corporation. Units shall have the following characteristics:
 - 1. Door Assembly: Steel door assembly with rabbeted meeting rails to form weathertight joints and provide full-width interlocking structural rigidity.
 - a. Panel Thickness: 2 inches (51 mm).
 - b. Exterior Surface: Ribbed.
 - c. Section Material: Nominal 24 gauge, galvanized steel.
 - d. Center and End Stiles: 16 gauge steel.
 - e. Springs:
 - 1) 10,000 cycles.
 - f. Full Glazed Aluminum Sash Panels:
 - 1) 1/8 inch (3 mm) double strength glass.
 - 2. Finish and Color: Two coat baked-on polyester, color selected by Architect.
 - 3. Windload Design: Provide to meet the Design/Performance requirements specified under structural engineering drawings.
 - 4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
 - 5. Lock:
 - a. Interior mounted slide lock.
 - b. Locking mechanism designed to maintain security for exterior while permitting break out when impacted from the inside.
 - 6. Weatherstripping:
 - a. Flexible bulb-type strip at bottom section.
 - b. Flexible Jamb seals.
 - c. Flexible Header seal.
 - 7. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
 - 8. Manual Operation: Chain hoist.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until openings have been properly prepared.
- B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- C. Verify electric power is available and of correct characteristics.
- D. If 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.

3.3 INSTALLATION

- A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.
- B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- C. Anchor assembly to wall construction and building framing without distortion or stress.
- D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- E. Fit and align door assembly including hardware.

3.4 CLEANING AND ADJUSTING

- A. Adjust door assembly to smooth operation and in full contact with weatherstripping.
- B. Clean doors, frames and glass.
- C. Remove temporary labels and visible markings.

3.5 PROTECTION

- A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.
- B. Protect installed products until completion of project.
- C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION

SECTION 09900
PAINTING

PART 1: GENERAL

1.01 SCOPE

- A. Perform all work required to complete the Finish Painting indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.
- B. The requirements of Division O - "Bidding and Contract Requirements" and Division 1 - "General Requirements" of this Project Manual shall apply to all work required for this section.
- C. Paint to completion of all exposed surfaces throughout the Project, both interior and exterior with the exception of the following:
 - 1. Surfaces which are delivered to the job site with a factory finish, unless indicated to be painted.
 - 2. Nonferrous metals.
 - 3. Integral color Concrete, Stucco or Cementitious Coatings.
 - 4. Exposed concrete floors.
 - 5. Face brick.

1.02 SUBMITTALS

- A. Detailed Painting Schedule
 - 1. Furnish a "Detailed Painting Schedule" for approval by the Architect. Indicate type of surface, type of paint material, and number of coats required, as set forth in the "Painting Requirements" hereinafter specified.
 - 2. Submit brand designation and grade of the indicated type produced by the approved manufacturer for each application listed or required.
 - 3. Submit product analyses and performance characteristics for all paint materials as requested by the Architect.
 - 4. Submit approval of the "Detailed Painting Schedule" before delivering material to the job site.
 - 5. No claim by the Painting Contractor as to the unsuitability or unavailability of any material specified or his unwillingness to use same or his inability to produce first-class work with same will be entertained, unless such claims are made in writing and submitted with his bid.
 - 6. The Architect will check the "Detailed Painting Schedule" and if any painting material listed therein does not represent, in the opinion of the Architect, such highest quality of the manufacturer, the Architect may direct its replacement with an acceptable painting material at no additional cost to the Owner.
 - 7. Owners maintenance manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product date pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
- B. Samples
 - 1. Submit duplicate samples of each type paint finish proposed for use.
 - 2. Samples shall be 3"x6" on suitable materials and shall be as true a representation of finished work as is practicable.
 - 3. Label each sample and show various stages of finish on each sample.

1.03 PRODUCT HANDLING

- A. Delivery
 - 1. Deliver material to job site in original, unopened containers and packages bearing manufacturers name, type of paint, stock number and color.
 - 2. Deliver all paints ready-mixed unless otherwise directed by the Architect.
- B. Storage
 - 1. Keep storage area neat, clean and adequately protected from paint spillage. Repair damage caused to surfaces within storage areas.
 - 2. Dispose of all cloths and cotton waste which might constitute a fire hazard at the end of each work day.

1.04 ENVIRONMENTAL CONDITIONS

- A. Do not apply paint or varnish under conditions that could adversely affect drying of final finish. Apply all materials under adequate illumination and ventilation.
- B. Do not apply paint or varnish when temperature is less than 50 deg. F. or more than 90 deg. F., or when excess humidity is present.

1.05 PROTECTION

- A. Protect or remove hardware, escutcheons, fixtures, plates, covers, and other items subject to damage or discoloration from painting.
- B. Carefully and adequately protect, as required, all surfaces not requiring painting in areas where painting is being carried on. Use tarpaulins or other suitable covers, with supports, if needed, to protect adjacent or underlying surfaces
- C. Maintain all wrappings or other factory-applied protection furnished with finishing hardware or other items provided by other trades and installed in areas where painting is required. If wrappings are displaced or removed, protect surfaces for the duration of painting work.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Material manufactured by The Sherwin Williams Company is the acceptable standard of quality. Coating systems from other listed manufacturers shall match the systems specified provided it complies with the Contract Documents.
 - 1. PAINT:
 - Sherwin-Williams Company
 - Pratt and Lambert, Inc.
 - PPG Paints
 - Benjamin Moore

2.02 MATERIALS

- A. PREPARED PAINTS AND COATINGS: All by the same manufacturer, unless otherwise specified.
- B. TINTING COLORS: By manufacturer of Prepared Paint.
- C. SPACKLING COMPOUND: Finely ground, grit-free when dry will set with no shrinkage to a smooth, hard, white surface and will sand properly and receive any finish.
- D. PATCHING PLASTER: White, nonshrinking, containing no lime and uniform in set and quality.
- E. TAPE AND BED MATERIALS:
 - 1. JOINT TAPE: USF Perf-A-Tape
 - 2. EMBEDDING AND FINISHING COMPOUND: USG Ready-Mixed Joint Compound All Purpose.
- F. PRIMERS:
 - 1. FERROUS METAL PRIMER: Sherwin Williams Pro-Cryl Universal Water Based Primer B66-310.
PPG Paints: Pitt-tech Plus Int/Ext DTM Primer/Finish 90-912
 - 2. ALKYD ENAMEL PRIMER: Sherwin Williams Pro-Cryl Universal Water Based Primer B66-310.
PPG Paints: 4160 Devguard DTM Primer
 - 3. ALKYD WOOD PRIMER: Sherwin Williams Premium Wall and Wood Primer B28W8111.
PPG Paints: Seal Grip Universal Int/Ext Alkyd Primer 6-14
 - 4. LATEX WALL PAINT PRIMER: Sherwin Williams Prep Rite High Build Primer B28W8601 with texture to produce fine finish plaster appearance on Drywall.
PPG Paints: Pure Performance Latex Primer, 9-900, 0g/LVOC
 - 5. SPOT PRIMER: Sherwin Williams Pro-Cryl Universal Water Based Primer B66-310.
PPG Paints: Pitt-tech Plus Int/Ext DTM Primer/Finish 90-912
 - 6. GALVANIZED PRIMER: Sherwin Williams Pro-Cryl Universal Water Based Primer B66-310.
PPG Paints: Pitt-tech Plus Int/Ext DTM Primer/Finish 90-912
 - 7. WATERPROOF EXTERIOR PRIMER/FINISH: Sherwin Williams Loxon XP.
PPG Paints: Perma-Crete Int/Ext Alkali Resistant Primer 4-603
- G. FILLERS/SEALERS:
 - 1. WOOD FILLER: Sherwin Williams Wood Filler.
 - 2. KNOT SEALER: Formula WP0578 of the Western Pine Association.
- H. HIGH PERFORMANCE PAINTS:
 - 1. SEMIGLOSS ENAMEL: Sherwin Williams Pro Industrial Pre-Catalyzed Epoxy Semi-Gloss K46W151
PPG Paints: Pitt Glaze Pre-Catalized Epoxy Semi-Gloss 16-510
- I. LATEX PAINTS:
 - 1. LATEX FLAT WALL PAINT: Sherwin Williams Pro Mar 200, Antimicrobial, Zero VOC, Latex Finish, Flat, Egg-Shell and Semi-Gloss.
PPG Paints: Pure Performance
 - 2. LATEX MASONRY PAINT, ACRYLIC: Sherwin Williams Loxon XP.
PPG Paints: Perma-Crete High Build 100% Acrylic
 - 3. VINYL LATEX EMULSION: Sher-Tex medium texture.

PPG Paints: Perma-Crete Textured Coatings

- J. LACQUER: Fed. Spec. TTP-P-143.
- K. WOOD STAIN: Sherwin Williams Semi-Transparent Polyurethane Exterior Stain A15T5.
PPG Paints: Flood Semi-Transparent Polyurethane Stain
- L. WOOD STAIN: Sherwin Williams Woodscapes Solid Color Acrylic House Stain A15 Series.
PPG Paints: Flood Acrylic Solid Color Stains
- M. OIL: Watco Danish Oil
- M. WAX: Watco Satin Carnauba Liquid Wax
- O. (1) INTERIOR EPOXY: One (1) coat Sherwin Williams Heavy Duty block-filler; then Sherwin Williams Pro Industrial Water Based Epoxy B73 Series.
PPG Paints: Speedhide 6-15 Hi Fill Block Filler, finish coat: Pitt-Glaze 16-551 series
- P. EXTERIOR Elastomeric: Sherwin Williams two (2) coats Loxon XP Waterproofing System
PPG Paints: 2 Coats Decra Flex 300 Smooth Flat 2260
- Q. FIRE RETARDANT PAINT: Sherwin Williams: Flame Control No. 20-20 interior fire retardant flat latex, shall be used on all exposed painted wood except doors and millwork.

2.03 MIXING:

- A. Tint prime coats and undercoats approximately to the shade of the final coat, but each with a slight variation in color to distinguish them from the preceding coat.
- B. Apply paint of consistency recommended by manufacturer. Additional thinning permitted only with specified approval.
- C. Use factory mixed colors, shades, and tints with finish paints matching the approved color samples. Job mixing permitted only with specific approval.

2.04 FINISH AND COLORS:

- A. Paint colors shall be as selected by the Architect. Before any work is begun, the Architect will furnish the Painting Contractor with a color schedule and/or chips showing where the *various* colors shall be used.
- B. ***60% of wall paint shall cover field wall and accent walls and surfaces terminating at corners floor and ceilings, 40% of wall paint shall be accent stripping, wall patterns, logo or graphics as selected by architect.***

PART 3: EXECUTION

3.01 CONDITION OF SURFACES

- A. Examine surfaces to receive painting before beginning work and correct defects that could affect quality of finished work. Prepare surfaces, as necessary, to receive painting as specified. Retouch shop coats and prime coats as necessary.
- B. Starting painting work shall be construed as evidence of acceptance of conditions under which work will be

done.

- C. Clean surfaces to be painted and spaces in which painting will be done, broom-clean and dust-free. Remove soil, prints, stains, and adhered materials that would affect finish painting.
- D. If acids have been used for cleaning, all traces of acid shall be thoroughly neutralized and rinsed and dried before any paint is applied.
- E. Meet requirements of other portions of specifications for preparation of specific items.
- F. Apply primer or first coat immediately after surface preparation to prevent contamination of the surface.

3.02 PREPARATION

A. Shop Painted Ferrous Metal

- 1. Clean surfaces free of concrete, mortar, plaster, rust, shavings, dirt, dust and other objectionable materials. Remove grease and oil with gasoline, benzine or other similar volatile cleaner. Use cleaner when space is properly ventilated and not in the presence of any open flame.
- 2. Touch up abraded or marred shop coats with spot primer specified.

B. Unpainted Ferrous Metal

- 1. Clean surfaces free of loose scale, rust, shavings, filings, dirt, dust and other objectionable material with wire brushes or other proper and acceptable means.
- 2. Remove grease and oil with gasoline, benzine or other similar volatile cleaner. Sandblast or wire brush to base metal all rusted areas on exposed exterior members. Use cleaner when space is properly ventilated and not in the presence of any open flame.

C. Zinc-Coated Metal (Galvanized)

- 1. Clean surfaces free of loose particles and other objectionable material. Remove grease and oil with mineral spirits or other similar cleaner.
- 2. Coat welded, chipped or abraded surfaces with "Galvalloy" galvanizing stick compound or ZRC Zinc Coating after wire brush cleaning.
- 3. Treat surfaces with an approved chemical compound such as a phosphoric acid-wash. Remove chemical compound completely with clean, fresh water and thoroughly dry surfaces prior to priming.

D. Gypsum Board

- 1. Mix and apply tape and bedding system in accordance with the manufacturer's recommendations.
- 2. Apply joint compound (embedding coat) to internal angles and butt joints approximately 3" wide and sufficiently thick to hide board surfaces. Cover screw heads and depressions with compound.
- 3. Apply tape to angles and joints, centered and seated into compound leaving sufficient compound under tape to provide proper bond. Apply a skim coat of compound over tape and clean excess compound from wallboard surface.
- 4. When first coat has thoroughly dried, apply second coat (fill coat) over embedding coat, filling board taper flush with board surface. For joints without taper, feather out 4" on either side of tape.
- 5. When second coat has thoroughly dried, apply third coat (finishing coat) tapered beyond edges of second coat and feathered to a smooth uniform finish which does not protrude beyond the plane of the board surface.
- 6. Apply at least two coats of compound to flanges of corner beads and metal edging. Extend compound

- approximately 8 to 10 inches either side of exposed metal. Apply three coats of compound in succession for all dimples at fastener heads
7. Sand all coats after each application has dried and leave wallboard and treated areas uniformly smooth, ready to receive decoration.
- E. Plaster: **shall be painted as described in this specification. Color as selected by architect.**
- F. Wood
1. Clean knots, pitch streaks or visible sap spots free of residue and treat with Knot Sealer. Apply second coat of sealer no less than two hours after the application of the first coat.
 2. Fill nail holes and other indentations with wood filler after first coat, matching color of stain or paint. Finish flush with adjacent surfaces.
 3. Sand wood surfaces smooth with No. 00 sand paper and remove dust prior to painting.
- G. Factory Finished Items
1. Factory finished items requiring painting shall be etched or otherwise prepared in an approved manner to receive final finish coat.
- H. Insulation
1. Clean surfaces of pipe, duct and equipment insulation, such as canvas jackets and troweled-on insulation and of rigid wall or ceiling insulation where items are required to be painted.
 2. Remove all loose, foreign and objectionable material prior to the application of any paint materials.
- I. Copper Piping
1. Wash surfaces with a 5 percent acetic acid solution and allow to dry. Do not damage adjacent surfaces due to acid spillage.
- J. Aluminum: Prefinished (or anodized) aluminum shall not be painted.
1. Remove oil or grease film by washing surfaces with mineral spirits or turpentine. Allow new, bare aluminum to weather for a month or roughen with steel wool before painting.

3.03 APPLICATION

- A. Do not open containers until required for use. Thoroughly mix paint before application and frequently stir during application so as to maintain pigment satisfactorily in suspension.
- B. Do not thin paint in excess of the printed directions of the manufacturer. Do not allow caking or setting of pigment into a hard mass.
- C. Apply paint uniformly without visible laps, sags, curtains, holidays or objectionable brushmarks. Exercise care so that paint does not splatter on surfaces not required to be painted. Remove promptly paint applied or splattered on surfaces not required to be painted.
- D. Insure that all primer and intermediate coats of paint are unscarred and completely integral at the time of application of each succeeding coat. Allow sufficient time between coats to ensure proper drying.
- E. Sand between all coats on wood and-metal surfaces prior to the application of succeeding coats.

- F. Remove doors for painting tops and bottoms. Finish top and bottom edges of doors the same as faces, after fitting.
- G. Match final coat of paint in color, tint and hue with the color displays approved by the Architect.
- H. Paint edges of doors occurring between rooms or spaces having different finishes the same as the room or space from which the same are visible when the door is in a partly opened position.
- I. Paint factory finished access panels, registers, grilles, diffusers, electrical panel boxes, connector covers and similar items the same color as adjoining walls or ceilings. Use color as directed where adjacent surfaces do not require painting.
- J. Finish all closets the same as the adjoining rooms, unless otherwise specified. Finish all other surfaces the same as nearest or adjoining surfaces unless otherwise shown.
- K. Paint exposed insulated and non-insulated piping, conduits, duct work and hangers a color and texture to match walls or ceilings adjacent to it. Where adjacent surfaces are unpainted, use color as directed.
- L. Back-prime all interior wood trim before installation, with alkyd primer or Okene Preservative.
- M. Protect all accent colors on walls with a coating of pale varnish as approved by the Architect.
- N. Application of Oil Finish:
 - 1. Apply Watco oil for saturated coat with brush or rag. Let set 30 minutes. Repeat procedure and let set 5 to 10 minutes. Wipe off excess with clean dry rag.
 - 2. Let set overnight. Repeat entire procedure.
 - 3. Let set overnight. Sand with light sandpaper. Apply coat of liquid wax and buff with clean dry rag.
 - 4. Match sample in Architect's office.

3.04 FIELD QUALITY CONTROL

- A. When painting is to be started, the manufacturer whose materials have been approved for use shall furnish competent technical assistance on the job to ensure that his materials are being applied properly. Manufacturer's assistance shall be available at all times until completion of the work.
- B. Each coat must be inspected and approved before application of the succeeding specified coat, otherwise no credit for the coat applied will be given and the Contractor automatically assumes the responsibility to recoat the work in question.
- C. Application equipment shall be cleaned a minimum of daily and no work shall be done with equipment which leaves adulterants in the coat of paint being applied.

3.05 CLEANING

- A. Remove from the premises upon completion of the work all staging, scaffolding and containers.
- B. Remove misplaced paint spots, oil or stains upon adjacent surfaces and leave the entire work in a clean condition. Touch up and restore finish where damaged.

3.06 PAINTING SCHEDULE

A. EXTERIOR WORK

1. Iron and Steel
 - 1st coat Sherwin Williams Pro-Cryl Universal Metal Primer
PPG Paints: Devguard 4160 DTM Primer
 - 2nd coat Sherwin Williams DTM Acrylic Semi-Gloss
PPG Paints: Devflex 4216 Semi-Gloss (Maintenance)
 - 3rd coat Sherwin Williams DTM Acrylic Semi-Gloss
PPG Paints: Devflex 4216 Semi-Gloss
2. Galvanized Iron and Steel
 - 1st coat Sherwin Williams Pro-Cryl Universal Metal Primer
PPG Paints: Devguard 4160 DTM Primer
 - 2nd coat Sherwin Williams DTM Acrylic Semi-Gloss
PPG Paints: Devflex 4216 Semi-Gloss (Maintenance)
 - 3rd coat Sherwin Williams DTM Acrylic Semi-Gloss
PPG Paints: Devflex 4216 Semi-Gloss
3. Machinery and Equipment.
 - Spot Prime Sherwin Williams Pro-Cryl Universal Metal Primer
PPG Paints: Devguard 4160 DTM Primer
 - 2nd Coat Sherwin Williams Pro Industrial Multi-Surface Acrylic B66W1501 Gloss
PPG Paints: Pitt Tech 90-1210
4. Exterior CMU
 - 1 coat Sherwin Williams Loxon Block Surfacers A24W200
PPG Paints: Perma-Crete Concrete Block & Masonry Surfacers 4-100XI
 - 2 coats Sherwin Williams Loxon XP Elastomeric Waterproofing System,
A24-1400 Series
PPG Paints: Decra Flex 300 Elastomeric 2260
5. Exterior Masonry Sherwin Williams Pro Industrial Anti-Graffiti Coating Clear, B97C150
Blok-Guard & Graffiti Control by Prosoco Clear
PPG Paints: See rep for sacrificial and non sacrificial
6. Exterior Stucco
 - 2 Coats Sherwin Williams Self Cleaning Acrylic Flat LX13W51
PPG Paints: Manor Hall

B. INTERIOR WORK

1. Miscellaneous Iron and Steel
 - 1st coat Sherwin Williams Pro-Cryl Universal Metal Primer
PPG Paints: Devguard 4160 DTM Primer
 - 2nd coat Sherwin Williams Pro Industrial Multi-Surface Acrylic Semi-Gloss
B66W1551
PPG Paints: Devflex 4216 Semi Gloss
 - 3rd coat Sherwin Williams Pro Industrial Multi-Surface Acrylic Semi-Gloss
B66W1551
PPG Paints: Devflex 4216 Semi Gloss

- | | | | |
|----|---|---|---|
| 2. | Primer | Miscellaneous Iron and Steel spot prime | Sherwin Williams Pro-Cryl Universal Metal Primer
PPG Paints: Devguard 4160 DTM Primer |
| | 1st coat | | Sherwin Williams Pro Industrial Multi-Surface Acrylic Semi-Gloss B66W1551
PPG Paints: Deviflex 4216 Semi Gloss |
| | 2nd coat | | Sherwin Williams Pro Industrial Multi-Surface Acrylic
PPG Paints: Devflex 4216 Semi Gloss |
| 3. | Galvanized Iron and Steel | | |
| | 1st coat | | Sherwin Williams Pro-Cryl Universal Metal Primer
PPG Paints: Devguard 4160 DTM Primer |
| | 2nd coat | | Sherwin Williams Pro Industrial Multi-Surface Acrylic B66W1551
PPG Paints: Devflex 4216 Semi Gloss |
| | 3rd coat | | Sherwin Williams Pro Industrial Multi-Surface Acrylic B66W1551
PPG Paints: Devflex 4216 Semi Gloss |
| 4. | Bonderized Steel | | |
| | 1st coat | | Sherwin Williams Pro-Cryl Universal Metal Primer
PPG Paints: Devguard 4160 DTM Primer |
| | 2nd coat | | Sherwin Williams Pro Industrial Multi-Surface Acrylic B66W1551
PPG Paints: Devflex 4216 Semi Gloss |
| | 3rd coat | | Sherwin Williams Pro Industrial Multi-Surface Acrylic B66W1551
PPG Paints: Devflex 4216 Semi Gloss |
| 5. | Gypsum Drywall | | |
| | 1st coat | | Sherwin Williams Prep Rite Hi-Build Primer B28W8601
PPG Paints: Pure Performance latex primer 9-900 |
| | 2nd coat | | Sherwin Williams Pro Mar 200 Zero VOC Latex Egg-Shell B20W12651
PPG Paints: Pure Performance egg shell 9-300 |
| | 3rd coat | | Sherwin Williams Pro Mar 200 Zero VOC Latex Egg-shell B20W12651
PPG Paints: Pure Performance egg shell 9-300 |
| 6. | Gypsum Drywall (High Traffic Areas, Hallways, Wet areas & Stairwells) | | |
| | 1st coat | | Sherwin Williams Prep Rite Hi-Build Primer B28W8601
PPG Paints: Pure Performance latex Primer 9-900 |
| | 2nd coat | | Sherwin Williams Pro Industrial Pre-Catalyzed Epoxy Egg-Shell, Semi-Gloss K46-W151
PPG Paints: Pitt-Tech Glaze Pre-Catalyzed Epoxy 16-310,93 g/L VOC Egg-Shell, Semi-Gloss |
| | 3rd coat | | Sherwin Williams Pro Industrial Pre-Catalyzed Epoxy Egg-Shell, Semi-Gloss K46-W151
PPG Paints: Pitt-Tech Glaze Pre-Catalyzed Epoxy 16-310,93 g/L VOC Egg-Shell, Semi-Gloss |
| 7. | Portland Cement Plaster & Stucco (that is not integral color) | | |
| | 1st coat | | Sherwin Williams Prep Rite Masonry Primer
PPG Paints: Seal Grip Int/Ext Acrylic Primer 17-921 |
| | 2nd coat | | Sherwin Williams Pro Mar 200 Zero VOC Latex Egg-Shell B20W2600
PPG Paints: Speedhide zero Interior Eggshell 4-4310XI |
| | 3rd coat | | Sherwin Williams Pro Mar 200 Zero VOC Latex Egg-Shell B20W2600
PPG Paints: Speedhide zero Interior Eggshell 4-4310XI |

SECTION 09900
PAINTING

8. Wood Surfaces (Natural Finish)
 - 1st coat Oil
 - 2nd coat Oil
 - 3rd coat Oil
 - 4th coat Wax
9. Wood Surfaces (Stained)
 - 1st coat Stain
 - 2nd coat Filler (open grain wood, only)
 - 3rd coat Lacquer Sanding Sealer
 - 4th coat Dull Rubbed Lacquer
 - 5th coat Dull Rubbed Lacquer
10. Machinery and Equipment
 - Spot Prime Sherwin Williams Pro-Cryl Primer
PPG Paints: Devguard 4160 DTM Primer
 - 2nd Coat Sherwin Williams Pro Industrial Multi-Surface Acrylic Gloss
PPG Paints: Dev Flex 4216 Semi Gloss
11. Exposed Canvas Covered Piping
 - 1st coat Sherwin Williams Drywall Latex Primer B28W8100
PPG Paints: Speedhide Interior Latex Sealer 6-2
 - 2nd coat To match paint specified for
 - 3rd coat coats adjoining surfaces
12. Exposed Rigid Insulation
 - 1st coat Primer as recommended by the manufacturer of the finish coats
XIM, UMA 400 Bonding Primer
 - 2nd coat Sherwin Williams Multi-Surface Acrylic Egg-Shell B666W1561
PPG Paints: Dev Flex 4216 Semi Gloss
13. Exposed-High: Temperature Metal Piping
 - 1st coat Sherwin Williams Kem Hi Temp Heat Resistant Paint
PPG Paints: High Heat Paint
 - 2nd coat Sherwin Williams Kem Hi Temp Heat Resistant Paint
PPG Paints: High Heat Paint
14. CMU
 - 1st coat Sherwin Williams Heavy Duty Block Filler or Loxon Block Surfacers
PPG Paints: Speedhide Int/Ext Masonry Hi Fill Block Filler
 - 2nd coat Sherwin Williams Pro Mar 200 Zero VOC, Latex Semi-Gloss,
B31W2651
PPG Paints: Aquapon Water Based Epoxy 98 Series, 325g/L VOC
 - 3rd coat Sherwin Williams Pro Mar 200 Zero VOC, Latex Semi-Gloss,
B31W2651
PPG Paints: Aquapon Water Based Epoxy 98 Series, 325g/L VOC

15. CMU (High Traffic Areas, Hallways, Wet areas & Stairwells)
- | | |
|----------|--|
| 1st coat | Sherwin Williams Loxon Block Surfacers
PPG Paints: Speedhide Int/Ext Masonry Hi Fill Block Filler |
| 2nd coat | Sherwin Williams Pro Industrial Water Based Catalyzed
Epoxy B73-300 Series
PPG Paints: Aquapon Water Based Epoxy 98 Series, 325g/L VOC |
| 3rd coat | Sherwin Williams Pro Industrial Water Based Catalyzed
Epoxy B73-300 Series
PPG Paints: Aquapon Water Based Epoxy 98 Series, 325g/L VOC |
16. Where indicated on drawings interior concrete floors shall be trowel smooth finish and shall be etched with 10% muriatic acid, flush with water and allowed to dry thoroughly.
- | | |
|----------|---|
| 1st coat | Sherwin Williams solvent base H & C Concrete Stain & Sealer: Clear or
Colored as selected by architect |
| 2nd coat | Sherwin Williams solvent base H & C Concrete Stain & Sealer: Clear or
Colored as selected by architect Sealer |
| 3rd coat | Sherwin Williams solvent base H & C Concrete Stain & Sealer: Clear or
Colored as selected by architect Sealer provide Anti-slip grit on the final
coat. |
17. Exposed Structural Steel
- | | |
|-------------|--|
| 1 – 2 coats | Sherwin Williams Low VOC Waterborne Acrylic Dryfall B42 Series
PPG Paints: Speedhide Super Tech Interior Dry-Fog Flat Latex 6-723XI |
|-------------|--|

3.07 PIPE IDENTIFICATION

- A. Conform to requirements of ASA A13, "Scheme for the Identification of Pipe Systems," as published by the American Society of Mechanical Engineers. Provide complete painting of piping in mechanical rooms only.
- B. Color Coding:
1. Domestic Water, Cold or Hot – Green SW4085
 2. Chilled, Heating or Condenser - Water - Green SW4085
 3. Gas - Orange SW4083
 4. Air - White SW4087
 5. Condensate - Black SW4090
 6. Electric Conduit - Yellow SW4084
 7. Oil - Orange SW4083
 8. Drain Lines - Black SW4090
 9. Steam - Orange SW4083
 10. Fire Protection Sprinkler – Red SW4081

3.08 SMOKE AND FIRE WALLS

- A. Contractor shall identify all one-hour smoke walls and horizontal exit walls, by painting with stencil on both sides of wall, the rating which applies to the wall, Identifications shall be 11'-0" above finish floor, or above finish ceiling where wall does not extend above 11'-0", and shall be spaced at maximum distance of 29'-0" o.c. Height of letters shall be 4". Color of paint for letters will be Black.

END OF SECTION

SECTION 10520
FIRE EXTINGUISHERS

PART 1: GENERAL

1.01 SCOPE

- A. Perform all work required to complete the Fire Extinguishers indicated by the Contract Documents and furnish all supplementary items necessary for their 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.

1.02 SUBMITTALS

- A. Samples
 - 1. Submit for approval samples of typical accessories showing construction and finish specified.
- B. Shop Drawings
 - 1. Submit manufacturer's literature and mark sufficiently to indicate compliance with these specifications. Show locations, methods of supporting, methods of anchoring and finishes of each accessory.

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. FIRE EXTINGUISHERS
 - J.L. Industries
 - Larsen's Manufacturing Co.
 - Muckle Mfg. Co. - Div. of Technico, Inc.
 - Profile International, Inc.
 - Seco Mfg., Inc.

2.02 MATERIALS

- A. FIRE EXTINGUISHERS. *J.L. Industries "Cosmic Model 10E, UL 4A-60BC (A, B, C fire class) refer to drawings for quantities.*
- B. *Provide wall bracket where indicated on drawings.*
- C. Require number of extinguishers and cabinets noted on drawings.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's latest written requirements and details.

END OF SECTION

SECTION 13121

PRE-ENGINEERED BUILDINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pre-engineered, shop fabricated structural steel building frame.

1.2 REFERENCES

- A. American Institute of Steel Construction:
1. AISC S335 - Specification for Structural Steel Buildings Allowable Stress Design, and Plastic Design.
 2. AISC S342L - Load and Resistance Factor Design Specification for Structural Steel Buildings.
 3. AISC S344L - Metric Load and Resistance Factor Design Specification for Structural Steel Buildings.
- B. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 5. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 6. ASTM A490 - Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
 7. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 8. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 9. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
 10. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 11. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 12. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

13. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 14. ASTM C991 - Standard Specification for Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings.
 15. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 16. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 17. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- C. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 2. AWS D1.1 - Structural Welding Code - Steel.
- D. Metal Building Manufacturers Association:
1. MBMA - Low Rise Building Systems Manual.
- E. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- F. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.
 2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
- G. Underwriters Laboratories Inc.:
1. UL - Building Materials Directory.
 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
- 1.3 SYSTEM DESCRIPTION
- A. Single span rigid frame.
- 1.4 DESIGN REQUIREMENTS
- A. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
- B. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.
- 1.5 PERFORMANCE REQUIREMENTS
- A. Conform to applicable codes for submission of design calculations, reviewed shop and erection drawings, required for acquiring permits.

- B. Cooperate with regulatory agency or authority and provide data as requested authority having jurisdiction.

1.6 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections, attachments, openings, cambers, loads, and reactions; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, method of installation; framing anchor bolt settings, sizes, and locations from datum, and foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.
- C. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.

PART 2 PRODUCTS

2.1 FABRICATION - FRAMING

- A. Fabricate members in accordance with AISC Specification for plate, bar, tube, or rolled structural shapes.
- B. Provide framing for door window louver skylight, ventilator openings.

PART 3 EXECUTION

3.1 ERECTION - FRAMING

- A. Erect framing in accordance with AISC Specification.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing.
- C. Set column base plates with non-shrink grout to achieve full plate bearing.
- D. Do not field cut or alter structural members without approval of Architect/Engineer.
- E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.2 ERECTION TOLERANCES

- A. Framing Members: 1/4 inch from level; 1/8 inch from plumb.

END OF SECTION

SECTION 15010

SUMMARY OF MECHANICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and other Division 15 Specification 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. 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:
 - Chilled Water Central Station Units
 - DX Air Handlers & RTU's
 - Exhaust fans
 - Sheet metal, Ductwork
 - Diffusers and Grilles
 - Duct accessories, including grilles, and louvers
 - HVAC Controls
 - Air Test and Balance

1.3 CONTINGENCY

1. Refer to architectural specifications for Mechanical Contingencies.

1.4 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.

1.5 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.

1.6 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. 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.

1.7 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 15050

BASIC MECHANICAL MATERIALS AND METHODS

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 the following basic mechanical materials and methods to complement other Division 15 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:
 - 1. PVC: Polyvinyl chloride plastic.

G. 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 Division 8.
- 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. 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 PIPE AND PIPE FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.7 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- 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 maximum thickness, unless thickness or specific material is indicated.

- a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32.
 - 1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
- F. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAgl: Silver alloy.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements: Manufacturer's standard solvent cements for the following:
 - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 2. PVC to ABS Piping Transition: ASTM D 3138.
- I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.
- K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.8 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

2.9 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.

2.10 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.

2.11 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-psig, 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 Division 15 piping 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. Refer to Division 7 for materials.

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. Refer to Division 7 for 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 Division 9 for 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 in Division 3.

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 15060

HANGERS AND SUPPORTS

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 hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
 - 1. Division 5 Sections for materials for attaching hangers and supports to building structure.
 - 2. Division 13 Sections on fire-suppression piping for fire-suppression pipe hangers.
 - 3. Division 15 Section "Mechanical Vibration Controls and Seismic Restraints" for vibration isolation and seismic restraint devices.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

1.6 QUALITY ASSURANCE

- A. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pipe Hangers:
 - a. Globe Pipe Hanger Products, Inc.
 - b. Grinnell Corp.
 - c. Michigan Hanger Co., Inc.

2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
 - 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
 - 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

2.3 MISCELLANEOUS MATERIALS

- A. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.

- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 2. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 3. Extension Hinged Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. C-Clamps (MSS Type 23): For structural shapes.
 5. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 6. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 7. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 8. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
- H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- I. Insulated Piping: Comply with the following:
 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9.
 2. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

- b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood inserts.
 - 6. Insert Material: Length at least as long as protective shield.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

END OF SECTION

SECTION 15070

SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Pipe, and equipment hangers, supports and associated anchors.
- B. Sleeves and seals.
- C. Flashing and sealing equipment and pipe stacks.

1.02 RELATED WORK

- A. Section 15240 - Vibration Isolation.
- B. Section 15260 - Piping Insulation.
- C. Section 15280 - Equipment Insulation.
- D. Section 15330 – Wet Pipe Fire Protection Sprinkler System.
- E. Section 15410 - Plumbing Piping and Valves.
- F. Section 15510 - Hydronic Piping.
- G. Section 15530 – Refrigerant Piping

1.03 REFERENCES

- A. ANSI/ASME B31.1 - Power Piping.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems.
- C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.04 QUALITY ASSURANCE

- A. Supports for Sprinkler Piping: In conformance with NFPA 13.
- B. Supports for Standpipes: In conformance with NFPA 14.

1.05 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division One.
- B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.
- C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.
- E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- F. Wall Support for Pipe Sizes 4 Inches and over: adjustable steel yoke and cast iron roll.
- G. Vertical Support: Steel riser clamp.
- H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
- I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

- J. Roof Pipe Supports and Hangers: Galvanized Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.
For pipes 2-1/2" and smaller – Type PP10 with roller
For pipes 3" through 8" – Type PS
For multiple pipes – Type PSE - Custom
- K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut "Cush-A-Clamp" or equal. Hangers: Plastic coated; Unistrut or equal.
- L. For installation of protective shields refer to specification section 15140-3.03.
- M. Shields for Vertical Copper Pipe Risers: Sheet lead.
- N. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief "Pipe Titan", Holdrite or equal.

2.02 HANGER RODS

- A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.03 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

- A. Metal Flashing: 20 gage galvanized steel.
- B. Lead Flashing: 4 lb. /sq. ft. sheet lead for waterproofing; 1 lb. /sq. ft. sheet lead for soundproofing.
- C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.
- D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.05 EQUIPMENT CURBS

- A. Fabricate curbs of hot dipped galvanized steel.
1. Provide with hurricane clip to anchor RTU to roof curb.
- B. For metal roof construction, roof [curbs shall be made of aluminum or stainless steel. Coordinate with architectural drawings and details.](#)

2.06 SLEEVES

- A. Sleeves for Pipes through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.
- B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe, schedule 40.
- C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed.
- D. Sleeves for Round Ductwork: Form with galvanized steel.
- E. Sleeves for Rectangular Ductwork: Form with galvanized steel.
- F. Fire Stopping Insulation: Glass fiber type, non-combustible, U.L. listed.
- G. Caulk: Paintable 25-year acrylic sealant.
- H. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.07 FABRICATION

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for

- continuous insulation wrapping.
- B. Design hangers without disengagement of supported pipe.
- C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.08 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 INSERTS

- A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.
- B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
- D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.02 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"

12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 and over	4'-0"	5/8"

- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.
- J. Portable pipe hanger systems shall be installed per manufacturers' instructions.
- K. Distances between supports are maximum distance. Supports shall be provided to carry the pipe/equipment load.

3.03 INSULATED PIPING: COMPLY WITH THE FOLLOWING INSTALLATION REQUIREMENTS.

- A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
- B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
- C. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

NPS	LENGTH	THICKNESS
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 THROUGH 14	24	0.075
16 THROUGH 24	24	0.105

- D. Piping 2" and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.
- E. Insert material shall be at least as long as the protective shield.
- F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.04 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of concrete.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.05 FLASHING

- A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor shower mop sink and all other drains watertight to adjacent materials.
- E. Provide curbs for mechanical roof installations 8 inches minimum high above roofing surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.06 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermfiber and 3M caulking and provide floor plate.
- C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with U.L. listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- D. Fire protection sleeves may be flush with floor of stairways.

END OF SECTION

SECTION 15075

MECHANICAL IDENTIFICATION

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 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 Division 15 Sections. 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.
 2. Valve-Tag Color:
 - a. Cold Water: Green.
 - b. Hot Water: Yellow.
 - c. Fire Protection: Red.
 3. 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

- B. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 15122

METERS AND GAGES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes meters and gages for mechanical systems and water meters installed outside the building.
- B. Related Sections include the following:
 - 1. Division 2 Section "Water Distribution" for water meters outside the building.
 - 2. Mechanical equipment Sections that specify meters and gages as part of factory-fabricated equipment.

1.03 SUBMITTALS

- A. Product Data: Include scale range, ratings, and calibrated performance curves for each meter, gage, fitting, specialty, and accessory specified.
- B. Shop Drawings: Include schedule indicating manufacturer's number, scale range, fittings, and location for each meter and gage.
- C. Product Certificates: Signed by manufacturers of meters and gages certifying accuracies under specified operating conditions and compliance with specified requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Liquid-in-Glass Thermometers:
 - a. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
 - b. Ernst Gage Co.
 - c. Marsh Bellofram.

- d. Palmer Instruments, Inc.
 - e. Terice: H. O. Terice Co.
 - f. Weiss Instruments, Inc.
 - g. Winter's Thermogauges, Inc.
- 2. Pressure Gages:
 - a. AMETEK, Inc.; U.S. Gauge Div.
 - b. Dresser Industries, Inc.; Instrument Div.; Ashcroft Commercial Sales Operation.
 - c. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
 - d. Ernst Gage Co.
 - e. Marsh Bellofram.
 - f. Noshok, Inc.
 - g. Terice: H. O. Terice Co.
 - h. Weiss Instruments, Inc.
 - i. WIKA Instruments Corp.
 - j. Winter's Thermogauges, Inc.
- 3. Test Plugs:
 - a. Flow Design, Inc.
 - b. MG Piping Products Co.
 - c. National Meter.
 - d. Peterson Equipment Co., Inc.
 - e. Sisco Manufacturing Co.
 - f. Terice: H. O. Terice Co.
 - g. Watts Industries, Inc.; Water Products Div.

2.02 THERMOMETERS, GENERAL

- A. Scale Range: Temperature ranges for services listed are as follows:
 - 1. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions (minus 18 to plus 38 deg C, with 1-degree scale divisions).
- B. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

2.03 LIQUID-IN-GLASS THERMOMETERS

- A. Description: ASTM E 1.
- B. Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches (230 mm) long.
- C. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

- D. Tube: Red or blue reading, organic-liquid filled with magnifying lens.
- E. Scale: Satin-faced nonreflective aluminum with permanently etched markings.
- F. Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

2.04 THERMOMETER WELLS

- A. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.
 - 1. Material: Stainless steel, for use in steel piping.
 - 2. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
 - 3. Insertion Length: To extend to center of pipe.
 - 4. Cap: Threaded, with chain permanently fastened to socket.

2.05 PRESSURE GAGES

- A. Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.
- B. Case: Drawn steel, brass, or aluminum with 4-1/2-inch- (115-mm-) diameter, glass lens.
- C. Connector: Brass, NPS 1/4 (DN8).
- D. Scale: White-coated aluminum with permanently etched markings.
- E. Accuracy: Grade B, plus or minus 2 percent of middle 50 percent of scale.
- F. Range: Comply with the following:
 - 1. Vacuum: 30 inches Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
 - 2. Fluids under Pressure: Two times the operating pressure.

2.06 PRESSURE-GAGE FITTINGS

- A. Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.
- B. Syphons: NPS 1/4 (DN8) coil of brass tubing with threaded ends.
- C. Snubbers: ASME B40.5, NPS 1/4 (DN8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.07 TEST PLUGS

- A. Description: Nickel-plated, brass-body test plug in NPS 1/2 (DN15) fitting.
- B. Body: Length as required to extend beyond insulation.
- C. Pressure Rating: 500 psig (3450 kPa) minimum.
- D. Core Insert: Self-sealing valve, suitable for inserting 1/8-inch (3-mm) OD probe from dial-type thermometer or pressure gage.
- E. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.
- F. Test Kit: Pressure gage and adapter with probe, two bimetal dial thermometers, and carrying case.
 - 1. Pressure Gage and Thermometer Ranges: Approximately two times the system's operating conditions.

PART 3 - EXECUTION

3.01 METER AND GAGE INSTALLATION, GENERAL

- A. Install meters, gages, and accessories according to manufacturer's written instructions for applications where used.

3.2 THERMOMETER INSTALLATION

- A. Install thermometers and adjust vertical and tilted positions.
- B. Install in the following locations:
 - 1. Inlet and outlet of each hydronic zone. Refer to chilled water piping schematic/riser.
 - 2. Inlet and outlet of each hydronic chiller.
 - 3. Refer to plans for additional locations.
- C. Install separable sockets in vertical position in piping tees where fixed thermometers are indicated.
 - 1. Install with socket extending to center of pipe.
 - 2. Fill sockets with oil or graphite and secure caps.
- D. Install thermometer wells in vertical position in piping tees where test thermometers are indicated.
 - 1. Install with stem extending to center of pipe.
 - 2. Fill wells with oil or graphite and secure caps.

3.03 PRESSURE-GAGE INSTALLATION

- A. Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.
- B. Install dry-type pressure gages in the following locations:
 - 1. Discharge of each pressure-reducing valve.
 - 2. Chilled-water inlets and outlets of chillers.
 - 3. Refer to plans for additional locations.
- C. Install liquid-filled-type pressure gages at suction and discharge of each pump.
 - 1. Refer to plans for additional locations.
- D. Install pressure-gage needle valve and snubber in piping to pressure gages.
 - 1. Exception: Install syphon instead of snubber in piping to steam pressure gages.

3.04 ADJUSTING AND CLEANING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.
- C. Clean windows of meters and gages and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION

SECTION 15140

DOMESTIC WATER PIPING

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 domestic water piping from locations indicated to fixtures and equipment inside the building.
- B. Related Sections include the following:
 - 1. Division 15 Section "Plumbing Specialties" for water distribution piping specialties.
- C. PVC: Polyvinyl chloride plastic.

1.3 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 (860 kPa).

1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic, potable domestic water piping and components.
- C. 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 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBING

- A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
 3. 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.
- B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
 3. 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.
 4. Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
 - a. 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.

2.3 PVC PIPING

- A. PVC Schedule 40 Pipe:

2.4 VALVES

- A. Refer to Division 15 Section "Valves" for bronze and cast-iron, general-duty valves.
- B. Refer to Division 15 Section "Plumbing Specialties" for balancing and drain valves.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.
- D. Fitting Option: Mechanically formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.
- E. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
1. NPS 1-1/2 (DN 40) and Smaller: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
 2. NPS 2 (DN 50): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
 3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
 4. NPS 4 to NPS 6 (DN 100 to DN150): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.

- F. Underground Domestic Water Piping NPS 4 (DN 100) and Smaller: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints. Water service larger than NPS 4 shall be PVC.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
 2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
 3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 4. Drain Duty: Hose-end drain valves.
- B. Cast-iron, grooved-end valves may be used with grooved-end piping.

3.4 PIPING INSTALLATION

- A. Refer to Division 2 for site water distribution and service piping.
- B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- C. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.
- D. Install underground copper tubing according to CDA's "Copper Tube Handbook."
- E. Install underground PVC piping according to ASTM D 2774 and ASTM F 645. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
- F. 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. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- G. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for wall penetration systems.
- H. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each domestic water service. Refer to Division 15 Section "Meters and Gages" for pressure gages, and to Division 15 Section "Plumbing Specialties" for drain valves and strainers.
- I. Install water-pressure regulators downstream from shutoff valves. Refer to Division 15 Section "Plumbing Specialties" for water-pressure regulators.
- J. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
- K. Perform the following steps before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.

- L. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

3.5 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. Grooved Joints: Assemble joints with keyed-coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- D. Mechanically Formed Outlets: Form tee in copper tube according to equipment manufacturer's written instructions. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.6 VALVE INSTALLATION

- A. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.
- B. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Refer to Division 15 Section "Plumbing Specialties" for calibrated balancing valves.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod
 - 2. NPS 1 and NPS-1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10mm) Rod.
 - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10mm) rod.
 - 4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13 mm) rod.
 - 5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13 mm) rod.

6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

G. Install supports for vertical copper tubing every 10 feet (3m).

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:
 1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
 3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.9 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
 2. 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:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping 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 domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.

3.10 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.

3.11 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:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) 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.
 - 2) 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.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. 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.

END OF SECTION

SECTION 15150

SANITARY WASTE AND VENT PIPING

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 soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.
- B. Related Sections include the following:
 - 1. Division 15 Section "Plumbing Specialties" for soil, waste, and vent piping systems specialties.

1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
 - 1. PVC: Polyvinyl chloride plastic.

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 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

2.2 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.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:
 - 1. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. NPS 2 to NPS 4 (DN 50 to DN 100): PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. NPS 5 and NPS 6 (DN 125 and DN 150): Use NPS 6 (DN 150) PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:
 - 1. NPS 2 to NPS 4 (DN 50 to DN 100): PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. NPS 5 and NPS 6 (DN 125 and DN 150): PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.3 PIPING INSTALLATION

- A. Refer to Division 2 Section "Sanitary Sewerage" for Project-site sanitary sewer piping.
- B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
 - 1. Encase piping with PE film according to ASTM A 674 or AWWA C105.
- E. 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. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- F. 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 $\frac{1}{4}$ 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.
- G. 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.
- H. 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.
- I. Install soil and waste drainage and vent piping at the code required minimum slopes, unless otherwise indicated:
- J. 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, Solvent, Single Stack: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
 - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

- B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- J. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 5. NPS 8 to NPS 12 (DN 200 to DN 300): (1200 mm) with 7/8-inch (22-mm) rod.
- K. Install supports for vertical PVC piping every 48 inches (1200 mm).
- L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 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 Division 15 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. Refer to Division 15 Section "Plumbing Specialties."

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.

3.7 FIELD QUALITY CONTROL

- A. 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.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. 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.

3.8 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 15410

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.
- B. Related Sections include the following:
 - 1. Division 15 Section "Drinking Fountains and Water Coolers."
 - 2. Division 15 Section "Plumbing Specialties" for backflow preventers and specialty fixtures not in this Section.

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 SHOWER FAUCETS

- A. Shower Faucet: Include hot- and cold-water indicators; tub spout; and shower head, arm, and flange. Coordinate faucet inlets with supplies and outlet with diverter valve.
 - 1. Manufacturers:
 - a. American Standard.
 - b. Eljber.
 - c. Kohler.

2.4 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.

2.5 TOILET SEATS

- A. Toilet Seat: Solid plastic.
 - 1. Manufacturers:
 - a. Bemis.
 - b. Beneke.
 - c. Centoco.
 - d. Church.

2.6 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.

2.7 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: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include steel uprights with feet.
 - 1. Manufacturers:
 - a. Josam.
 - b. J.R. Smith
 - c. Zurn.
 - 2. Accessible Fixture Support: Include rectangular steel uprights.
- C. Lavatory Support: Type II, lavatory carrier with concealed arms and tie rod. Include steel uprights with feet.
 - 1. Manufacturers:
 - a. Josam.
 - b. J.R. Smith
 - c. Zurn.
 - 2. Accessible Fixture Support: Include rectangular steel uprights.

- 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.

2.8 WATER CLOSETS

- A. Water Closets: Accessible, wall-hanging, back-outlet, vitreous-china fixture designed for flushometer valve operation.
 - 1. Products:
 - a. American Standard, Inc.
 - b. Kohler Co.
 - c. TOTO USA, Inc.
- B. Water Closets: Accessible, floor mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
 - 1. Products:
 - a. American Standard, Inc.
 - b. Kohler Co.
 - c. TOTO USA, Inc.

2.9 URINALS

- A. Urinals,: Accessible, wall-hanging, back-outlet, vitreous-china fixture designed for flushometer valve operation.
 - 1. Products:
 - a. American Standard, Inc.
 - b. Kohler Co.
 - c. TOTO USA, Inc.

2.10 LAVATORIES, SINKS

- A. Lavatories,: Accessible, wall hanging, vitreous-china fixture.
 - 1. Products:
 - a. American Standard, Inc.
 - b. Kohler Co.
 - c. Toto

2.11 KITCHEN SINKS

- A. Kitchen Sinks: Commercial, counter-mounting, stainless-steel fixture.
 - 1. Products:
 - a. Elkay Manufacturing Co.
 - b. Just Manufacturing Co.

2.12 SERVICE SINKS

- A. Service 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 15415

DRINKING FOUNTAINS AND WATER COOLERS

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 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.

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 15 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 15 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 7 for sealant and installation requirements.

3.4 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. 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 15430

PLUMBING SPECIALTIES

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 the following plumbing specialties:
 - 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.
 - 9. Cleanouts.
 - 10. Floor drains.
 - 11. Roof drains.
 - 12. Grease interceptors.

1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Domestic Water Piping: 125 psig (860 kPa).
 - 2. Sanitary Waste and Vent Piping: 10-foot head of water (30 kPa).
 - 3. Storm Drainage Piping: 10-foot head of water (30 kPa).

1.5 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. Balancing valves.
2. Water hammer arresters, and trap seal primer valves and systems.
3. Hose bibbs, hydrants.
4. Washer-supply outlets.
5. Cleanouts, floor drains, and roof drains.
6. Roof flashing assemblies.
7. Grease interceptors.
8. Sleeve penetration systems.

B. Shop Drawings: Diagram power, signal, and control wiring.

1.6 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.
- E. NSF Compliance:
 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
 2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

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.
 1. Manufacturers:
 - a. Armstrong Pumps, Inc.
 - b. Flow Design, Inc.
 - c. ITT Industries; Bell & Gossett Div.
 - d. Taco, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 2. NPS 2 (DN 50) and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
 3. NPS 2 (DN 50) and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
 4. NPS 2-1/2 (DN 65) and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

- 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.
 - 1. Manufacturers:
 - a. Conbraco Industries, Inc.
 - b. Crane Co., Crane Valve Group; Crane Valves.
 - c. Grinnell Corporation.
 - d. NIBCO INC.
 - e. 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 (860 kPa).
 1. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25) 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 TRAP SEAL PRIMER VALVES

- A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:
 1. Manufacturers:
 - a. Josam Co.
 - b. MIFAB Manufacturing, Inc.
 - c. Precision Plumbing Products, Inc.
 - d. Smith, Jay R. Mfg. Co.
 2. 125-psig (860-kPa) minimum working pressure.
 3. Bronze body with atmospheric-vented drain chamber.
 4. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
 5. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
 6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.6 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.
 1. Manufacturers:

- a. Josam Co.
 - b. Smith, Jay R. Mfg. Co.
 - c. Tyler Pipe; Wade Div.
 - d. Zurn Industries, Inc.; Specification Drainage Operation.
- B. 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.
- C. 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.
- D. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.
- E. 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.
- F. 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.
- G. 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.
- H. 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.
- I. 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.

2.7 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.

2.8 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.

2.9 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.

2.10 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.

2.11 ROOF DRAINS

- A. Roof Drains: Comply with [ASME A112.21.2M] [ASME A112.3.1].
 - 1. Application: Roof drain.
 - 2. Products:
 - a. Josam Co.

- b. Mifab
- c. Smith, Jay R. Mfg. Co.
- d. Tyler Pipe, Wade Div.
- e. Watts Industries, Inc., Drainage Products Div.
- f. Zurn Industries, Inc.

2.12 GREASE INTERCEPTORS

- A. Grease Interceptors: Comply with PDI-G101.
 - 1. Products:
 - a. American Industrial Precast Products, Inc.
 - b. Brooks Products
 - c. Park Equipment Co.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.
- C. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.
- D. 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.
- E. 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.
- F. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- G. 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.
- H. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
- I. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

- J. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- K. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
- L. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.
- M. 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.
- N. 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.
- O. 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.
- P. 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.
- Q. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- R. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
- S. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
- T. 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. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect plumbing specialties to piping specified in other Division 15 Sections.
- D. Ground equipment.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- F. Connect plumbing specialties and devices that require power according to Division 16 Sections.
- G. 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, according to Division 7 Section "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.

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 15485

ELECTRIC, DOMESTIC WATER HEATERS

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 the following for domestic water systems:
 - 1. Tankless, electric water heaters.
 - 2. Commercial, electric water heaters.
 - 3. Compression tanks.
 - 4. Accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of water heater. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Shop Drawings: Detail water heater 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. Product Certificates: Signed by manufacturers of water heaters certifying that products furnished comply with requirements.
- D. Maintenance Data: For water heaters to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on specific units indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Fabricate and label water heater, hot-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

- E. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:
1. ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.
 2. ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings," for household water heaters.

1.5 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Point-of-Use, Tankless, Electric Water Heaters:
 - a. Chronomite Laboratories, Inc.
 - b. Eemax
 2. Commercial, Point-of-Use, Storage, Electric Water Heaters:
 - a. Rheem
 - b. State Industries.
 3. Commercial, Storage, Electric Water Heaters:
 - a. Lochinvar Corp.
 - b. PVI Industries, Inc.
 - c. State Industries.
 4. Water Heater Stand and Drain Pan Units:
 - a. Safety: W. H. Safety Products, Inc.
 5. Compression Tanks:
 - a. Bell & Gossett
 - b. Taco, Inc.
 - c. Zurn Industries, Inc.; Wilkins Div.

2.2 POINT-OF-USE, TANKLESS, ELECTRIC WATER HEATERS

- A. Description: Comply with UL 499.
- B. Construction: Without hot-water storage.
1. Working-Pressure Rating: 150 psig (1035 kPa).

2. Tappings: ASME B1.20.1, pipe thread.
 3. Interior Finish: Materials complying with NSF 61, barrier materials for potable-water tank linings.
 4. Jacket: Aluminum or steel, with enameled finish, or plastic.
- C. Heating System: Electric-resistance type.
1. Temperature Control: Adjustable thermostat.
 2. Safety Control: Automatic, high-temperature-limit cutoff device or system.
- D. Mounting: Bracket or device for wall mounting.

2.3 COMMERCIAL, POINT-OF-USE, STORAGE, ELECTRIC WATER HEATERS (6 TO 40 GALLON)

- A. Description: Comply with UL 174 or UL 1453, and listed by manufacturer for commercial applications.
- B. Storage Tank Construction: Non-ASME-code steel with 150-psig (1035-kPa) working-pressure rating.
1. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, drain, anode rod, and controls as required. Attach tappings to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
 2. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
 3. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
 4. Jacket: Steel, with enameled finish.
- C. Heating Elements: Two, unless otherwise indicated; electric, screw-in, immersion type.
1. Temperature Control: Adjustable thermostat.
- D. Anode Rod: Factory installed, magnesium.
- E. Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.
- F. Special Requirement: NSF 5 construction.

2.4 COMMERCIAL, STORAGE, ELECTRIC WATER HEATERS (OVER 40 GALLONS)

- A. Description: Comply with UL 1453.
- B. Storage Tank Construction: ASME-code steel with 150-psig (1035-kPa) working-pressure rating.
1. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometer, drain, anode rods, and controls as required. Attach tappings to tank shell before testing and labeling.
 - a. NPS 2 (DN50) and Smaller: Threaded ends according to ASME B1.20.1, pipe threads.
 2. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
 3. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.

- 4. Jacket: Steel, with enameled finish.
- C. Heating Elements: Electric, screw-in or bolt-on, immersion type arranged in multiples of three.
 - 1. Exception: Water heaters up to 9-kW input may have 2 or 3 elements.
 - 2. Staging: Input not exceeding 18 kW per step.
 - 3. Temperature Control: Adjustable surface-mounted thermostat.
 - 4. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
- D. Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.
- E. Anode Rods: Factory installed, magnesium.
- F. Dip Tube: Factory installed. Not required if cold-water inlet is near bottom of storage tank.
- G. Special Requirement: NSF 5 construction.

2.5 COMPRESSION TANKS

- A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
- B. Construction: 150-psig (1035-kPa) working-pressure rating.
- C. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
- D. Tank Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
- E. Tank Exterior Finish: Manufacturer's standard, unless finish is indicated.
- F. Air-Charging Valve: Factory installed.

2.6 WATER HEATER ACCESSORIES

- A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.
- B. Vacuum Relief Valves: Comply with ASME PTC 25.3. Furnish for installation in piping.
 - 1. Exception: Omit if water heater has integral vacuum-relieving device.
- C. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.
- D. Water Heater Stands: Water heater manufacturer's factory-fabricated, steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches (457 mm) above the floor.
- E. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated, steel bracket for wall mounting and capable of supporting water heater and water.

- F. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4 (DN20).

PART 3 - EXECUTION

3.1 CONCRETE BASES

- A. Install concrete bases of dimensions indicated. Refer to Division 3 and Division 15 Section "Basic Mechanical Materials and Methods."

3.2 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
 - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
- B. Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.
- D. Install vacuum relief valves in cold-water-inlet piping.
- E. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 15 Section "Plumbing Specialties" for drain valves.
- F. Install thermometers on water heater inlet and outlet piping
 - 1. Exception: Omit thermometers for the following:
 - a. Commercial, point-of-use, water heater inlet piping.
 - b. Water heater with thermometer outlet piping.
- G. Fill water heaters with water.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect hot- and cold-water piping with shutoff valves and unions. Connect hot-water-circulating piping with shutoff valve, check valve, and union.
- D. Make connections with dielectric fittings where piping is made of dissimilar metal.

- E. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections. Arrange wiring to allow unit service.
- 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 Standards.

3.4 FIELD QUALITY CONTROL

- A. In addition to manufacturer's written installation and startup checks, perform the following:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Verify that piping system tests are complete.
 - 3. Check for piping connection leaks.
 - 4. Check for clear relief valve inlets, outlets, and drain piping.
 - 5. Check operation of circulators.
 - 6. Test operation of safety controls, relief valves, and devices.
 - 7. Energize electric circuits.
 - 8. Adjust operating controls.
 - 9. Adjust hot-water-outlet temperature settings. Do not set above 140 deg F (60 deg C) unless piping system application requires higher temperature.
 - 10. Balance water flow through manifolds of multiple-unit installations.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters.
 - 1. Train Owner's maintenance personnel on procedures for starting and stopping, troubleshooting, servicing, and maintaining equipment.
 - 2. Review data in maintenance manuals. Refer to Division 1.
 - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 15837

CENTRIFUGAL FANS

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 centrifugal fans and vent sets.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base air ratings on actual site elevations.
- B. Operating Limits: Classify according to AMCA standards.

1.4 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 Division 1.

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. 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.

1.6 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.

1.7 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 Division 7.

1.8 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, L₅₀ of 200,000 hours.
 - 2. Roller-Bearing Rating Life: ABMA 11, L₅₀ 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 Division 15 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 Division 15 Section "Mechanical Identification."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 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 Division 15 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 Division 1 Section "Closeout Procedures."
 - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 15855

DIFFUSERS, REGISTERS, AND GRILLES

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 ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
 - 1. Division 10 Sections for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 - 2. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
 - 3. Division 15 Section "Testing, Adjusting, and Balancing" for balancing diffusers, registers, and grilles.

1.3 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.

1.4 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.

1.5 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 16010

SUMMARY OF ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and other Division 15 Specification 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, electrical meter, disconnect 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. 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.

1.7 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 16020

BASIC ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions, Division 1 Specification Sections and all relevant documents shall form a part of this Division of the Specifications, and shall be incorporated in this Section and each Division 16 Section hereinafter as if repeated verbatim herein. All conditions imposed by these documents shall be applicable to all portions of the work under this Division. Certain specific paragraphs of said references may be referred to hereinafter in this Division. 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 Division 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 Division 16 of these Specifications.
- B. The work covered by this Division 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 Divisions of the Specifications for related work.

1.3 DEFINITION OF "CONTRACTOR"

- A. Where the word "Contractor" is used under any Section of this Division 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 Division of the Specifications. The Contractor shall specifically and distinctly assume, and does so 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 Division, 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 Division of the Specifications be similarly furnished, installed and connected under this Division, 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 Division 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 Division as related to the work of all other Divisions 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 Division.

1.11 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 1 of 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 Division with the work of other Divisions, 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 Division.
- 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 Division in strict accordance with the applicable provisions of Division 3, 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 Division 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 DIVISION'S EQUIPMENT

- A. Verify the electrical requirements of all equipment furnished under other Divisions, 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 completion of the job, 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 removed. Components shall be cleaned of oxidation. The inside and outside of all switchgear shall also be wiped clean with a lemon-oil rag after all other cleaning is complete.
- C. 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 blueline 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 sepias 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 16050

BASIC ELECTRICAL MATERIALS AND METHODS

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 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.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For electricity-metering equipment.
- B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

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. Comply with NFPA 70.

1.6 COORDINATION

- A. 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.
- B. 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.
- C. Coordinate electrical service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
 - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.
- C. 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, minimum.

2.2 CONCRETE BASES

- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
- B. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

2.3 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 RACEWAY AND CABLE INSTALLATION

- A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
- B. Install raceways and cables at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
- C. Use temporary raceway caps to prevent foreign matter from entering.
- D. 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.
- E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.
- F. Install raceways embedded in slabs 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. Install conduit larger than 1-inch trade size (DN27) 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.
- G. 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.
- H. Install telephone and signal system raceways, 2-inch trade size (DN53) and smaller, 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, in addition to requirements above.
- I. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch (1830-mm) flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.
- J. Set floor boxes level and trim after installation to fit flush to finished floor surface.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.4 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. 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.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

- H. 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.
- I. Simultaneously install vertical conductor supports with conductors.
- J. 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 (610 mm) from the box.
- K. 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.
- L. 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.
- M. 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

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. 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.

- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. 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 (51 mm) 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 (15-m) maximum intervals in straight runs, and at 25-foot (8-m) 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.
- E. 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.
- F. 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 (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.
- G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
 - 1. Phase A: Black.
 - 2. Phase B: Red.
 - 3. Phase C: Blue.
 - 4. Neutral: White.
 - 5. Ground: Green.
- H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
 - 1. Phase A: BROWN.
 - 2. Phase B: ORANGE.
 - 3. Phase C: YELLOW.
 - 4. Neutral: White with a colored stripe or gray.
 - 5. Ground: Green.

- I. 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.
- J. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.6 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.7 FIRESTOPPING

- A. 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 Division 7 Section "Firestopping."

3.8 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) 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 (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.9 CUTTING AND PATCHING

- A. 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.
- B. 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

- A. 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.
- B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.
1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
 2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
 3. 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.
 4. 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.
 5. 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

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.12 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. 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 16055

SITE ELECTRICAL

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions and Division 1 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 Division 1 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 Divisions 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. 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 16060

GROUNDING AND BONDING

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 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. Division 2 Section "Underground Ducts and Utility Structures" for ground test wells.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Data: For the following:
 - 1. Ground rods.
 - 2. Chemical rods.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. 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. 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.
- B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
- C. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 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. Racor, 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 Division 16 Section "Conductors and Cables."
- B. Material: copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. 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.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: stranded, unless otherwise indicated.
- G. 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.
- H. 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.
- I. 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. Ground Rods: Copper-clad steel.
 - 1. Size: 3/4 by 120 inches (19 by 3000 mm) in diameter.

- B. 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.
- C. Test Wells: Provide handholes as specified in Division 2 Section "Underground Ducts and Utility Structures."

PART 3 - EXECUTION

3.1 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.
- F. 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.
- G. 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. 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.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. 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.
- D. 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.
 - E. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
 - F. 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.
 - G. 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.
 - H. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
 - I. 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.
 - J. 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.
 - K. 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.
 - L. 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. 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.
- B. 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.
- C. 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.
- D. 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.
- E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
- F. 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.
- G. 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.
- H. 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. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
- B. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
- C. 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. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
 - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
 - e. 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. 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 Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions and Division 1 Specification sections, apply to work covered by this Section.
- B. Comply with Division 16 Sections, as applicable. Refer to other Divisions 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.
 - 1. 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.
 - 3. Wiring devices.
 - 4. Wiring.
 - 5. Three phase motor rotation.

1.3 SUBMITTALS

- A. Submit product data in accordance with Division 1 for products specified under PART 2 - PRODUCTS.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- B. Brady
- C. Panduit
- D. Thomas & Betts
- E. Seton

2.2 IDENTIFICATION

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 Division identification as to its given name, voltage and origination of service. Examples are as follows:

'LB'	'HD'
480Y/277V	480Y/277V
FED FROM 'MDP'	FED FROM 'MDP'
'RDP'	'TX-R'
208Y/120V	300 KVA, 480V to
FED FROM TX-R	208Y/120V
FED FROM 'MDP'	

3. Provide for each motor starter enclosure, circuit breaker enclosure, disconnect switch and any other similar equipment furnished under this Division, identification as to the specific load that it serves and the origination of service. Examples are as follows:

'CH-1'	'AHU-1'
FED FROM 'MDP'	FED FROM 'DPA'

4. Provide for each feeder protective device in each distribution panelboard and any other similar equipment furnished under this Division, 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.

B. Junction Boxes and Pull Boxes

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

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provided with a nameplate stating voltage and system served.

C. Wiring Device Wall Plates

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.

D. Wire Markers

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.

F. Rotation Tags

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

- A. Nameplates shall be properly attached to identify panelboards, feeder circuit breakers, disconnect switches, pull boxes and other similar equipment furnished under this Division.

3.3 WIRE MARKERS

- 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 16120

BUILDING WIRE AND CABLE

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 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 Division 16 Section "Basic Electrical Materials and Methods."
- G. Seal around cables penetrating fire-rated elements according to Division 7 Section "Firestopping."
- H. Identify wires and cables according to Division 16 Section "Basic Electrical Materials and Methods."
- I. Identify wires and cables according to Division 16 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 16130

RACEWAYS AND BOXES

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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
 - 1. 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.
 - 2. 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. Division 16 Section "Basic Electrical Materials and Methods" for raceways and box supports.
 - 2. Division 16 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. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Metal Conduit and Tubing:
 - a. Alflec 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. Arco 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. Wireway Covers: Screw – cover type flanged-and-gasketed type.
- E. Finish: Manufacturer's standard enamel finish.

2.5 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1.
- B. 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. 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 .
- B. 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. 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. Minimum Raceway Size: 3/4-inch trade size (DN21).
- C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.
- D. 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.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.
- G. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."
- H. Use temporary closures to prevent foreign matter from entering raceways.
- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- J. 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.
- K. 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.
- L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- M. 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.
- N. 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.
- O. 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.
- P. Tighten set screws of threadless fittings with suitable tools.
- Q. 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.
- R. 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.
- S. 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.
- T. 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.
- U. 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.
- V. 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.
- W. 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.
- X. 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.

- Y. Do not install aluminum conduits embedded in or in contact with concrete.
- Z. 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.
- AA. 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.
- BB. Set floor boxes level and adjust to finished floor surface.
- CC. Set floor boxes level and trim after installation to fit flush to finished floor surface.
- DD. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- EE. 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 16140

WIRING DEVICES

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 receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

- A. GFI: Ground-fault circuit interrupter.
- B. 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. Samples: For devices and device plates for color selection and evaluation of technical features.
- D. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

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. Receptacles for Owner-Furnished Equipment: Match plug configurations.
- B. 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. Straight-Blade and Locking Receptacles: Heavy-Duty grade. The device shall be 20-ampere, 125-volts, Nema configuration 5-20R, back and side wired.
- B. Special Receptacles for NEMA configuration refer to Manufacturer specs.
- C. 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.
- D. 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.
 - 1. Devices: Listed and labeled as isolated-ground receptacles.
 - 2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.

2.3 SWITCHES

- A. General
 - 1. Switches shall be toggle or decorative 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.
 - 1. Switches shall be SPST, DPST, 3-way or 4-way as indicated on the Drawings.
 - 2. 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. Control: Continuously adjustable slide, toggle, or rotary knob. Single-pole or three-way switch to suit connections.
 - 2. 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.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: 0.04-inch- (1-mm-) thick, Type 302, satin-finished stainless steel.
 - 3. Material for Unfinished Spaces: stainless steel.

2.5 FLOOR SERVICE FITTINGS

- A. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- B. 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. 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.
- F. Protect devices and assemblies during painting.
- G. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 16 Section "Electrical Identification."
- B. Comply with Division 16 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. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

- B. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
- C. 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. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. 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 16190

SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions and Division 1 Specification sections, apply to work covered by this Section.
- B. Comply with Division 16 Sections, as applicable. Refer to other Division 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

- B. Unistrut Corp.
- C. B-Line Systems, Inc.
- D. Midland Ross-Kindorf

2.2 MATERIALS

- A. Suspension Hangers

1.1 Suspension hangers for individual conduit runs shall be zinc plated formed steel type.

- B. Vertical Supports

1.1 Malleable iron one hole pipe straps shall be used for vertical runs.

- C. Clamps

1.1 Beam clamps shall be used for bar joists and beams.

- D. Anti-Vibration Hangers

1.1 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 ½"; 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 16500

Corrosive Areas: PVC; at factory apply a minimum of 10-mil-thick PVC coating, bonded to metal, inside and outside.

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:

NOMINAL CONDUIT SIZE	ROD DIAMETER
1/2" through 2"	1/4"
2-1/2" through 3"	3/8"
4" and 5"	1/2"

- 3 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".
- 4 Where numerous conduits are run parallel to one another, they may be supported from a trapeze type hanger arrangement with strut bottom.
- 5 Anti-vibration type hangers shall be provided for equipment as required to minimize vibration and/or as directed by the Architect/Engineer.

B. Supports

- 1 Support of hangers shall be by means of sufficient quantities of individual after set steel expansion shields, or beam clamps attached to structural steel.
- 2 Stiff-legs shall be furnished and installed in cases where support from overhead structure is not possible.
- 3 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.
- 4 Furnish and install complete any additional structural support steel, brackets, fasteners, etc., as required to adequately support all raceway and equipment.
- 5 Support of hangers from concrete slabs shall be by means of sufficient quantity of "U" brackets attached with after set expansion shields and bolts.
- 6 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 16440

DISCONNECT SWITCHES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions and Division 1 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 Division 1 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. Cutler – Hammer Products
- B. Square D Co.
- C. G.E

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

- A. Install disconnect switches where indicated shown or not shown.
- B. Install fuses in fusible disconnect switches.

END OF SECTION

SECTION 16442

PANELBOARDS

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 load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
 - 1. Lighting and appliance branch-circuit panelboards.
 - 2. Distribution panelboards.
- B. Related Sections include the following:
 - 1. Division 16 Section "Fuses."

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. 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. UL listing for series rating of installed devices.
 - e. 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. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- D. 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.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 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. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 EXTRA MATERIALS

- A. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. Square D Co.
 - c. G.E

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. Outdoor Locations: NEMA 250, Type 3R.
 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 3. 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. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- F. Bus: Hard-drawn copper, 98 percent conductivity.
- G. Main and Neutral Lugs: Copper mechanical type suitable for use with conductor material.
- H. Equipment Ground Bus: Copper and adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- J. Isolated Equipment Ground Bus: Copper and adequate for branch-circuit equipment ground conductors; insulated from box.
- K. Extra-Capacity Neutral Bus: Copper neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
- L. Split Bus: Vertical buses divided into individual vertical sections.
- M. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
- N. Gutter Barrier: Arrange to isolate individual panel sections.
- O. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.
- P. 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. 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. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISTRIBUTION PANELBOARDS

- A. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Protective Devices: Circuit breaker.
- C. 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. 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^2t 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.
- B. 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.
- C. 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. 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.
- E. Install filler plates in unused spaces.
- F. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Basic Electrical Materials and Methods" [Electrical Identification.]
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. 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. Rebalance 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 16475

FUSES

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 the following:
 - 1. Fuses.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each fuse type specified.
- C. Field test reports indicating and interpreting test results.
- D. Maintenance data for tripping devices to include in the operation and maintenance manual specified in Division 1.

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. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 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. 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. Manufacturers: Subject to compliance with requirements, provide fuses by one of the following:
 - 1. Cooper Industries, Inc.; Bussmann Div.

2. Eagle Electric Mfg. Co., Inc.
3. Ferraz Corp.
4. General Electric Co.; Wiring Devices Div.
5. Gould Shawmut.
6. 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. Motor Branch Circuits: Class RK1, time delay.
- B. 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 16511

INTERIOR LIGHTING

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 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. Certified results of laboratory tests for fixtures and lamps for photometric performance.
 - 3. Emergency lighting unit battery and charger.
 - 4. LED lights
 - 5. Types of lamps.
- B. 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.
- C. 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.
- D. Product Certificates: Signed by manufacturers of lighting fixtures certifying that products comply with requirements.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- F. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 1.

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. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

- A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract 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.

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. 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.
- C. 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 16521

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of exterior fixtures, poles, and supports. The terms “lighting fixtures”, “fixture” and “luminaire” are used interchangeably.

1.2 RELATED WORK

- A. Section CAST-IN-PLACE CONCRETE.
- B. Section SCHEDULE FOR FINISHES: Finishes for exterior light poles and luminaires.
- C. Section REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- D. Section LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
- E. Section GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- F. Section RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
- G. Section UNDERGROUND ELECTRICAL CONSTRUCTION: Underground handholes and conduits.
- H. Section LIGHTING CONTROLS: Controls for exterior lighting.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit six copies of the following in accordance with Section REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
 - 1. Shop Drawings:
 - a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
 - b. Material and construction details, include information on housing and optics system.
 - c. Physical dimensions and description.
 - d. Wiring schematic and connection diagram.
 - e. Installation details.
 - f. Energy efficiency data.

- g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
 - h. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.
 - i. Submit site plan showing all exterior lighting fixtures with fixture tags consistent with Lighting Fixture Schedule as shown on drawings. Site plan shall show computer generated point-by-point illumination calculations. Include lamp lumen and light loss factors used in calculations.
2. Manuals:
- a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
- a. Certification by the Contractor that the exterior lighting systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Aluminum Association Inc. (AA):
AAH35.1-06 Alloy and Temper Designation Systems for Aluminum
- C. American Association of State Highway and Transportation Officials (AASHTO):
32-LTS-6..... Structural Supports for Highway Signs, Luminaires and Traffic Signals
- D. American Concrete Institute (ACI):
318-05 Building Code Requirements for Structural Concrete
- E. American National Standards Institute (ANSI):
C81.61-09 Electrical Lamp Bases – Specifications for Bases (Caps) for Electric Lamps
- F. American Society for Testing and Materials (ASTM):
A123/A123M-12 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M-09..... Zinc Coating (Hot-Dip) on Iron and Steel Hardware
B108-03a-08 Aluminum-Alloy Permanent Mold Castings
C1089-13 Spun Cast Prestressed Concrete Poles
- G. Federal Aviation Administration (FAA):
AC 70/7460-IK-07 Obstruction Lighting and Marking
AC 150/5345-43F-06 Obstruction Lighting Equipment
- H. Illuminating Engineering Society of North America (IESNA):
HB-9-00 Lighting Handbook
RP-8-05 Roadway Lighting
LM-52-03 Photometric Measurements of Roadway Sign Installations
LM-72-10 Directional Positioning of Photometric Data

- LM-79-08..... Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
- LM-80-08..... Approved Method for Measuring Lumen Maintenance of LED Light Sources
- TM-15-07..... Backlight, Uplight and Glare (BUG) Ratings
- I. National Electrical Manufacturers Association (NEMA):
- C78.41-06 Electric Lamps – Guidelines for Low-Pressure Sodium Lamps
- C78.42-07 Electric Lamps – Guidelines for High-Pressure Sodium Lamps
- C78.43-07 Electric Lamps – Single-Ended Metal-Halide Lamps
- C78.1381-98 Electric Lamps – 70-Watt M85 Double-Ended Metal-Halide Lamps
- C82.4-02 Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps
(Multiple-Supply Type)
- C136.3-05 For Roadway and Area Lighting Equipment – Luminaire Attachments
- C136.17-05 Roadway and Area Lighting Equipment – Enclosed Side-Mounted Luminaires for
Horizontal-Burning High-Intensity-Discharge Lamps – Mechanical
Interchangeability of Refractors
- ICS 2-00 (R2005) Controllers, Contactors and Overload Relays Rated 600 Volts
- ICS 6-93 (R2006) Enclosures
- J. National Fire Protection Association (NFPA):
- 70-11 National Electrical Code (NEC)
- K. Underwriters Laboratories, Inc. (UL):
- 496-08 Lampholders
- 773-95 Plug-In, Locking Type Photocontrols for Use with Area Lighting
- 773A-06 Nonindustrial Photoelectric Switches for Lighting Control
- 1029-94 High-Intensity-Discharge Lamp Ballasts
- 1598-08 Luminaires
- 8750-09..... Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.6 DELIVERY, STORAGE, AND HANDLING

Provide manufacturer's standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 305 mm (12 inches) above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

Luminaires, materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

2.2 POLES

A. General:

1. Poles shall be as shown on the drawings, and as specified. Finish shall be as specified on the drawings.
2. The pole and arm assembly shall be designed for wind loading of (10 mph) minimum, as required by wind loading conditions at project site, with an additional 30% gust factor and supporting luminaire(s) and accessories such as shields, banner arms, and banners that have the effective projected areas indicated. The effective projected area of the pole shall be applied at the height of the pole base, as shown on the drawings.
3. Poles shall be //embedded// //anchor-bolt// type designed for use with underground supply conductors. Poles shall have handhole having a minimum clear opening of 65 x 125 mm (2.5 x 5 inches). Handhole covers shall be secured by stainless steel captive screws.
4. Provide a steel-grounding stud opposite handhole openings, designed to prevent electrolysis when used with copper wire.
5. Provide a base cover that matches the pole in material and color to conceal the mounting hardware pole-base welds and anchor bolts.
6. Hardware and Accessories: All necessary hardware and specified accessories shall be the product of the pole manufacturer.
7. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.

B. Types:

1. Pole – refer to light fixture schedule.

2.3 FOUNDATIONS FOR POLES

- A. Foundations shall be cast-in-place concrete, having 3000 psi minimum 28-day compressive strength.
- B. Foundations shall support the effective projected area of the specified pole, arm(s), luminaire(s), and accessories, such as shields, banner arms, and banners, under wind conditions previously specified in this section.
- C. Place concrete in spirally-wrapped treated paper forms for round foundations, and construct forms for square foundations.
- D. Rub-finish and round all above-grade concrete edges to approximately 6 mm (0.25-inch) radius.
- E. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings. Anchor bolts shall be in a welded cage or properly positioned by the tie wire to stirrups.
- F. Prior to concrete pour, install electrode per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.4 LUMINAIRES

- A. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and relamping.
- B. Illumination distribution patterns, BUG ratings and cutoff types as defined by the IESNA shall be as shown on the drawings.
- C. Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.
- D. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- E. Lamp sockets for high intensity discharge (H.I.D) fixture shall have locking-type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61-09 and UL 496-08.
- F. Pre-wire internal components to terminal strips at the factory.
- G. Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.
- H. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- I. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.
- J. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

2.5 LAMPS

- F. 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): ≥ 85 .
 - 4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating Engineering Society (IES) LM79 for photometric performance and LM80 for lumen maintenance and L70 life.//
- G. Mercury vapor lamps shall not be used.

2.6 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 μ s, 10kA/8 x 20 μ 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): ≥ 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 INSTALLATION

- A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer’s recommendations.
- B. Pole Foundations:
 1. Excavate only as necessary to provide sufficient working clearance for installation of forms and proper use of tamper to the full depth of the excavation. Prevent surface water from flowing into the excavation. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath, and the end of conduit.
 2. Set anchor bolts according to anchor-bolt templates furnished by the pole manufacturer.
 3. Install poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
 4. After the poles have been installed, shimmed, and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material. Provide a plastic or copper tube, of not less than 9 mm (0.375-inch) inside diameter through the grout, tight to the top of the concrete base to prevent moisture weeping from the interior of the pole.
- C. Install lamps in each luminaire.
- D. Adjust luminaires that require field adjustment or aiming.

3.2 GROUNDING

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

3.3 ACCEPTANCE CHECKS AND TESTS

Verify operation after installing luminaires and energizing circuits.

END OF SECTION

SECTION 16693

BRANCH CIRCUIT PANELBOARD POWER CONDITIONING SURGE PROTECTION DEVICE

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 Division 16 Sections, as applicable. Refer to other Divisions 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. 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 3rd 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.
- D. 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. 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.

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.

B. Electrical Requirements

- 1 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.
 - 2 Operating Frequency: The operating frequency range of the device shall be 47 to 63 Hertz.
 - 3 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.
 - 4 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

Location	Per Mode	120/208vac 3 phase	277/480vac 3 phase
	Surge Current Rating	VPR	VPR

Switchgear	200,000 amps	900v	1200v
Distribution Panel	150,000 amps	900v	1200v
Sub or Branch Panel	100,000 amps	900v	1200v

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.

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

2.1 MANUFACTURER

- 1 Square D
- 2 Cutler-Hammer
- 3 Current Technology
- 4 THOR SYSTEMS

2.2 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

2.3 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.

2.4 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.

2.5 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.

2.6 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.

2.7 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