

PROJECT NO. 26-0023 SPRINGVALE DOG PARK

BID DATE - WEDNESDAY AUGUST 5TH, 2026 2:30 PM

BID DOCUMENTS

BRIAN KORAL
CITY MANAGER
CITY OF EAST RIDGE, TENNESSEE
1517 TOMBRAS AVENUE
EAST RIDGE, TENNESSEE 37412



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BIDDER REQUEST FOR INFORMATION

Questions regarding the project or the Bid Documents must be in writing as required by the Instruction to Bidders. Questions must be in writing on this form and submitted to **Asa Engineering & Consulting, Inc. at 201 Cherokee Blvd., Suite 101, Chattanooga, Tennessee, 37405, email: Christy MacKenzie at cmackenzie@asaengineeringinc.com**. To be given consideration, the request must be received at least five (5) days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be emailed, with telephone or email verification, to all prospective bidders no later than three (3) days prior to the date fixed for the opening of bids. I will also be mailed at the request of the bidder. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his/her bid as submitted. All addenda so issued shall become part of the Contract Documents.

Contract: **SPRINVALE DOG PARK -EAST RIDGE**

Contract Number: **26-0023**

From: _____

Company: _____

Date: _____

CLARIFICATION IS NEEDED FOR THE FOLLOWING ITEMS:

(List Specification Section, Paragraph, Drawing Number and/or Detail Number)

END OF DOCUMENT

ADVERTISEMENT FOR BIDS

CITY OF EAST RIDGE, TENNESSEE
OWNER

Separate sealed bids for furnishing all supervision, materials, labor, tools, and equipment necessary for the construction of the following described project will be received by the City of East Ridge, at **1517 Tombras Ave, East Ridge, TN 37412**, until **2:30 p.m., local time**, on **Wednesday, August 5th, 2026**, and then publicly opened and read aloud:

**SPRINGVALE DOG PARK
CONTRACT NUMBER 26-0023**

The scope of work shall consist of the following major elements including, but not limited to:

Furnishing all supervision, materials, labor, tools, and equipment necessary for the grading, drainage, paving, concrete sidewalk and dog park amenity pads, fencing, restroom facilities, utilities, and landscaping associated with project.

Add Alternate Bid Item #1, #2, and #3 are shown in the enclosed Bid Summary exhibit.

Plans and contract documents will be available for distribution on, or before, **Friday July 10th, 2026**, by contacting Asa Engineering & Consulting, Inc., at (423)805-3700, or by emailing Christy MacKenzie at cmackenzie@asaengineeringinc.com.

A Pre-Bid Conference will be held, beginning at **10:00 a.m. on Monday July 20th, 2026**, at the City of East Ridge's City Hall, located at 1517 Tombras Avenue, East Ridge, Tennessee 37412. A site visit, as needed, will immediately follow the Pre-Bid conference. Bidders are encouraged to attend both the pre-bid conference and site visit.

All bidders must be licensed and shall comply with all requirements of the State of Tennessee Contractor's Licensing Act.

The City of East Ridge is an Equal Opportunity Employer.

CITY OF EAST RIDGE, TENNESSEE

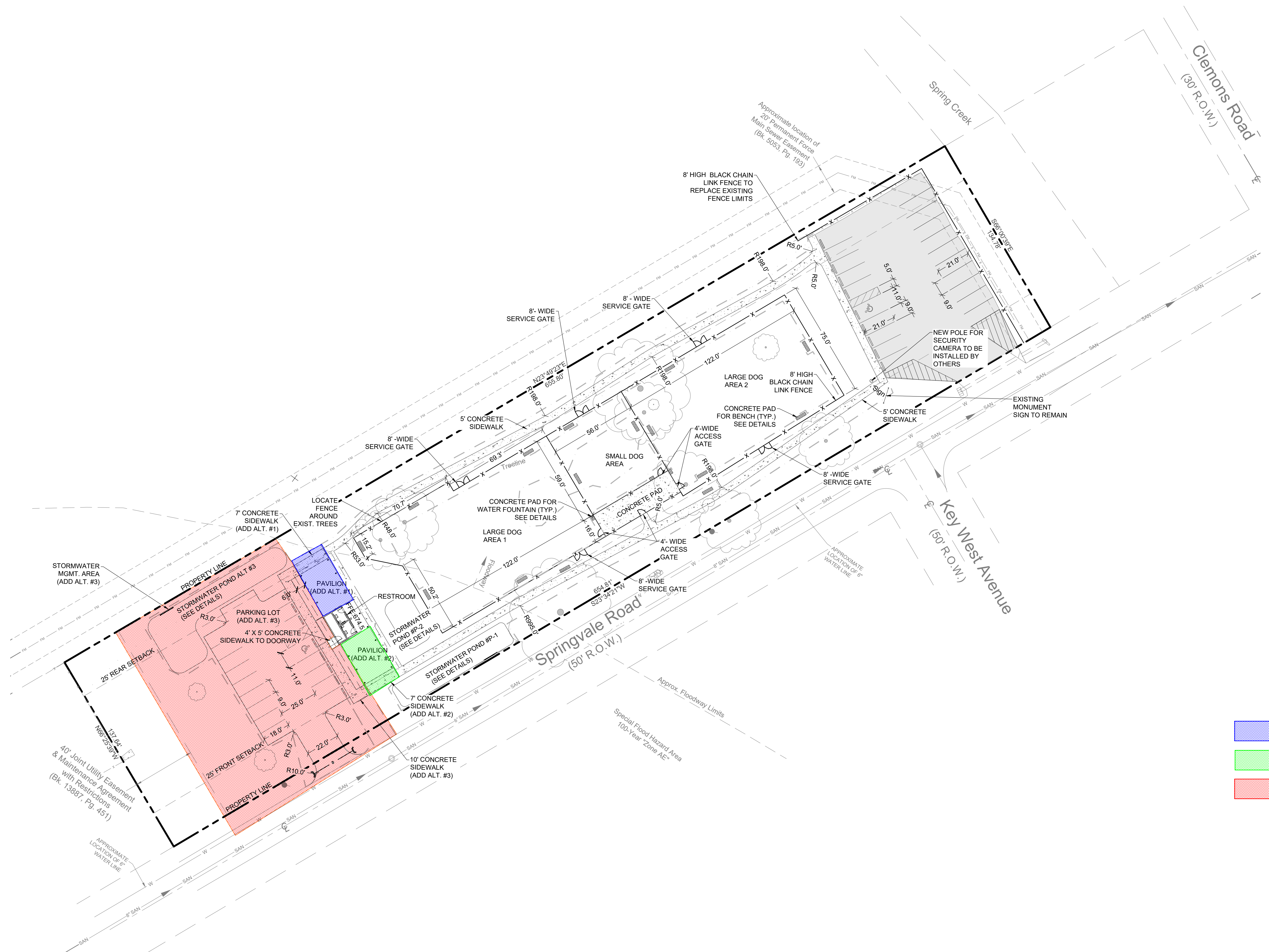
RECOMMENDED FOR APPROVAL:

APPROVED:

END OF DOCUMENT

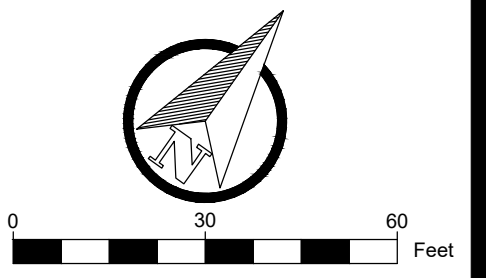
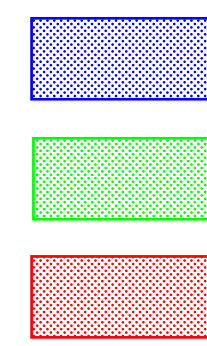
SPRINGVALE DOG PARK
 EAST RIDGE, TN 37412
 FOR
CITY OF EAST RIDGE

4/23/2019 1:44:04 PM | J:\01_P\Projects\2026-0023 East Ridge Springvale Dog Park\Engineering\Civil\Sheets\2 SITE PLAN.dwg |



BID SUMMARY:

1. BASE BID: INCLUDES GRADING, DRAINAGE, AND PAVING FOR THE CONCRETE SIDEWALK AND DOG PARK AMENITY PADS, FENCING, RESTROOM FACILITIES, UTILITY SERVICES, MILL AND OVERLAY OF EXISTING PARKING LOT, AND LANDSCAPING.
2. ALT. #1: INCLUDES WEST SIDE PAVILION BUILDING AND ADJACENT SIDEWALK ON WEST SIDE.
3. ALT. #2: INCLUDES EAST SIDE PAVILION BUILDING AND ADJACENT SIDEWALK ON EAST SIDE.
4. ALT. #3: INCLUDES NEW PARKING LOT, SIDEWALK SOUTH OF RESTROOMS, AND ASSOCIATED STORMWATER MANAGEMENT AREA.



ANY LOCATIONS OF UNDERGROUND UTILITIES AS SHOWN HEREON ARE BASED ON ABOVEGROUND STRUCTURES AND RECORD DRAWINGS PROVIDED THE SURVEYOR AND MAY VARY FROM LOCATIONS SHOWN HEREON. ADDITIONAL BURIED UTILITIES/STRUCTURES MY BE ENCOUNTERED. NO EXCAVATIONS WERE MADE DURING THE PROGRESS OF THIS SURVEY TO LOCATE BURIED UTILITIES/STRUCTURES. FOR INFORMATION REGARDING THESE UTILITIES, CONTACT THE APPROPRIATE AGENCIES.

No.	Revision/Issue	Date

PROJECT NO.	26-0023
DATE	07/01/2026
SCALE	AS SHOWN
DESIGNED BY	ASA
DRAWN BY	ASA
CHECKED BY	ASA
TITLE	BID SUMMARY EXHIBIT
SHEET NO.	EX-A

INSTRUCTIONS TO BIDDERS

1. General

Instructions to Bidders are also contained in other parts of these Contract Documents and apply with equal force to the instructions set forth in these Instructions to Bidders. All Bidders shall comply with every requirement, obligation, responsibility, and provision imposed on the Contractor by these Contract Documents even though said requirements, obligations, responsibilities, and provisions shall be complied with by the Contractor in part or in total prior to the opening of bids or the award of the Contract. If any Bidder fails to comply in every respect with any condition imposed on the Bidder or the Contractor, as the case may be, it is understood and agreed that the bid submitted may be declared by the Owner, at the sole discretion of the Owner without recourse, as non-responsive, and the Owner may award the Contract to the next lowest responsive and responsible bidder, or all bids may be rejected.

Definitions of terms used in these Instructions to Bidders and other Contract Documents are contained in the General Conditions of these Contract Documents.

2. Proposal Requirements and Conditions

The Bidder's attention is directed to Section 2, Proposal Requirements and Conditions, of the General Conditions of these Contract Documents which contain specific instructions to, and information for, Bidders. The instructions and information contained in said Section 2 are supplemented by that set forth herein and in other parts of these Contract Documents.

3. Qualification of Bidders

The Bidder must be capable of performing the work covered by these Contract Documents in a satisfactory manner and within the time specified. The Bidder shall furnish with his Bid, on forms contained in the Proposal, information and evidence required by the Owner for the Owner's use in determining the Bidder's qualifications for performing the work. The Bidder shall promptly furnish all additional information, evidence, or statements requested by the Owner, after the bids have been opened and evaluated, or his bid may be declared non-responsive.

If the Bidder is a subsidiary, division, or corporation, 50 percent or more of whose ownership is held by another corporation, firm, or person, the Bidder shall furnish the same information, evidence, and statements on the principal owner that are required to be submitted by the Bidder to the Owner by these Contract Documents.

The information and evidence required to be submitted by the Bidder shall include, but not be limited to: (1) financial statements; (2) list of subcontractors; (3) list of Bidder experience; and (4) lists of construction equipment available to the Bidder for performing the work.

4. Responsibility of Bidder to Inform Himself as to All Conditions Relating to the Work and the Project

The Bidder, by and through the submission of his Bid, agrees that he shall be held responsible: (1) for examining and fully understanding the Scope of Work, the Contract Documents, and all requirements thereof; (2) for having examined the site, the location, and the route of all proposed work; (3) for having familiarized himself fully with the construction schedule, site constraints, and the contractor's access requirements to the site; (4) for having satisfied himself as to the character of the work, the location, the surface and underground obstructions, the nature of the ground, subsurface water conditions, and all other subsurface conditions, and all other physical characteristics of the work and conditions relating thereto, in order that he may include in the prices bid, all costs pertaining to the work and thereby provide for the satisfactory completion thereof, including the removal, relocation, or replacement of any objects or obstructions which will be encountered in the performance of the work (based on the descriptions in the Specifications).

If Bidders fail to fully understand any clause or requirement of these Contract Documents, inquiry in writing must be made of the Engineer for his interpretations of the Contract Documents five (5) calendar days in advance of the submission of a bid. Failure on the part of Bidders to thoroughly acquaint themselves with the work to be performed and the conditions under which it will be performed shall not be considered as a valid excuse for claims of any kind after the award of the Contract.

5. Familiarity with Laws and Regulations

The Bidder is required to be familiar with all Federal, State, and Local laws, ordinances, rules, and regulations that in any manner affect the work. Ignorance on the part of the Bidder shall not, in any way, relieve him from responsibility for compliance with said laws and regulations or any of the provisions of these Contract Documents.

The Bidder's attention is directed to the fact that all applicable Federal, State, and Local laws, ordinances, rules, and regulations and the regulations of any agency of government having jurisdiction over the work, or any part thereof, shall apply to the work or the performance thereof, and that said laws and regulations shall be a part of these Contract Documents, the same as if herein repeated.

6. Time for Completion and Liquidated Damages

6.01 It is understood and agreed that time is of the essence of the Contract and the Bidder agrees to complete the work within the contract time specified in the Proposal, the Contract, and other Contract Documents.

6.02 Should the Contractor fail to complete the work under these Contract Documents within the time specified in the Proposal, the Contractor shall pay to the Owner, as liquidated damages and not as a penalty, the amount specified in

the Proposal per calendar day of default unless extensions of time granted by the Owner specifically provide for the waiving of liquidated damages.

7. Addenda

If a Bidder is in doubt as to the meaning of any of the Contract Documents or if he finds discrepancies or ambiguities in, or omissions from any of the Contract Documents, he shall immediately submit a written request at least five (5) calendar days in advance of the bid opening date to the Engineer for interpretation or clarification. Said request by the Bidder and reply by the Engineer in the form of an addendum shall be in conformance with the provisions of these Contract Documents. All addenda shall become a part of these Contract Documents and shall be attached to the front cover of this bound volume submitted by the Bidder as his bid. The issuance of a written addendum by the Engineer shall be the only method whereby an interpretation or clarification will be made. No oral clarifications by the Owner or the Engineer will be made. Each Bidder shall be bound by all addenda, whether or not received by him.

8. Preparation of Bids

All bids shall be submitted on the prescribed forms contained in this bound volume and shall include all items listed in the Table of Contents of this volume and all addenda. All blank spaces of the Proposal and required accompanying documents, certifications, and statements shall be filled in handwritten in ink or typewritten and completed as required by the provisions of these Contract Documents. Failure by the Bidder to fill in and complete all blanks and to supply all required information, documents, certifications, and statements may render the bid non-responsive, at the Owner's sole discretion without recourse, and the Owner may award the Contract to the next lowest responsive, responsible bidder or all bids may be rejected.

8.01 Proposal: The Proposal bound in this volume, together with other documents, certifications, and statements required with the submission of the bid, shall be the form on which the bid is submitted and may not be removed from this bound volume. Alternately the contractor may only submit the bid documents provided separately with these specifications. Items such as bid bonds may be stapled to the appropriate pages in the documents. Modification of the Proposal or accompanying documents, certifications, and statements, may render the bid non-responsive.

The Bidder must sign the Proposal in the space provided for the signature. If the Bidder is an individual, the words "doing business as _____" or "Sole Owner" should appear beneath such signature. In the case of partnership, the signature of at least one of the partners must follow the firm name, and the words "Member of the Firm" should be written beneath such signature. If the Bidder is a corporation, the title of the officer signing the Proposal in behalf of the corporation must be stated, and evidence of his authority to sign the Proposal must be submitted.

8.02 Proposal: The total base bid for the work described in these Contract Documents shall be the sum of the prices bid for the individual bid items in the Schedule I - Base Bid Items. Any Additive Alternate may be included in the Contract at the option of the City.

The amount of the total price or total bid for each individual bid item in the Schedule I - Base Bid Items will determine the lowest bid subject to qualification and other requirements of these Contract Documents, and the City may make multiple awards to the lowest bidder for each individual bid item.

The City reserves the right to make one award to the bidder whose total base bid (the sum of the bid prices bid for the individual bid items in Schedule I – Base Bid Items) is the lowest, subject to qualification and other requirements of these Contract Documents.

8.03 Sales Taxes: The attention of the Bidder is directed to the laws of the State of Tennessee. The Bidder shall include all applicable state and local sales taxes in the price bid. The Bidder will be required to comply with all applicable laws and to file any required exemption certificates.

8.04 Statement of Equipment: The Bidder shall fill out the Statement of Equipment, providing all the data requested on the form.

8.05 Financial Statement: The successful Bidder shall be required to submit a Financial Statement prior to award of the contract, if requested.

8.06 Statement of Bidder's Qualifications: The Bidder shall fill out the Statement of Bidder's Qualifications, providing all the data requested on the form.

8.07 Affidavit: The Bidder shall fill out and properly execute the Affidavit contained in the Proposal.

9. Bid Security

Each bid must be accompanied by a certified check or Bid Bond on the prescribed form included herein or an approved form in an amount not less than five percent (5%) of the amount of the bid, duly executed by the Bidder as principal and having as surety thereon a surety company acceptable to the Owner and the Owner's attorney and authorized to write such Bid Bond under the laws of the State of Tennessee. The certified checks or Bid Bonds of all unsuccessful Bidders, except the three lowest Bidders, will be returned after the opening of bids. The certified checks or Bid Bonds of the three lowest Bidders will be returned after the Owner and the accepted Bidder have executed the Contract and the accepted Bidder has filed an acceptable Contract Bond; or if the award of the Contract has not been made within 60 days after the date of the opening of bids, upon demand of any Bidder at any time thereafter, provided that he has not been notified of the acceptance of his bid.

Attorneys-in-Fact of other officers who sign bid bonds for a surety company must file with such bonds a certified copy of his power of attorney authorizing him to sign said bonds.

10. Obligation of Bidders

It is the obligation of the Bidder prior to submitting his bid:

- (1) To fully satisfy himself, using whatever means and methods he considers necessary or convenient, as to the requirements of these Contract Documents and the work covered hereunder.
- (2) To read and to be thoroughly familiar with the Drawings and other Contract Documents.
- (3) To comply with all requirements and provisions of these Contract Documents.
- (4) To make, from his own personal knowledge and experience, or professional advice, his own investigation of subsurface conditions.
- (5) To satisfy himself that the Drawings and other Contract Documents are adequate for the work to be performed hereunder.
- (6) To complete the Proposal and all accompanying documents, certifications, and statements as specified in these Contract Documents.

The failure of the Bidder to understand or comply with these obligations shall not relieve him from any responsibilities, duties, or obligations imposed by any provision of these Contract Documents. It is understood and agreed that the Bidder will not make any claims against the Owner or the Engineer for the Bidder's failure to comply with these requirements and that failure to comply may render the bid non-responsive at the Owner's sole discretion without recourse.

11. Submission of Bids

Each bid shall be submitted on the Proposal Form as furnished herein, together with a suitable bid security and with the required documents, certifications and statements, herein described.

Each bid must be submitted in a sealed envelope. In compliance with all the requirements of Chapter No. 135, Public Acts of 1945 of the General Assembly of the State of Tennessee, and House Bill No. 2180 (Public Chapter No. 882) known as the Contractor's Licensing Act of 1976, the envelope must also bear on the outside the following:

- (1) Name of the bidder
- (2) Address of the bidder
- (3) Name of Project for which bid is submitted;
- (4) Bidder's License Number and State of Registration

- (5) Bidder's License Date of Registration
- (6) Bidder's License Category or Classification; License Amount; and
- (7) Bidder's License Expiration Date.
- (8) The names of the bidder's Subcontractors for electrical, plumbing and heating, ventilating and air conditioning work (no more than one in each category) must also appear on the face of the envelope with the license classification, license number and expiration date shown for each one.

All envelopes containing bids that are not marked as described above will be declared non-responsive, will not be opened, will be returned to the Bidder unopened, and will be handled as described in Paragraph 14 herein.

If the bid is forwarded by mail, the sealed envelope containing the Proposal shall be enclosed in another envelope addressed to the **City of East Ridge, City Hall, 1517 Tombras Avenue, East Ridge, TN 37412.**

12. Modification of Bids

Bid modifications will be accepted from Bidders if addressed to the Owner and received prior to the opening of the bids.

Any Bidder may modify his bid by telegraphic communication at any time prior to the opening of bids, provided such telegraphic communication is received by the Owner prior to the opening of bids, and, provided further, the Owner is satisfied that a written confirmation of the telegraphic modification over the signature of the bidder was mailed prior to the opening of bids. The telegraphic communication should not reveal the bid price but should provide the addition or subtraction or other modification so that the final prices or terms will not be known by the Owner until the sealed bid is opened. If written confirmation is not received within two (2) calendar days from the opening of bids, no consideration will be given to the telegraphic modification.

13. Withdrawal of Bids

Any bid may be withdrawn prior to the time scheduled in the Advertisement for Bids for the opening thereof. A bid may also be withdrawn 60 days after the date of the opening of the bids, provided that the Bidder has not been notified that his bid has been accepted.

14. Opening of Bids

Bids will be publicly opened and read aloud at the time and place stated in the Advertisement for Bids. The officer whose duty is to open them will decide when the specified time has arrived, and no bids received thereafter will be considered. No responsibility will be attached to any officer for the premature opening of a bid not properly addressed and identified. Bidders or their authorized agents are invited to be present.

15. Right to Accept or Reject Bids

Bids which contain modifications to the Contract Documents, or which are incomplete, unbalanced, conditional, or obscure, or which contain additions not requested or irregularities of any kind, or which do not comply in every respect with the "Instructions to Bidders" and other Contract Documents, may be declared non-responsive and rejected at the sole discretion of the Owner without recourse. The Owner reserves the right to waive any informality, to evaluate the bids, to reject any or all bids, and to re-advertise for bids.

16. Non-responsive Bids

Any bid that does not fully comply, in every respect, with all provisions, instructions, conditions, and requirements of these Contract Documents may be declared to be non-responsive by the Owner, at the Owner's sole discretion and without recourse, and the Owner may award the Contract to the next lowest responsive and responsible Bidder, or all bids may be rejected.

A bid may be declared by the Owner to be non-responsive for, but not limited to, any of the following reasons:

- (1) Failure to fill out all blanks and complete the Proposal and required accompanying documents, certifications, and statements.
- (2) Modification or alteration of the Proposal or other Contract Documents.
- (2) Failure to furnish adequate information for the Owner to determine if the Bidder is qualified.
- (3) Submission of a qualified or conditional bid.
- (4) Failure to furnish information, evidence, and statements of the principal Owner when the Bidder is owned 50 percent or more by another firm, corporation, or person.
- (5) Submission of unrealistic data, erroneous data, inaccurate data, or data that cannot be documented or substantiated.
- (7) Lack of adequate financial resources and capabilities.
- (8) Failure to comply with the requirements of Article 20 of Instructions to Bidders.

17. Disqualification of Bidders

17.01 One Proposal: Only one Proposal from a person, firm, partnership, or corporation under the same or under different names will be considered. If it is

believed that a Bidder is interested in more than one Proposal for the work involved, all Proposals in which such a Bidder is interested will be declared non-responsive and will be rejected.

17.02 Collusion Among Bidders: If it is believed that collusion exists among the Bidders, the Proposals of all participants in such collusion will be declared non-responsive and will be rejected. Participants in such collusion will not be considered in future Proposals for the same work.

17.03 Debarred or Suspended Contractors: Bidders debarred or suspended by the City of East Ridge or who are debarred or suspended by operation of any other applicable state or federal law or regulation, are not eligible to be contractors or subcontractors to this contract.

17.04 Affidavit of No Collusion by Bidder: All bidders are required to execute a notarized affidavit of No Collusion by Bidder, and a bidder who fails to do so will be disqualified.

18. Criteria for Evaluation of Bids

A contract will be awarded, if it is awarded, to the lowest responsible and responsive bidder who submits the lowest bid for each individual bid item in Schedule I in accordance with the Contract Documents. It is understood and agreed that the Owner will determine, without recourse, which Bidder is the lowest responsible and responsive Bidder for each individual bid item. The Owner reserves the right to award a single contract to the Bidder whose total base bid (the sum of the prices bid for the individual bid items in Schedule I – Base Bid Items) is the lowest. In determining the Bidder or Bidders who will receive awards, the following specific criteria will be considered.

18.01 The Bidder shall maintain a permanent place of business. This requirement applies to the Bidder where the Bidder is a division of a corporation, or where the Bidder is owned, 50 percent or more, by a person, corporation, or firm.

18.02 The Bidder shall demonstrate that he has adequate construction management experience and sufficient equipment resources to properly perform the work under, and in conformance with, these Contract Documents. This evaluation will be based upon a list of completed or active projects and a list of construction equipment available to the Bidder to perform the work.

18.03 The Bidder shall demonstrate that he is familiar with the work covered by these Contract Documents.

18.04 The Bidder shall demonstrate that he has financial resources of sufficient strength to meet the obligations incident to the performance of the work covered by these Contract Documents. The Bidder shall complete the financial statement in the Proposal form. The ability to obtain the required Performance and Payment Bonds will not alone demonstrate adequate financial capability.

The Bidder may demonstrate financial capability by submitting a suitable financial statement of an Equity Partner, provided an agreement is executed binding the Bidder and said Equity Partner, jointly and severally, to fulfill all duties, obligations, and responsibilities of the Contractor covered by these Contract Documents if the Contract is awarded to the Bidder. The agreement shall be submitted with the Bid and shall be satisfactory to the Owner's Attorney, or the bid may be declared non-responsive.

18.05 The Bidder shall furnish all data required by these Contract Documents. Failure to do so may result in the Bid being declared non-responsive. Acceptance of the Bidder's documentation and substantiation or Contract Award by the Owner does not relieve the Bidder of liability for nonperformance as covered in the Contract Documents; nor will the Bidder be exempted from any other legal recourse the Owner may elect to pursue.

19. Award of Contract

Following the opening of bids, the Engineer will evaluate the proposals. After completion of the evaluation of the proposals the Engineer will recommend to the Owner that the Bidder who is both responsive and responsible and whose bid totals the lowest number of dollars, for each individual bid item in Schedule I, should be awarded a contract. The Owner reserves the right to award a multiple contract to the Bidder based on the total of Schedule I, individual Site Locations or a combination of Site Locations based on lowest bid per each site. The Engineer will notify all Bidders in writing of the Owner's intent to award a contract or contracts. The City Council in an open public session will pass a Resolution of award of the contract or contracts to the recommended bidder(s).

20. Liquidated Damages for Failure to Enter into Contract

The certified check or Bid Bond filed with and as a part of the Proposal will be forfeited to the Owner as agreed upon as liquidated damages if the Bidder to whom the Contract is awarded shall fail to execute the appropriate Contract Documents within ten (10) days following written notice to him that such forms are ready for execution.

21. Execution of Contract

Each Bidder to whom a Contract is awarded will be required to execute, in seven (7) counterparts, the prescribed Contract form, Performance Bond form, and Payment Bond form within ten (10) days from the date of notice to him that such forms are ready for execution.

22. Security for Faithful Performance of Contract

Simultaneously with his delivery of the executed Contract form to the Owner, the Bidder to whom the Contract has been awarded shall deliver to the Owner an executed Performance Bond on the prescribed form in the amount of one hundred percent (100%) of the total

amount of the accepted total bid as security for the faithful performance of his Contract, including meeting performance guarantees and for the repair and/or replacement of defective or deficient work for a period of one (1) year after the date of final acceptance of the work. At the same time, the successful Bidder shall deliver to the Owner an executed Payment Bond on the prescribed form in the amount of one hundred percent (100%) of the total amount of the accepted total bid as security for the payment of all persons performing labor or furnishing materials in connection therewith. The surety on said bonds or other security shall meet the requirements of these Contract Documents and shall be satisfactory to the Owner and the Owner's Attorney.

END OF DOCUMENT

SECTION 00201

CONTRACTOR'S IDENTIFICATION
(ALL BLANKS MUST BE FILLED. USE N/A AS NECESSARY)

This form shall be attached to the sealed envelope containing the Bid. All prime contractors and contractors for electrical, plumbing, and heating, ventilation, and air conditioning contracts for bids of \$25,000 or more and/or masonry items for \$100,000 or more are required to complete this form pursuant to TCA 62-6-119. Failure to provide all of this information on the sealed envelope shall be considered a non-responsive Bid and shall not be opened or shall automatically disqualify such bid.

BIDDER:

Complete the following for all applicable Electrical, Plumbing, Masonry and Heating, Ventilation, and Air Conditioning Subcontractors: Prime Contractor must fill in space below when performing Electrical, Plumbing, or Heating, Ventilation, and Air Conditioning Sub-Contractor work for any bids of \$25,000 or more; and for Masonry for any bids of \$100,000 for more:

Name: _____

Subcontractor: _____

Address: _____

Tennessee License No.: _____

License Expiration Date: _____

License Classification: _____

If TaxID Number (TIN) issued, list below. Otherwise, list Owner's Social Security Number (SSN).

TaxID Number: _____

Subcontractor: _____

Tennessee License No.: _____

Tennessee License No.: _____

License Registration Date: _____

License Expiration Date: _____

License Expiration Date: _____

License Classification: _____

Monetary Limit: _____

_____ (\$ _____)

Subcontractor: _____

Classification : _____

Tennessee License No.: _____

License Expiration Date: _____

License Classification: _____

SEALED BID PROPOSAL FOR :

City of East Ridge
City Hall
1517 Tombras Ave
East Ridge, TN 37412
Phone Number: (423) 867-7711

Contract Name: Springvale Dog Park
Contract Number: 26-0023

Date & Time: 2:30 P.M. on August 5, 2026

BID PROPOSAL

Project Description: Springvale Dog Park; Project No. 26-0023

Proposal _____

_____ hereinafter called "Bidder"), doing business as

a corporation, a partnership, an individual

To the City of East Ridge, Tennessee (hereinafter called "Owner").

The Bidder, in compliance with your Advertisement for Bids for the construction of this project having examined the Drawings and Specifications with related documents, other Contract Documents, and the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby proposes to furnish all supervision, labor, materials and equipment, and to construct the project in accordance with the Contract Documents, within the time set forth therein, and at the price stated on the attached Bid Schedule. This price is to cover all expenses including overhead and profit incurred in performing the work required under the Contract Documents, of which this proposal is a part.

Bidder hereby agrees to begin work under this contract on or before a date to be specified in written "Notice to Proceed" of the Owner and to fully complete the project within the number of consecutive calendar days stipulated in the specifications. Bidder further agrees to pay liquidated damages as hereinafter provided in the General Conditions.

Bidder acknowledges receipt of the following addenda:

Bidder agrees to perform all the construction of the project for the attached price complete with appurtenant and accessory work described in the specifications and as shown on the plans.

The attached price shall include all supervision, labor, materials, equipment, bailing, shoring, removal, overhead, profit, insurance, etc., to cover the finished work of the several kinds called for.

Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

The Bidder agrees that this bid shall be firm and may not be withdrawn for a period of 60 calendar days after the scheduled closing time for receiving bids.

Upon receipt of written notice of the acceptance of this bid, Bidder will execute the formal contract attached within ten (10) days and deliver a surety bond or bonds as required by the General Conditions. The bid security attached in the sum of 5% of the total bid is to become the property of the Owner in the event the contract and bond are not executed within the time above set forth, as liquidated damages for the delay and additional expense to the Owner caused thereby.

Respectfully submitted:

By _____
Signature

Title _____

Business Address

ATTEST:

Name _____ (SEAL)
(Please Type)

Title _____

Note: Attest for a corporation must be by the corporate secretary; for a partnership, by another partner; for an individual, by a Notary.

END OF DOCUMENT

BID SCHEDULE

Spingvale Dog Park

CONTRACT NUMBER 26-0023

EAST RIDGE, TENNESSEE

DESCRIPTION

Furnishing all labor and materials for the grading, drainage, paving, concrete sidewalk and dog park amenity pads, fencing, restroom facilities, utilities and landscaping associated with the project.
Include Lump Sum Bids for Add Alternate Numbers 1, 2 and 3.

TOTAL BASE BID

LUMP SUM BASE BID \$ _____

ADD ALT. #1 BID \$ _____

ADD ALT. #2 BID \$ _____

ADD ALT. #3 BID \$ _____

Note : Dollar amounts are to be shown in both words and figures. In case of discrepancy, dollar amounts shown in words will govern.

Contractor certifies that he has reviewed the plans and specifications, and that all items of work not specifically listed in the Bid Schedule are included in the prices for the various items listed on the Bid Schedule.

BIDDER: _____ DATE: _____

BY: _____ (Signature) TITLE: _____

ADDRESS: _____

CITY: _____ STATE: _____ ZIP CODE: _____

TELEPHONE NUMBER: _____

**SPRINGVALE DOG PARK
PROJECT NO. 26-0023**

Contractor shall familiarize himself with the project and be comfortable that the bid price provided is adequate to perform the proposed work based on the estimated quantities listed in the plans. The quantities listed in the plans are based on GIS information and survey data. Reimbursement for quantity overages will be paid at the appropriate contract unit price below (scale tickets required).

Work for each bid item shall include all work proposed in the plans.

ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	ITEM TOTAL
1	TOTAL LUMP SUM BASE BID	L.S.	1		
TOTAL BASE BID, CONTRACT 26-0023 _____					
<i>Proposed start date:</i> _____					
ALTERNATE ADD / DEDUCT					
ALTERNATE PRICING FOR ADDITIONAL WORK ITEMS NOT INCLUDED IN THE BASE BID					
<i>If the project is to start after the fall of 2022, then TDOT Special Provision 109B Bituminous Material Index will be utilized.</i>					
ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	ITEM TOTAL
1	ADD ALTERNATE NO. 1 BID	L.S.	1		
2	ADD ALTERNATE NO. 2 BID	L.S.	1		
3	ADD ALTERNATE NO. 3 BID	L.S.	1		

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____

as Principal, and _____

as Surety, are hereby held and firmly bound unto City of East Ridge, Tennessee, as Owner in the penal sum of five percent of the total bid for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that whereas the Principal has submitted to City of East Ridge, Tennessee, a certain Bid attached hereto and hereby made a part hereof to enter into a contract in writing for the construction of **Contract Number 26-0023, Springvale Dog Park Project.**

NOW, THEREFORE,

- (a) If said Bid shall be rejected, or in the alternate,
- (b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and Surety have executed this Bond by causing their respective names to be hereunto subscribed and their seals to be hereunto affixed by their duly authorized officers, on this the _____ day of _____, 2026.

CONTRACTOR - PRINCIPAL:

By _____

Name _____

(Please Type)

Title _____

(SEAL)

SURETY:

By _____

Name _____

(Please Type)

Title _____

WITNESS:

Name _____

(Please Type)

(SEAL)

Title _____

Note: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

END OF DOCUMENT

00302-2

**CERTIFICATION OF BIDDER REGARDING EQUAL EMPLOYMENT OPPORTUNITY
INSTRUCTIONS**

This certification is required pursuant to Executive Order 11246 (30 F. R. 12319-25). The implementing rules and regulations provide that any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or subcontract subject to the Equal Opportunity Clause; and, if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the bidder has not filed a compliance report due under applicable instructions, such bidder shall be required to submit a compliance report within seven calendar days after bid opening. No contract shall be awarded unless such report is submitted.

CERTIFICATION BY BIDDER

Bidder's Name: _____

Address: _____

-
1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause. Yes___ No___
 2. Compliance reports were required to be filed in connection with such contract or subcontract. Yes___ No___
 3. Bidder has filed all compliance reports due under applicable instructions, including SF-100. Yes___ No___
 4. If answer to Item 3 is "No," please explain in detail below.

Certification -- The information above is true and complete to the best of my knowledge and belief.

Name and Title of Signer (Please Type)

Signature

Date

END OF DOCUMENT

00303-1

STATEMENT OF BIDDER'S QUALIFICATIONS

All questions must be answered, and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information he desires. Attach all additional sheets to these Contract Documents.

1. Name of Bidder.
2. Permanent main office address.
3. When organized.
4. If a corporation, where incorporated.
5. How many years have you been engaged in the contracting business under your present firm or trade name?
6. Contracts on hand: (Schedule these, showing amount of each contract and the appropriate anticipated dates of completion.)
7. General character of work performed by your company.
8. Have you ever failed to or been directed not to complete any work awarded to you? If so, where and why, and which project?
9. Have you ever defaulted on a contract? If so, where, and why and which project?
10. List the most important projects recently completed by your company, stating the approximate cost for each, and the month and year completed. (See form 00400-(2))
11. List your major equipment available for this contract.
12. List experience in construction work similar in importance to this project.

13. Background and experience of the principal members of your organization, including officers.

14. Credit available: \$ _____

15. Give bank reference: _____

16. Will you, upon request, submit a detailed financial statement and furnish any other information that may be required by the City of East Ridge?

17. The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the City of East Ridge in verification of the recitals comprising this Statement of Bidder's Qualifications.

Dated this _____ day of _____, 2026.

Name of Bidder

By _____

Title _____

State of _____

County of _____

_____ being duly sworn deposes and says that he is
_____ of _____

and that the answers to the foregoing questions and all statements therein contained are true and correct.

Subscribed and sworn to before me this _____ day of _____, 2026.

Notary Public

(SEAL)

My Commission Expires:

(Date)

END OF DOCUMENT

STATEMENT OF REFERENCES

List three (3) projects constructed by your company within the last five (5) years that are of similar scope and size as this project.

Project 1: _____

Description: _____

Approximate Cost: _____ Completed: _____

Client or Owner Contact: _____

Title: _____ Phone: _____

Project 2: _____

Description: _____

Approximate Cost: _____ Completed: _____

Client or Owner Contact: _____

Title: _____ Phone: _____

Project 3: _____

Description: _____

Approximate Cost: _____ Completed: _____

Client or Owner Contact: _____

Title: _____ Phone: _____

END OF DOCUMENT

STATEMENT OF EQUIPMENT

I/We hereby, certify that all machinery and equipment necessary to perform the scope of work contained in these contract documents is either owned by me/us or that we have made arrangements to obtain the same from others. I/We further agree that I/we will furnish a complete list of equipment/machinery with kind/size/capacity/ownership, should the owner request the same.

Signed: _____

Name: _____

Title: _____

END OF DOCUMENT

PARTNERSHIP CERTIFICATE

STATE OF _____

COUNTY OF _____

On this _____ day of _____, 2026, before me personally appeared _____

_____ known to me to be the person who executed the above instrument, who, being by me first duly sworn, did depose and say that he is a general partner in the firm of _____

_____ and that said firm consists of himself and _____

_____ and that he executed the foregoing instrument on behalf of said firm for the uses and purposes stated therein, and that no one except the above named members of the firm have any financial interest whatsoever in said proposed contract.

Subscribed and sworn to before me, this _____ day of _____, 2026.

Notary Public

My Commission Expires:

END OF DOCUMENT

CORPORATE CERTIFICATE

I, _____, certify that I am the Secretary of the corporation named as Contractor in the foregoing proposal; that _____, who signed said proposal in behalf of the Contractor was then _____ of said corporation; that said proposal was duly signed for and in behalf of said corporation by authority of its Board of Directors, and is within the scope of its corporate powers; that said corporation is organized under the laws of the State of _____.

Subscribed and sworn to before me, this _____ day of _____, 2026.

Notary Public

My Commission Expires:

END OF DOCUMENT

Chapter No. 817 (HB0261/SB0377). "Iran Divestment Act" enacted.
Vendor Disclosure and Acknowledgement

By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each bidder is not on the list created pursuant to § 12-12-106.

(SIGNED) _____

(PRINTED NAME) _____

(BUSINESS NAME) _____

(DATE) _____

(SIGNED) _____

(PRINTED NAME) _____

(BUSINESS NAME) _____

(DATE) _____

END OF DOCUMENT

STATEMENT OF LICENSE CERTIFICATE

Each Contractor Bidding Shall Fill In and Sign the Following:

This is to certify that _____ has fully complied with all the requirements of Chapter No. 135, Public Acts of 1945 of the General Assembly of the State of Tennessee and House Bill No. 2180 (Public Chapter No. 822), known as the Contractors Licensing Act of 1976. The Contractor's license number and other information outlined in the Information for Bidders, expiration date, and that part of classification applying to the bid shall appear on the envelope containing the bid; otherwise the bid will not be considered.

The State Board for Licensing General Contractors issued to _____

Certificate No. _____, which expires on _____, 20__.

Signed: _____

Name: _____

Title: _____

END OF DOCUMENT

JOINT VENTURE QUESTIONNAIRE

In the event a joint venture bid is submitted, the following questions shall be answered, submitted with the bid and signed by the owner, partner, officer, representative, or agent of each joint venturer.

1. What is the separate bonding capability of each member of the joint venture?
2. What other work is in progress by total contract dollar amount and percentage of completion for each joint venturer?
3. Are there any particular risks associated with this Contract which contributed to the decision to joint venture, and if so, what?
4. Has consideration been given to utilization of a subcontract as opposed to formation of a joint venture, and if so, why was the joint venture format chosen?
5. Has either member of the joint venture been separately awarded a contract by the City of East Ridge, and if so, what was the most recent contract awarded to each?
6. What will be the contribution of each participant in the joint venture with respect to personnel, equipment, and other resources of each company allocated to this Contract?
7. What will be the specific contribution of each participant of the joint venture for the completion of work to be performed and material to be supplied under this Contract?
8. Will there be separate management for the joint venture? If not, which company will supervise, or how will the contract be supervised?
9. Why will the joint venture be more efficient than the possibility of both companies separately bidding and either company being awarded the contract separately?

10. Does the formation of the joint venture promote competition on this Contract, and if so, how?

11. Has the joint venture, or any participant therein, received any legal advice with respect to the antitrust implications of formation of a joint venture, and if so, from what attorneys?

_____	_____
Name of Joint Venturer	Name of Joint Venturer
By _____	By _____
Title _____	Title _____

State of _____

County of _____

_____ being duly sworn deposes and says that he is _____ of _____

and _____ being duly sworn deposes and says that he is _____ of _____

and that the answers to the foregoing questions and all statements therein contained are true and correct. Subscribed and sworn to before me this _____ day of _____, 2026.

Notary Public

My Commission Expires:

(Date)

(SEAL)

END OF DOCUMENT

AFFIDAVIT OF NO COLLUSION BY PRIME BIDDER

**CONTRACT NUMBER 26-0023
FOR THE CITY OF EAST RIDGE**

STATE OF _____

COUNTY OF _____

The undersigned, _____, having been
duly sworn, deposes and states as follows:

1. I am the (title) _____
(sole owner, a partner, president, secretary, etc.) of _____

(Name of Corporation) (Partnership) (Limited Partnership) (Joint Venture) which is a
_____ (Corporation) (Proprietorship)
(Partnership) (Limited Partnership) (Joint Venture) in good standing formed under the law of
_____ (State of Incorporation or formation),
hereinafter referred to as "bidder."
2. I am authorized to make this affidavit on behalf of said bidder, and I have personal
knowledge of the matters set forth herein.
3. On _____, 2026, said bidder is submitting a bid to the
City of East Ridge for the above captioned contract. This bid was prepared under my
personal supervision and direction. During the preparation of the bid, I have taken
affirmative steps to inquire about the circumstances of the bid preparation in general and
about any contacts between or among this bidder and any other bidders or prospective
bidders in particular.
4. I am aware of the Federal and State laws including without limitation, the Sherman Act (15
U.S.C. 1) and the Tennessee antitrust laws (T.C.A. 47-25-101, et seq.), which make it illegal to
agree to fix or rig bids or otherwise agree to restrain competition in bidding for contracts
with the City of East Ridge. I am aware in particular that violations of the Sherman Act are

AFFIDAVIT OF NO COLLUSION BY PRIME BIDDER

**CONTRACT NUMBER 26-0023
FOR THE CITY OF EAST RIDGE**

federal crimes punishable by a fine of up to \$1.0 million for a corporation, and a fine of up to \$100,000 for an individual or by imprisonment not exceeding three years, or both.

5. I hereby certify and attest that the bid identified in paragraph 3 is based solely upon the independent knowledge, expertise and business judgment of the bidder acting through its officers and agents and is not the product of, nor was it prepared in connection with, any contract, combination, conspiracy, understanding or collusion between or among any other bidder or prospective bidder on said contract.

Signature

Subscribed and sworn to before me this _____ day of _____, 2026.

Notary Public

My Commission Expires: (SEAL)

END OF DOCUMENT

AFFIDAVIT OF NO COLLUSION BY SUBCONTRACTOR

**CONTRACT NUMBER 26-0023
FOR THE CITY OF EAST RIDGE**

STATE OF _____

COUNTY OF _____

The undersigned, _____, having been
duly sworn, deposes and states as follows:

1. I am the (title) _____
(sole owner, a partner, president, secretary, etc.) of _____

(Name of Corporation) (Partnership) (Limited Partnership) (Joint Venture) which is a
_____ (Corporation) (Proprietorship)
(Partnership) (Limited Partnership) (Joint Venture) in good standing formed under the law of
_____ (State of Incorporation or formation),
hereinafter referred to as "subcontractor."
2. I am authorized to make this affidavit on behalf of said subcontractor, and I have personal
knowledge of the matters set forth herein.
3. On _____, 2026, said subcontractor is submitting a bid
to the City of East Ridge for the above captioned contract. This bid was prepared under my
personal supervision and direction. During the preparation of the bid, I have taken
affirmative steps to inquire about the circumstances of the bid preparation in general and
any other subcontractor or prospective subcontractors in particular.
4. I am aware of the Federal and State laws including without limitation, the Sherman Act (15
U.S.C. 1) and the Tennessee antitrust laws (T.C.A. 47-25-101, et seq.), which make it illegal to
agree to fix or rig bids or otherwise agree to restrain competition in bidding for contracts
with the City of East Ridge. I am aware in particular that violations of the Sherman Act are

AFFIDAVIT OF NO COLLUSION BY SUBCONTRACTOR

**CONTRACT NUMBER 26-0023
FOR THE CITY OF EAST RIDGE**

federal crimes punishable by a fine of up to \$1.0 million for a corporation, and a fine of up to \$100,000 for an individual or by imprisonment not exceeding three years, or both.

5. I hereby certify and attest that the bid identified in paragraph 3 is based solely upon the independent knowledge, expertise and business judgment of the bidder acting through its officers and agents and is not the product of, nor was it prepared in connection with, any contract, combination, conspiracy, understanding or collusion between or among any other subcontractor or prospective subcontractor on said contract.

Signature

Subscribed and sworn to before me this _____ day of _____, 2026.

Notary Public

My Commission Expires: _____ (SEAL)

END OF DOCUMENT

SECTION 00486

DRUG-FREE WORKPLACE AFFIDAVIT OF PRIME BIDDER

STATE OF _____

COUNTY OF _____

Comes the affiant after having first been duly sworn and testifies as follows:

1. My name is _____ I hold the principal office of
_____ for _____
(Name of Principal Office) (Name of Bidding Entity)

2. _____ has submitted a bid to
the _____
(Name of Bidding Entity)
City of East Ridge for the construction of Contract:

SPRINGVALE DOG PARK; CONTRACT NO. 26-0023

3. _____ employs more than five (5)
employees.
(Name of Bidding Entity)

4. In accordance with Tenn. Code Ann. §50-9-113, this is to certify that
_____ has in effect at the time of its submission of
(Name of Bidding Entity)
a bid to perform the construction of the City of East Ridge project identified above,
a drug-free workplace program that complies with Title 50, Chapter 9 of the Tennessee
Code.

5. This affidavit is made on personal knowledge.

Further the affiant saith not this _____ day of _____, 2026.

Signature

Subscribed and sworn to before me this _____ day of _____,
2026.

Notary Public

My Commission Expires:

(Date)

(SEAL)

END OF DOCUMENT

CONTRACT

ARTICLES OF AGREEMENT entered into this _____ day of _____, 2026, between the CITY OF EAST RIDGE, TENNESSEE, hereinafter called the City, and _____, hereinafter called the Contractor.

ARTICLE I. The Contractor hereby contracts and agrees to furnish all supervision, labor, materials and equipment and execute in a thorough and workmanlike manner, complete in every respect, in accordance with the Drawings, Specifications and other Contract Documents made therefor and hereto attached, and to the satisfaction of the City of East Ridge, or its successor, all of the Work shown, specified and otherwise required in these contract documents, to-wit:

Contract No. 26-0023
SPRINGVALE DOG PARK

ARTICLE II. The prices shown in the Bid Schedule shall be the amount of the compensation to the Contractor for the proper and satisfactory completion of the work specified herein, including all contingencies, in full conformity with the Contract Documents. This compensation shall be full payment for the performance of the work and the furnishing of labor, materials, transportation, supplies, tools, equipment, taxes, employee benefits, incidentals, services, and other items necessary or convenient for completion of the work in a satisfactory and acceptable manner, and within the intent of these Contract Documents.

ARTICLE III. The Contractor agrees that he has informed himself fully of the conditions relating to the construction and labor under which the work will be or is now being performed, and this Contractor must employ, so far as possible, such methods and means in the carrying out of his work as will not cause any interruption or interference with any other contractor.

ARTICLE IV. All work and material required under this Contract shall be in such quantities, kinds and qualities, and in such places, and of such dimensions and forms as may be designated by the plans and specifications, or by the working plans provided by the Engineer.

ARTICLE V. The purchase of all materials, the delivery of same, and all incidental expenses which may arise during the construction and finishing of said work above specified, shall be at the sole cost and expense of the Contractor.

ARTICLE VI. All materials which the said Contractor may procure or deliver upon or in the vicinity of said work herein specified to be incorporated in and become a part of said improvement, shall, from the time of such procurement or delivery become the property of the City of East Ridge, except any surplus which shall remain over the final completion of this Contract.

ARTICLE VII. The Contractor hereunder contracts and agrees to complete the whole of the work contemplated in this Contract in **one hundred eighty (180) calendar days**. Time of the completion of the work is the essence of the Contract, and the Contractor is prepared to make completion of the work in such quantity and on such dates as are herein specified, and the parties having agreed, after estimates, that the sum of **two Hundred dollars and no cents (\$200.00)** per day would be liquidated damages in case of the Contractor's failure to perform, now, therefore, the aforementioned sum per day, not as a penalty but to be considered and taken as liquidated damages suffered by the City of each day's delay in completion of this Contract.

ARTICLE VIII. It is agreed that the Contractor will not assign, transfer, or sublet the said work or any part thereof without the written consent of the City of East Ridge.

ARTICLE IX. Estimates shall be made every thirty (30) days during the progress of the work by the Contractor and submitted to the Engineer for his approval. When, in the Engineer's judgment, the estimate shall represent a fair value of such work done in accordance with the provisions of this contract, the Contractor shall be paid ninety-five (100%) percent.

ARTICLE X. An omission to disapprove the work poorly done, at the time of a monthly or other estimate, by the Engineer shall not be construed into an acceptance of any defective work.

All documents bound herein and all other documents not bound herein but given to Contractor in connection with the work shall be and are hereby made a part of this contract. These contract documents shall include, but not be limited to, the following: the Contract, Advertisement for Bids, Instructions to Bidders, Bid Proposal and Proposal Documents, Bid Bond, Performance Bond, Payment Bond, Certificates, General Provisions, Supplementary General Provisions, Specifications, Drawings, Addenda, Change Orders, Notice to Proceed, and Specifications, Drawings, and Engineering Data furnished to the Contractor.

IN TESTIMONY WHEREOF, the said parties have hereunto set their hands and seals the day and year first above written.

Attest:

CITY OF EAST RIDGE

_____ By: _____
City Manager

CONTRACTOR

Name

Attest:

_____ By: _____

Title

CITY FINANCE OFFICER'S CERTIFICATE

I do hereby certify that the funds required to be paid by the City under this contract have been appropriated or a loan authorized and have been encumbered and will be available as needed for payment.

This _____ day of _____, 2026.

City Finance Officer

CITY ATTORNEY'S APPROVAL

This contract approved as to form and legality this the ____ day of _____, 2026.

City Attorney

END OF DOCUMENT

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that _____

_____, a
(Name and Address of Contractor)

_____, of the State of _____,
(Corporation, Partnership, or Individual)

the "Principal," and _____
(Name and Address of Surety)

_____, the "Surety," are held and firmly bound unto
the City of East Ridge, Tennessee (the "Owner") existing under and by virtue of the laws of the
State of Tennessee, in the sum of _____

(\$ _____) in lawful money of the United States, for the payment of which sum
in lawful money of the United States well and truly to be made we do hereby bind ourselves,
our heirs, executors, administrators, successors, and assigns jointly and severally.

The condition of this obligation is such that whereas Principal has entered into a certain
Contract with the Owner, dated as of the _____ day of
_____, 2026, which is by reference incorporated in and made a part
hereof as fully as if copied here verbatim, for the following work:

Contract No. 26-0023
SPRINGVALE DOG PARK

NOW, THEREFORE, if the Principal shall in all respects comply with and perform all the terms and conditions of the Contract (which includes the Drawings, Specifications, and Contract Documents) and such alterations as may be made in said contract as the documents therein provide for, during the original term thereof and any extensions thereof which may be granted by the Owner, with or without notice to Surety, and during the one-year warranty period, and if Principal shall satisfy all claims and demands and shall fully indemnify, protect, defend, save and hold harmless the Owner, the Engineer, and their agents and employees against and from all costs, expenses, damages, injury, or conduct, want of care, skill, negligence, or default, including compliance with performance guarantees and patent infringement by the Principal, then this obligation shall be void; otherwise, Principal and Surety jointly and severally agree to pay to Owner any difference between the sum to which the Principal would be entitled on completion of the contract and that which the Owner may be obliged to pay for the completion of the work by contract or otherwise, together with any damages, direct or indirect, or consequential, which Owner may sustain on account of such work, or on account of the failure of the Principal to keep and execute all provisions of the Contract.

Principal and Surety further bind themselves, their heirs, executors, administrators, and assigns, jointly and severally, that if the Principal shall keep and perform its agreement to repair or replace defective work or equipment during the warranty period of one (1) year as provided, then this paragraph shall be void; but if default shall be made by Principal in the performance of its contract to so repair or replace said work, then this paragraph shall be in effect and Owner shall have and recover from Principal and its Surety damages for all defective conditions arising by reason of defective materials, work, or labor performed by or on the account of Principal and it is further understood and agreed that this obligation shall be a continuing one against the Principal and Surety hereon, and that successive recoveries may be had hereon for successive breaches until the full amount shall have been exhausted; and it is further understood that the obligation therein to maintain said work shall continue throughout said maintenance period, and the same shall not be changed, diminished, or in any manner affected from any cause during said time; and to fully indemnify, protect, defend, save and hold harmless the Owner, the Engineer, and their agents and employees for any damages it may be caused to pay on account of injury to person, loss of life or damage to property.

And the Surety, for value received, hereby stipulates and agrees that the obligations of the Surety and this Bond shall in no way be impaired or affected by any extension of time, modification, omission, addition, or change in or to the contract, the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provision thereof, or by any assignment subletting or other transfer thereof, or of any part thereof, of any work to be performed, or of any moneys due to become due thereunder; and the said Surety does hereby waive notice of any and all such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts, and transfer, and hereby stipulates and agrees that any and all things done and omitted to be done by and in relation to executors, administrators, successors, assignees, subcontractors, and other transferees shall have the same effect as to said Surety as though done or omitted to be done by and in relation to the Principal.

IN WITNESS WHEREOF, the Principal and Surety have executed this Bond by causing their respective names to be hereunto subscribed and their seals to be hereunto affixed by their duly authorized officers, on this the _____ day of _____, 2026.

CONTRACTOR - PRINCIPAL:

By _____

Name _____
(Please Print or Type)

Title _____

ATTEST:

Name _____
(Please Print or Type)

(SEAL)

Title _____

Note: Attest for a corporation must be by the corporate secretary; for a partnership by another partner; for an individual by a Notary.

SURETY:

By _____

Name _____
(Please Print or Type)

Title _____

WITNESS:

Name _____
(Please Print or Type)

(SEAL)

Title _____

Note: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

END OF DOCUMENT

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that _____

_____, a
(Name and Address of Contractor)

_____, of the State of _____,
(Corporation, Partnership, or Individual)

the "Principal," and _____
(Name and Address of Surety)

_____, the "Surety," are held and firmly bound unto
the City of East Ridge, Tennessee (the "Owner") existing under and by virtue of the laws of
the State of Tennessee, in the sum of _____

(\$ _____) in lawful money of the United States, for the payment of which
sum in lawful money of the United States well and truly to be made we do hereby bind
ourselves, our heirs, executors, administrators, successors, and assigns jointly and
severally.

The condition of this obligation is such that whereas Principal has entered into a
certain Contract with the Owner, dated as of the _____ day of _____,
2026, which is by reference incorporated in and made a part hereof as fully as if copied
here verbatim, for the following work:

Contract No. 26-0023

SPRINGVALE DOG PARK

NOW, THEREFORE, if the Principal shall fully pay for all the labor and materials used by said Principal or any immediate or remote subcontractor or furnisher of labor or materials under him in the performance of the work in lawful money of the United States as the same shall become due, including all amounts due for materials, lubricants, oil, gasoline, electricity, coal and coke, repairs on machinery, equipment, and tools, consumed or used in connection with performance of the work and all insurance premiums and other charges incurred under said contract, then this obligation shall be void; otherwise to remain in full force and effect.

Principal and Surety further bind themselves, their heirs, executors, administrators, and assigns, jointly and severally, that they shall promptly make payments of all taxes, licenses, assessments, contributions, penalties, and interest thereon, when, and if, the same may be lawfully due the State of Tennessee or any County, Municipality, or political subdivision thereof by reason of and directly connected with the performance of the Contract, or any part thereof.

And the Surety, for value received, hereby stipulates and agrees that the obligations of the Surety and this Bond shall in no way be impaired or affected by any extension of time, modification, omission, addition, or change in or to the contract, the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provision thereof, or by any assignment subletting or other transfer thereof, or of any part thereof, of any work to be performed, or of any moneys due to become due thereunder; and the said Surety does hereby waive notice of any and all such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts, and transfer, and hereby stipulates and agrees that any and all things done and omitted to be done by and in relation to executors, administrators, successors, assignees, subcontractors, and other transferees shall have the same effect as to said Surety as though done or omitted to be done by and in relation to the Principal.

IN WITNESS WHEREOF, the principal and Surety have executed this Bond by causing their respective names to be hereunto subscribed and their seals to be hereunto affixed by their duly authorized officers, on this the _____ day of _____, 2026.

SIGNATURES ON NEXT PAGE

CONTRACTOR - PRINCIPAL:

By _____

Name _____

(Please Print or Type)

Title _____

ATTEST:

Name _____

(Please Print or Type)

(SEAL)

Title _____

Note: Attest for a corporation must be by the corporate secretary; for a partnership by another partner; for an individual by a Notary.

SURETY:

By _____

Name _____

(Please Print or Type)

Title _____

WITNESS:

Name _____

(Please Print or Type)

(SEAL)

Title _____

Note: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

END OF DOCUMENT

CITY OF EAST RIDGE



CHANGE ORDER

Contract No.: _____
 Contractor: _____
 Project Name: _____

Change Order No.: _____
 Date: _____
 Council Res. #'s: _____
 (Attach Copies)
 Purchase Order # _____

Check Reason for Change Order

- Error/Omission
- Field Condition
- Field Dispute Settlement
- Owner Request
- Value Engineering
- Other: _____

Contract Days Changed: _____

Revised Completion Date: _____

Original Contract Amount \$ _____
 Net Change by Previous C.O.s \$ _____
 Contract Amount Prior to this C.O. \$ _____
 Total Amount of this C.O. \$ _____
NEW CONTRACT AMOUNT \$ _____

Description / Justification (Add more pages if necessary)

The terms and conditions of this Change Order, including the cost and time contained herein, constitute a full accord and complete satisfaction for all costs and time of performance related to the work described or referenced herein, including but not limited to, all delay and impact costs for the entire Project resulting from this Change Order. Except as amended herein, all provisions of the Contract remain in full force and effect.

APPROVALS

CONTRACTOR		CITY OF EAST RIDGE	
Signature _____	Date _____	Signature _____	Date _____
TITLE _____		TITLE _____	
ENGINEER / ARCHITECT		CITY OF EAST RIDGE	
Signature _____	Date _____	Signature _____	Date _____
TITLE _____		TITLE _____	

CITY OF EAST RIDGE

CR# _____

Date Issued: _____

PO#: _____

CHANGE REQUEST FORM (CRF)

Contract No. _____
Project Name: _____
Engineer: _____
Contractor: _____

Requested By: _____
Drawing: _____
Problem Desc: _____

Revised Scope Description/Details

Contractor Acknowledgement:	
<input type="checkbox"/> No Change in Contract Amount is required.	<input type="checkbox"/> A Change in Contract Amount is required: _____
<input type="checkbox"/> No Change in Contract Time is required.	<input type="checkbox"/> A Change in Contract Time is required: _____ days
_____ INSPECTOR	_____ CONTRACTOR
Change in Contract Amount is within the Contingency Amount authorized under Resolution No. _____ <input type="checkbox"/> Yes <input type="checkbox"/> No _____	Proceed with Execution <input type="checkbox"/> Yes <input type="checkbox"/> No _____
_____ ENGINEER	_____ CITY OF EAST RIDGE



CR# _____
Date Issued: _____
PO#: _____

CHANGE REQUEST FORM (CRF)

Contract No. _____
Project Name: _____
Engineer: _____
Contractor: _____

Requested By: _____
Drawing: _____
Problem Desc: _____

Revised Scope Description/Details

Contractor Acknowledgement:	
<input type="checkbox"/> No Change in Contract Amount is required.	<input type="checkbox"/> A Change in Contract Amount is required: _____
<input type="checkbox"/> No Change in Contract Time is required.	<input type="checkbox"/> A Change in Contract Time is required: _____ days
_____ INSPECTOR	_____ CONTRACTOR
Change in Contract Amount is within the Contingency Amount authorized under Resolution No. _____ <input type="checkbox"/> Yes <input type="checkbox"/> No _____	Proceed with Execution <input type="checkbox"/> Yes <input type="checkbox"/> No _____
_____ ENGINEER	_____ CITY OF EAST RIDGE

CERTIFICATE OF PROPERTY RESTORATION

Project _____ Date _____
Contractor _____
Property Owner _____
Property Address _____

The contractor for this project has cleaned up and restored my property to my satisfaction where the property was disturbed during construction.

- I agree
- I do not agree (please explain below)

Property Owner Date

Witness Date

Please explain why you do not agree:

Note: A copy will be forwarded to the Contractor if the Property Owner is not satisfied with the restoration for further action.

CERTIFICATE OF SUBSTANTIAL COMPLETION

Contract No. _____ Engineer's Project No. _____

Project _____

Contractor _____

Contract For _____ Contract Date _____

This Certificate of Substantial Completion applies to all Work under the Contract documents or to the following specified parts thereof:

To _____
Owner

And To _____
Contractor

The work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR AND ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on:

(Date of Substantial Completion)

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents. When this certificate applies to a specified part of the Work the items in the tentative list shall be completed or corrected by CONTRACTOR within _____ days of the above date of Substantial Completion.

Recommended by _____
Engineer/Architect Date

Recommended by _____
Project Manager Date

GENERAL PROVISIONS

SECTION 1. DEFINITION OF TERMS

- 1.1 Definitions. Wherever the words, forms or phrases defined or pronouns used in their stead, occur in these specifications, in the contract or in the advertisement or any document, or instrument herein contemplated or to which these specifications apply, the intent and meaning shall be construed and interpreted as set forth in this section.
- 1.2 Addenda. Any change in specifications after advertisement for bids which modify or interpret the contract documents, drawings or specifications by additions, deletions, clarifications, or modifications. After issuance, any addenda shall become a part of the specifications, as much as though fully contained therein.
- 1.3 Administrator. The City Manager of the City of East Ridge under whose general administration and observation this contract is being performed.
- 1.4 Award. The formal acceptance of the proposal of the lowest responsible bidder by the City Council, subject to the execution and approval of a satisfactory contract and the required bonds therefor, and following such other conditions as may be specified or otherwise required by law.
- 1.5 Bid. The offer or proposal of the Bidder submitted on the prescribed Bid Proposal Form setting forth the Contract Price(s) for the work to be performed under these Contract Documents.
- 1.6 Bonds. Bid, Performance, and Payment Bonds and other instruments of security to be furnished by the contractor in accordance with the Contract Documents.
- 1.7 Change Order. A written agreement, executed by the City, the Contractor, the Engineer and the Architect authorizing an addition, deletion, or revision of the work within the general scope of the Contract Documents or authorizing an adjustment in the contract price or the contract time. This "change order" becomes a part of the contract when properly executed and approved.
- 1.8 City. The City of East Ridge, Tennessee.
- 1.9 City Attorney. The person duly authorized by the City of East Ridge to act in the capacity of City Attorney, his authorized designee, or special counsel to the City, acting severally within the scope of the particular duties entrusted to them.
- 1.10 Contract. The written agreement between the City and the Contractor for the performance of the work in accordance with the requirements of the Contract Documents, and for the payment of the agreed consideration therefore. Whenever, in any portion of the Contract Documents, a requirement of the Contract is stated, it shall be interpreted to mean a requirement of the Contract Documents as defined herein, unless

the context indicates the more restricted definition of that portion of the Contract Documents which is captioned "Contract."

- 1.11 Contract Documents. The Contract, Advertisement for Bids, Instructions to Bidders, Bid Proposal and Proposal Documents, Bid Bond, Performance Bond, Payment Bond, Certificates, General Provisions, Supplementary General Provisions, Specifications, Drawings, Addenda, Change Orders, Notice to Proceed, and Specifications, Drawings and Engineering Data furnished by the Contractor and accepted by the Owner. Whenever, in any portion of the Contract Documents, the terms "plans and specifications" or "specifications" or "contract" or words of like import appear, they shall be interpreted to mean "Contract Documents" as defined herein unless the context indicates that a more restrictive designation of a particular portion of the Contract Documents is intended.
- 1.12 Contract Time. The number of calendar days allowed by these Contract Documents, including authorized time extensions, for the completion of the work sufficient to be accepted as substantially complete by the Owner. The Contract Time shall begin ten (10) days after the date of issuance of the Notice to Proceed.
- 1.13 Contractor. The person, firm, or corporation whose proposal is accepted by the Owner and who entered into a Contract with the Owner for performance of the work covered by and in conformance with these Contract Documents.
- 1.14 Engineer. The City Engineer (or when retained by the City, an Architect or consulting engineer) and his duly authorized assistants, observers, inspectors or administrators acting severally within the scope of the particular duties entrusted to them.
- 1.15 Inspector. An authorized representative of the Engineer assigned to make necessary observations of the work performed by the Contractor.
- 1.16 Multiple Awards. The City reserves the right to award more than one contract from a single solicitation. Multiple Awards are the formal acceptance by the City Council of the proposal of the lowest responsible bidder for each individual bid item, subject to the execution and approval of a satisfactory contract and the required bonds therefore, and following such other conditions as may be specified or otherwise required by law.
- 1.17 Owner. The City of East Ridge, Tennessee.
- 1.18 Plan or Plans. All of the drawings pertaining to the contract showing the scope and characteristics of the work or a part thereof, including such supplementary drawings as the Engineer may issue in order to elucidate other drawings or for the purpose of showing the changes in the work or for showing details not shown thereon.
- 1.19 Shop Drawings. All drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by the Contractor, a Subcontractor, a Manufacturer, a Supplier, or a Distributor, which illustrate how specific portions of the work shall be fabricated or installed. Shop drawings may also mean detail drawings, working drawings, construction drawings, and engineering data.

- 1.20 Specifications. The written directions, provisions and requirements contained herein pertaining to the method and manner of performing the work or to the quantities or qualities of materials, equipment, construction systems, standards or workmanship to be furnished under the contract.
- 1.21 Special Provisions. The special clauses setting forth conditions or requirements peculiar to the specific project, supplementing the General Provisions and taking precedence over any condition or requirements of the General Provisions with which they are in conflict.
- 1.22 Subcontractor. The person, firm, or corporation having a direct contract with the Contractor or with any other Subcontractor for performing a part of the work covered by these Contract Documents at the site.
- 1.23 Substantial Completion. The date of completion of the work in conformance with the Contract Documents, as determined by the Owner or Engineer, when the project or a specified part thereof can be utilized for the purposes for which it is intended.
- 1.24 Supplemental General Provisions. Modifications to these standard General Conditions.
- 1.25 Surety or Sureties. The corporate body which is bound by such bonds as are required with and for the contractor, and which engages to be responsible for the entire and satisfactory fulfillment of the contract and for any and all requirements as set out in the specifications, contract or plans.
- 1.26 The Work. The Work, including the furnishing of labor, materials, tools, and incidentals, necessary or required to complete the improvement in conformity with the directions, provisions and requirements of the specifications, limitations and conditions of the contract and in accordance with the intent of the plans.
- 1.27 Working Day. Any day, other than a legal holiday or Sunday, on which the approximate normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the work, unless work be suspended for causes beyond the contractor control.

SECTION 2. PROPOSAL REQUIREMENTS AND CONDITIONS

- 2.1 Contents of Proposal Form. The City will furnish bidders with proposal forms which will state the general location and description of the contemplated work.
- 2.2 Interpretation of Estimate. The quantities of the work and materials shown on the proposal form or on the plans are believed to approximately represent the work to be performed and materials to be furnished and are to be used for comparison of bids. Payment to the contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased or portions of the work omitted as hereinafter provided without in any way invalidating the bid prices. When the Bid

Proposal Form contains the provision for receiving bids based on a lump sum price, the Contractor shall be held responsible for having prepared his own estimate of the quantities necessary for the satisfactory completion of the work specified in these Contract Documents and for having based the lump sum price bid on his estimate of quantities.

- 2.3 Examination of Documents and Site of the Work. Bidders are advised that the plans, specifications, estimates, addenda and bulletins of the Engineer shall constitute all the information which the City will furnish. No other information given by the City or any official thereof, prior to the execution of the contract shall ever become a part of or change the contract, plans, specifications or estimates or be binding upon the City. Bidders are required, prior to submitting any proposal, to read carefully the specifications, the proposal, and other contract documents; to examine carefully all estimates open for examination and all plans on file in the Engineer's office; to visit the site of the work, to examine carefully local conditions; to inform themselves by their independent research of the difficulties to be encountered and judge for themselves the accessibility of the work and all attending circumstances affecting the cost of doing the work or the time required for its completion and obtain all information required to make an intelligent proposal. Bidders shall rely exclusively upon their own estimates, investigation and other data which are necessary for full and complete information upon which the proposal may be based. It is mutually agreed that submission of a proposal will be evident that the bidder has made the examination and investigations required herein.
- 2.4 Preparation of Proposal. The bidder shall submit his proposal on the forms furnished by the City with all blank spaces in the proposal form correctly filled in. Bid prices shall be either typed or legibly written with ink, both in words and in numerals, for which it is proposed to do the work contemplated or furnish the materials required. In case of conflict between words and numerals, the words will govern. Proposals shall be submitted in a sealed envelope which has the completed "Contractor's Identification" form securely attached thereto.
- 2.5 Proposal Guaranty. Proposals will not be considered unless accompanied by a certified or cashier's check on a duly organized bank payable to the order of the City of East Ridge, Tennessee, or bidding bond made by some bonding company authorized to transact business in the State of Tennessee, for a sum of not less than five percent of the total amount of the bid. The proposal guaranty is required as evidence of good faith and as a guarantee that, if awarded the contract, the bidder will execute the contract and furnish the required bonds within ten (10) days after the award.
- 2.6 Filing of Proposal. No proposals will be considered by the City unless they are filed in sealed envelopes with the City within the time limit for receiving proposals as stated in the advertisement and shall be made on proposal forms attached to Specifications, together with the Contract Documents, Bid Bond, and Statement of Compliance with General Contractors Licensing Law and other required miscellaneous forms, all of which are to be sealed in an envelope addressed to the City of East Ridge, Tennessee, with the completed "Contractor's Identification" form securely attached thereto.

Each proposal must contain the full name and address of each person, firm or corporation interested therein. In case of a partnership, the name and address of each partner must be stated. The firm, corporation or individual name of the bidder must be signed in the space provided for the signature on the proposal blank. In case of a corporation, the title of the officer signing must be stated, and the person signing shall also state under the laws of what State the corporation was chartered and the names and titles of the officers having authority, under the by-laws, to sign contracts. The proposal shall also be attested by its Secretary. In case of a partnership or firm, the signature of at least one of the partners must follow the firm name.

- 2.7 Withdrawal of Proposal. Permission will not be granted to withdraw or modify any proposal after it has been filed and before time set for opening of proposals. Requests for non-consideration must be made in writing addressed to and filed with the City before the time set for opening the proposals. After other proposals are opened and read, the proposal for which withdrawal is properly requested will be returned unopened.
- 2.8 Opening of Proposals. The proposals filed with the City will be opened at the time stated in the advertisement. Bidders are invited to attend the meeting at the time set for opening of proposals, at which time they should make any protests as to procedure followed in inviting bids.
- 2.9 Irregular Proposals. Proposals will be considered irregular if they show any omissions, alterations of forms, additions or conditions not called for, unauthorized alternate bids or irregularities of any kind. However, the City reserves the right to waive technicalities and make the award in the best interest of the City.
- 2.10 Rejection of Proposals. The City reserves the right to reject any or all proposals, and all proposals submitted are subject to this reservation.
- 2.11 Disqualification of Bidders. Bidders may be disqualified and their proposal not considered for any of the following specific reasons:
 - (a) Failure to complete and sign any of the following forms:
 - Equipment Statement
 - State License Certificate
 - Proposal
 - Affidavit of No Collusion by Bidder
 - (b) Where more than one proposal for an individual, firm, partnership or corporation is filed under the same or different names and where such proposals are not identical in every respect.
 - (c) Where the bidder is in arrears on any existing contracts, failed to satisfactorily perform on existing or previous contracts, has an interest in any litigation or disputes against the City, or having defaulted on a previous contract.
 - (d) A failure to have adequate equipment.

- (e) Uncompleted work which in the judgment of the City will hinder or prevent prompt completion of additional work, if awarded.

Nothing herein shall be deemed to limit the discretion of the City to determine whether or not a bidder not hereby disqualified is the lowest responsible bidder.

2.12 Conditions Precedent to Award of Contracts. The following stipulations shall all and severally be conditions precedent to the award by the City of East Ridge of all contracts for construction, to-wit:

- (a) No member of the City Council nor any officer, director or other person whose duty it is to vote for, let out, overlook or in any manner superintend this contract and who is related to said member within the third degree by either consanguinity or affinity, nor any other official who may be directly interested in this contract or work of any kind whatsoever under its direction. "Directly interested" means any contract with the official himself or with any business in which the official is the sole proprietor, a partner, or the person having the controlling interest. "Controlling interest" shall include the individual with the ownership or control of the largest number of outstanding shares owned by any single individual or corporation.
- (b) It shall not be lawful for any officer, director, or other person whose duty it is to vote for, let out, overlook, or in any manner to superintend any work or any contract in which the City shall or may be interested, to be indirectly interested in any such contract unless the officer publicly acknowledges his interest and rescues himself from any of his duties which include the consideration of, voting on, letting out, overseeing, or superintending the work or contract giving rise to the conflict. "Indirectly interested" means any contract in which the officer is interested but not directly so, but includes contracts where the officer is directly interested but is the sole supplier of goods or services in a municipality or county. (See T.C.A. Section 12-4-101, et seq.)
- (c) The essence of all the contracts shall be excellence of quality, integrity and durability of the completed product as specified; and the contractor hereunder shall be held responsible therefor.
- (d) The contractor shall maintain and guarantee the integrity of the completed work for a full period of one year after the completion as set forth more fully in Section 4 of these General Provisions.
- (e) The decisions of the Engineer, as to quality, integrity and durability of the work shall be final and conclusive as to all parties to said contract, whether it be directly by and between the contractor and said City or by and between him and another party; and said Engineer shall have full authority to condemn by written notice to contractor, or his agent or foreman on job, and shall order the removal, reconstruction and restoration of all work that in his opinion, is in any respect inferior, defective or faulty, or that shows signs of disintegration and failure, at any time before final estimate is

issued and payment made therefor, or within a period of one year after the completion and acceptance thereof in writing by the City.

- (f) Contractor shall remove, reconstruct and restore all such condemned work in full conformance with the specifications, and in complete compliance with the requirements of the official notice, in writing, of said Engineer relating thereto, and within the period of time designated in the notice.

Should the contractor neglect, refuse, or fail to remove, reconstruct and restore all of the defective work so condemned and rejected, within the period of time, as required by said official notice, then and in event of such failure on contractor's part, whether said work was executed by contract directly with the City or by private contract directly with other parties, the City of East Ridge will look to and require, respectively, the surety on the Performance Bond, executed by the contractor under contract directly with said City, to make good and have all such defective and condemned work removed, reconstructed and restored in complete compliance with the requirements of the official notice of said Engineer to that effect; and likewise, in the event that such work was done under private contract, as aforesaid, the City of East Ridge will look to and require the surety on the Performance Bond executed by said contractor to make good and have all such defective and condemned work removed, reconstructed and restored in complete compliance with the requirements of the official notice of said Engineer to that effect, in each instance as the case may be.

- (g) The lump sum bid by the contractor for any and all work and the compensation to be paid therefore shall cover and include the cost of all materials, forms, supports, labor, work and things necessary for a complete workmanlike job, and shall also include the cost of all services, duties and obligations of said contractor and of the corresponding surety on the Performance Bond collateral therewith as stipulated in subsections above set out, to the satisfaction and approval of the Engineer.

SECTION 3. AWARD AND EXECUTION OF CONTRACT

- 3.1 Consideration of Proposal. After the proposals are opened, the prices will be tabulated for comparison on the basis of the quantities shown in the approximate estimate. Until the final award of the contract, the City reserves the right to reject any and/or all proposals, to waive technicalities; and to advertise for new proposals or to have the improvements done by said City.
- 3.2 Award of Contract. The City acting by and through the City Council will either award the contract or reject all proposals received thereon after the formal opening of proposals and evaluation of the bids.

The award of the contract, if it is awarded, will be to the lowest responsible bidder whose proposal complies with the requirements of the City.

Projects will be awarded only to responsible bidders, and an award will not be made in any case, until all necessary investigations have been made into the responsibility of the low bidder.

If the project is funded in part by a state or federal grant, then the award may be subject to the concurrence of the granting contract agency.

All references to contract include each to be awarded where multiple awards are made.

- 3.3 Return of Proposal Guaranty. As soon as the proposal prices have been compared, the Engineer may, in his discretion, return the proposal guaranties accompanying those proposals which in his judgment would not be considered in making the award. After the award is made, only each successful bidder's proposal will be retained until the required contract and bonds have been executed, after which it will be returned to the bidder.
- 3.4 Surety Bonds. With the execution and delivery of the contract, the contractor shall furnish and file with the City in the amount herein required, the following bonds which must be approved by the City Attorney.

A good and sufficient Performance Bond in an amount equal to one hundred percent (100%) of the total amount of the contract, guaranteeing the full and faithful execution of the work and performance of the contract according to its terms, which bond shall remain in effect for twelve (12) months after the completion of the work.

A good and sufficient Payment Bond in an amount equal to one hundred (100%) percent of the total amount of the contract, guaranteeing full payment for all of the labor and materials used in the performance of the work and all other charges incurred under this contract.

No surety will be accepted who is now in default or delinquent on any bond. All bonds shall be executed by surety companies licensed to do business in the State of Tennessee and acceptable to the City Attorney, and in the event the contract is funded in part by federal or state grants, then said bonds must also be satisfactory to the granting agency. Each bond shall be executed by the contractor and the surety.

Should any surety on the contract be determined unsatisfactory at any time by the City, notice will be given to the contractor to that effect and the contractor shall forthwith substitute a new surety or sureties satisfactory to the City Attorney. No payment will be made under the contract until the new surety or sureties, as required, have qualified and been accepted by the City Attorney.

- 3.5 Execution of Contract. The contract shall be made in the name of the City of East Ridge and shall be executed on behalf of the City by the Administrator following approval by the City Council.
- 3.6 Failure to Execute Contract. Upon failure of the bidder to execute the required bonds or to sign the required contract within ten (10) days after the contract is awarded, he will be

considered to have abandoned his proposal and the City may annul the award. By reason of the uncertainty of market prices of materials and labor, and it being impracticable and extremely difficult to fix the amount of damages to which the City would be put by reason of said bidder's failure to execute said bonds and contract within ten (10) days, the proposal guaranty accompanying the proposal shall be the agreed amount of damages which the City will suffer by reason of such failure on the part of the bidder and shall thereupon immediately be forfeited to the City. The filing of a proposal will be considered as an acceptance of this provision.

SECTION 4. SCOPE OF WORK.

- 4.1 Intent of Contract Documents. The intent of the contract documents including the plans and specifications is to prescribe a complete work or improvement which the Contractor undertakes to do, in full compliance with the contract documents. The Contractor shall do all the work as provided in the plans, specifications, proposal and contract and shall do such additional, extra and incidental work as may be considered necessary to complete the work in a satisfactory and acceptable manner. He shall furnish all labor, materials, products, supplies, tools, equipment and incidentals necessary to the prosecution of the work.

The Contractor shall provide all work and materials not shown in detail but necessary for completion of the project as indicated or specified including a proper and suitable foundation preparation, base or support and a reasonable finish consistent with adjacent work which is shown or specified. The Contractor shall make plural and complete all work which, to avoid needless repetition or for the sake of brevity, has been shown separate or partially indicated. The Contractor shall follow the drawings and execute all work in strict accordance therewith and with the kind and quality of materials indicated and specified. Materials or work described in words which, when so applied, have a well-known technical or trade meaning shall be held to refer to such recognized standards. Any deviation from the Drawings, Specifications, and other Contract Documents which may be required by the exigencies of construction, shall in all cases conform to the written instruction of the Engineer. The applicable provisions of the Contract Documents shall apply with equal force to all work, including extra work, performed under these Contract Documents, whether performed either directly by the Contractor or by any Subcontractor.

- 4.2 Special Provisions. Should any work or any condition which is not thoroughly or satisfactorily stipulated or covered by the Standard Specifications be anticipated on any proposed work, "Special Provisions" for such work may be prepared and shall be considered as a part of the specifications and contract, the same as though contained fully therein.
- 4.3 Increase or Decrease Quantities. The City shall have the right to increase or decrease the amount of work to be done under these Contract Documents at any time or times during the life of the Contract, when and, as found necessary and the Contractor shall perform the work as altered, increased or decreased at the negotiated price. The City shall have the right to delete any bid item in its entirety.

Any such changes will be set forth in a Change Order which will specify, in addition to the work to be done in connection with the changes made, adjustment of contract time, if any, and the basis of compensation for such work, if any. A Change Order will not become effective until approved by the City. After approval, the Change Order will become a part of the Contract Documents.

- 4.4 Alterations of Plans and Specifications. The City reserves the right, at any time, to make such changes in the plans and the character of the work as may be necessary or desirable to insure completion in the most satisfactory manner, provided such changes do not materially alter the original plans and specifications or change the general nature of the work as a whole. Such changes shall not be considered as waiving or invalidating any condition or provision of the contract.
- 4.5 Extra Work. When any work is necessary to the proper completion of the project of which no prices are provided in the proposal or contract, the Contractor shall do such work, but only when and as ordered by the Engineer. Payment for the extra work will be made as hereinafter provided.

Extra work is defined as: (1) that additional work of a different character or function or for that work for which no basis of payment is prescribed in these Contract Documents; such as a lump sum contract, or (2) that work involving revisions of the details of the work in such manner as to render inequitable payment under items upon which the Contractor bid; or (3) that additional work of a similar nature and character as that done under the negotiated price. (See para. 8.9 of this Section)

No claim for extra work will be considered unless said extra work was ordered in writing as aforesaid, and the claim presented in writing to the Engineer within 30 days after receipt by the Contractor of the written order to perform said extra work.

If the performance of the extra work results in additional time being required by the Contractor to complete the work covered by these Contract Documents, said Change Order will provide for an equitable extension in the contract time.

- 4.6 Final Cleaning Up. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall clean and remove from the site of the work surplus and discarded materials, temporary structures, stumps or portions of trees and debris of any kind. He shall leave the site of the work in a neat and orderly condition and shall obtain a signed release from the owners of private property upon which the work has been done. Waste materials removed from the site of the work shall be disposed of at locations satisfactory to the Engineer.
- 4.7 Maintenance of the Work. The Contractor shall maintain the work during construction and until the work is accepted. The notice of final acceptance by the City shall also notify him that he is relieved of the maintenance except as otherwise provided in Section 4.8. Portions of the work shall be opened for use by the City or the general public, and this shall not be interpreted to mean that the Contractor is relieved of maintenance.

All costs of maintenance work during construction and before the work is finally accepted shall be included in the Contract Price bid for the work, and the Contractor will not be paid any additional amount for maintenance work.

- 4.8 Maintenance of the Work After Completion. The Contractor shall maintain and keep in good repair the work covered by these Contract Documents for a period of one (1) year from the date of acceptance by the City. The Contractor shall promptly (a) perform all necessary work, (b) repair or replace all defective materials or products, and (c) correct any defective condition resulting from defective materials, products, work, or labor performed by the Contractor under these Contract Documents which may appear or be discovered during said period. It is further understood and agreed that the Contractor shall fully indemnify, protect, defend, save and hold harmless the City, the Engineer, and their agents and employees from all liabilities on account of injury to persons, loss of life, or damage to property resulting from said defective conditions or failure to promptly correct said defective conditions.

The Contractor will not be required to perform any routine maintenance, repairs resulting from normal wear and tear, or repairs necessary due to acts of the City, its employees, or agents.

- 4.9 Guarantee. The Contractor shall guarantee the equipment, materials, products, and workmanship furnished under these Contract Documents to be as specified and to be free from defects for a period of one year after the date of final acceptance by the City. In addition, the equipment furnished by the Contractor shall be guaranteed to be free from defects in design.

Upon notification, the Contractor shall promptly make all adjustments, repairs, or replacements which, in the opinion of the Engineer or the City, arose out of defects and became necessary during the guarantee period.

The cost of all materials, parts, labor, transportation, supervision, special tools, and supplies required for replacement or repair of parts and for correction of defects shall be paid by the Contractor or by the Surety.

This guarantee shall be extended to cover all repairs and replacements furnished under the guarantee, and the period of the guarantee for each such repair or replacement shall be one year after installation or completion of said repair or replacement.

If within ten (10) days after the City has notified the Contractor of a defect, failure, or abnormality in the work, the Contractor has not started to make the necessary repairs or adjustments, or if the Contractor fails to complete the repairs or adjustments in a timely and satisfactory manner, it is understood and agreed that the City is hereby authorized to make the repairs or adjustments or to order the work to be done by a third party, the cost of the work to be paid by the Contractor or by the Surety.

In the event of an emergency that occurs when the Contractor or his representative cannot be immediately contacted, and where the emergency is such that, in the sole

judgment of the City, delay could cause serious loss or damage or presents an imminent hazard to others, repairs or adjustments may be made by the City, or a third party chosen by the City, without advance notice to the Contractor, and the cost of the work shall be paid by the Contractor or by the Surety.

SECTION 5. CONTROL OF WORK AND MATERIALS.

5.1 Authority of the Engineer. The Engineer shall administer the Contract. All work shall be done to the satisfaction of the Engineer. The Engineer shall consult with the Architect or other Project Engineer when appropriate, and the Engineer shall decide all questions which arise as to quality and acceptability of materials furnished, work performed, manner of performance, rate of progress of the work, sequence of construction, interpretation of plans and specifications, acceptable fulfillment of the contract, compensation and suspension of work. He shall determine the amount and quality of work performed and materials furnished, and his decision and estimates shall be final.

The Contractor may request and shall receive written instructions from the Engineer upon any important item.

5.2 Conformity With Plans; Allowable Deviations. All work shall conform to the lines, grades, cross-sections and dimensions shown on the plans. Any deviation from the plan which may be required by the exigencies of construction will be determined by the Engineer and authorized by him in writing.

5.3 Coordination and Interpretation of Contract Documents. The parts of the Contract Documents are complementary, each part being an essential part of these Contract Documents which are intended to describe and provide for a complete work. A requirement occurring in one is as binding as though occurring in all.

The Contractor shall carefully study and compare all Drawings, Specifications, and other instructions; shall test all figures on the Drawings before laying out the work; shall notify the Engineer of all errors, inconsistencies, or omissions which he may discover; and shall obtain specific instructions before proceeding with the work. The Contractor shall not take advantage of any error or omission which may be found in the Drawings or other Contract Documents. The Engineer will make such corrections therein and interpretations thereof as he may deem necessary for the fulfillment of the intent of the Contract Documents, and his interpretations shall be final. The Contractor shall be responsible for all errors in construction which could have been avoided by such examination and notification and shall correct at his own expense all work improperly constructed through failure to notify the Engineer and request specific instruction.

In case of unresolved conflict between items of the Contract Documents, the following order of precedence shall govern, with the higher item taking precedence over a lower item:

Contract (including Supplemental Agreements and Change Orders thereto)
Addenda

Bid Proposal
Supplementary General Provisions
General Provisions
General Conditions
Specifications
Governing Standard Specifications
Schedules on Drawings
Notes on Drawings
Details on Drawings
Large Scale Drawings
Small Scale Drawings
Dimensions Given in Figures
Scaled Dimensions

In the event of any discrepancy between any drawing and the figure written thereon, the figures, unless obviously incorrect, shall be taken as correct.

When measurements are affected by conditions already established or where items are to be fitted into constructed conditions, it shall be the Contractor's responsibility to verify all such dimensions at the site, and the actual job dimensions shall take precedence over scale and figure dimensions on the Drawings.

Wherever a stock size of manufactured item or piece of equipment is specified by its nominal size, it shall be the responsibility of the Contractor to determine the actual space requirements for setting and for entrance to the setting space and to make all necessary allowances and adjustments therefor in his work without additional cost to the City.

- 5.4 Governing Standard Specifications. The Governing Standard Specifications specified herein shall be considered a part of these Specifications and other Contract Documents the same as if herein repeated.

All materials and other work and the prosecution and control of the work shall be in conformance with the applicable requirements of Governing Standard Specifications unless specifically modified or superseded in these Contract Documents. In case of conflict between the Governing Standard Specifications and other parts of these Contract Documents, these Specifications and other Contract Documents bound herein shall govern. All sections of Governing Standard Specifications relating to measurement and payment shall not apply to the work specified herein. Where terms such as Engineer, Purchaser, City, Department, or other terms of similar import are used in the Governing Standard Specifications, it shall be understood that they will be appropriately interpreted to mean the City or the Engineer as specified herein.

Various Governing Standard Specifications referred to throughout these Contract Documents are frequently indexed by number and year (i.e., AWWA C110-71). When the year has not been designated or no year is associated with the referenced specification, the Governing Standard Specification in effect on the date of the Advertisement shall govern. Tentative specifications shall be construed as current unless otherwise noted.

Where obsolete Federal Specifications have been referenced, they shall be superseded by the Federal Specification in effect on the date of the Advertisement.

All standard specifications, manuals, standard details, publications, or other standard items referred to in the Drawings or other Contract Documents shall be considered a part of these Contract Documents the same as if herein repeated.

- 5.5 Authority of the City Engineer. If the City has retained an Architect or consulting engineer to assist the City Engineer in administering the contract, then the authority of the City Engineer should be as specified herein. If the administration of the contract is performed by the City Engineer without having an Architect or consulting engineer, then the authority of the City Engineer shall be as specified in this section and the following section captioned "Authority of the Project Engineer." The general administration and observation of the performance and execution of the work under these Contract Documents is vested in the City Engineer. The detailed administration and observation of the performance and execution of the work is vested in the Project Engineer as set forth below.

The City Engineer may authorize a person to act as the City Engineer's authorized representative or agent in carrying out the duties specified in these Contract Documents. The instructions of the City Engineer, or authorized representative, shall be strictly and promptly followed in every case.

The City Engineer, or authorized representative, shall have authority to suspend operations at any time, without additional cost to the Owner, when the work, in the City Engineer's opinion, is not being carried out in conformity with the Drawings, Specifications, and other Contract Documents.

The City Engineer, or authorized representative, may appoint Inspectors as are necessary to observe the performance of the work under these Contract Documents and the amount, character, and quality of materials supplied.

- 5.6 Authority of the Project Engineer. The Project Engineer (severally referred to in the Contract documents simply as "Engineer") is an Architect, consulting engineer, or other person designated by the City to perform certain duties of the City, specified herein, as a duly authorized representative or agent of the City. When such specified duties are indicated herein to be performed by the "Engineer" or by the City's "authorized representative," said duties shall be performed by the Project Engineer acting for the City and solely as an agent or representative of the City. The City may specifically designate that other duties will be performed by the Project Engineer by notifying the Contractor and the Project Engineer that said duties will be performed by the Project Engineer.

The Project Engineer shall have free access to the materials and the work at all times for measuring or observing the same, and the Contractor shall afford him all necessary facilities and assistance for so doing. After written authorization to proceed with the work, the Project Engineer shall:

- 5.6.1 Make periodic visits to the site to observe the progress and quality of the executed work and to determine in general if the work is proceeding in accordance with the Contract Documents; he will appoint a Resident Project Representative and Inspectors to make periodic and timely on-site observations to check the quality and quantity of the work; he will not supervise the contractor's work; he will not act as foreman or superintendent for the Contractor, nor will he manage or interfere with management of the contractor's work; he will not be responsible for the techniques, construction means, methods, sequences or procedures, time of performance, or the safety precautions and programs incident thereto; and he will not be responsible for the Contractor's failure to perform the construction work in accordance with the Contract Documents. During such visits and on the basis of his on-site observations and professional judgment, the Project Engineer will keep the City informed of the progress of the work, will exercise reasonable care to guard the City against defect and deficiencies in the work of the Contractor, and will advise the City immediately verbally and by written notifications of any work he knows to be defective or not conforming to the requirements of these Contract Documents.
- 5.6.2 Review engineering data, samples, catalog data, schedules, shop drawings, laboratory, shop, and mill tests of materials and equipment and other data which the Contractor is required to submit, only for conformance with the design concept of the project and compliance with the information given by these Contract Documents; and assemble written guarantees which are required by these Contract Documents.
- 5.6.3 Advise and consult with the City during the performance of the work; and act as the City's representative to issue instructions of the City to the Contractor.
- 5.6.4 Based on his on-site observations and on his review of the Contractor's payment requests, determine the amount owed to the Contractor and approve in writing payment to the Contractor in such amounts; such approvals of payment to constitute a representation to the City, based on such observations and review and the data comprising such requests, that the work has progressed to the point indicated and that, to the best of his knowledge, information, and belief, the quality of the work is in accordance with these Contract Documents, subject to the results of any subsequent test called for in these Contract Documents and any qualifications stated in his approval.
- 5.6.5 Conduct, in company with the City, a final inspection of the project for conformance with the design concept of the project and compliance with the information given by these Contract Documents, and approve a Final Payment request.
- 5.6.6 Prepare and submit for the City's approval proposed change orders.
- 5.7 Authority and Duties of Resident Project Representative. The Resident Project Representative and Inspectors are authorized to observe all work done and materials

furnished under these Contract Documents, but will not be on-site at all hours the work is in progress. Such observation will extend to all or to any part of the work and when appropriate to the preparation, fabrication, or manufacture of the materials or products to be incorporated in the work.

The authority and duties of the Resident Project Representative and Inspectors are to examine the materials and products furnished, observe the work done, call to the attention of the Contractor any deviation from these Contract Documents and report the results of the examinations and observations to the Engineer.

The Resident Project Representative and/or Inspectors will not be authorized to revoke, alter, enlarge, or relax any requirements of these Contract Documents, nor to approve or accept any portion of the work, nor will they be authorized to issue instructions contrary to these Contract Documents. They will in no case act as foremen nor will they interfere with management of the work.

- 5.8 Inspection. The Engineer and authorized representatives thereof shall be given every facility for ascertaining whether or not the work performed, and materials used are in accordance with the requirements and intent of these Contract Documents.

Failure of the Engineer or authorized representatives during the progress of the work to discover defects or deficiencies in the work or to reject materials, products, or work not in accordance with these Contract Documents shall not be considered to relieve the Contractor, under any circumstances, from his obligations under these Contract Documents or the acceptance thereof or a waiver of defects therein; and payment to the Contractor or partial or entire occupancy by the City shall not be construed to be an acceptance of the work or materials which are not strictly in accordance with these Contract Documents.

Moreover, the undertaking of inspections by the Engineer or authorized representatives thereof shall not be construed as supervision of actual construction nor make the Engineer or authorized representative responsible for providing a safe place or safe conditions for the performance of work under the Contract by the Contractor, or Contractor's employees or those of Suppliers or Subcontractors, or for access, visits, use, work, travel, or occupancy by any person and the Contractor agrees to fully indemnify, protect, defend, save and hold harmless the City, the Engineer, and their agents and employees from all claims for damages for personal injury (including accidental death) and property damage which may arise from any operations under this contract, including claims by employees of the Contractor or of any Subcontractor or Supplier.

The payment of any compensation, irrespective of its character or form, or the giving of any gratuity, or the granting of any valuable favor, directly or indirectly, by the Contractor to any authorized representative of the City or Engineer is strictly prohibited, and any such act on the part of the Contractor will constitute a breach of the Contract.

Any advice or consultation offered to the Contractor by a representative of the City or Engineer shall not be construed as binding on the City or Engineer or as releasing the Contractor from fulfilling all the terms and conditions of these Contract Documents.

All materials and products shall be inspected before their use in the work, and the Contractor shall notify the Engineer in time to enable him to inspect any work or materials before being covered. The Contractor shall furnish necessary personnel and facilities for such inspection. The presence or absence of a representative of the Engineer shall not lessen or otherwise affect the responsibility of the Contractor to properly perform the work.

5.9 Additional Instructions and Detail Drawings. The Contractor may be furnished additional instructions and detail drawings by the Engineer as necessary to carry out the work required by these Contract Documents. The additional instructions and detail drawings furnished shall become a part of these Contract Documents. The Contractor shall perform the work in accordance with the additional instructions and detail drawings.

5.10 Review of Engineering Data. Engineering Data covering all equipment and fabricated products to be furnished under these Contract Documents shall be submitted to the Engineer for review. These data shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorages, and supports required; performance characteristics; and dimensions needed for installation and correlation with other materials and equipment. Data submitted shall include drawings showing essential details of any changes proposed by the Contractor and all required wiring and piping layouts.

At the time of each submission, the Contractor shall in writing call the Engineer's attention to any deviations that the Engineering Data may have from the requirements of these Contract Documents.

The Engineer will review the engineering data submitted in a timely and expeditious manner, provided the data is submitted in accordance with these Contract Documents, is complete, and is suitable for his review.

Seven (7) copies of each drawing and necessary data shall be submitted to the Engineer. Each drawing or data sheet shall be clearly marked with the name of the project, the Contractor's name, and references to applicable specification paragraphs and drawing sheets. When catalog pages are submitted, the applicable items shall be identified. Each drawing or data sheet shall bear the Contractor's stamp of approval which shall be construed as certification that he has reviewed, checked, and approved the Engineering Data and that the data are in conformance with the requirements of these Contract Documents and that he has determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data required for preparation, accuracy, and sufficiency of the Engineering Data.

When the drawings and data are returned marked "NOT APPROVED," the corrections shall be made as noted thereon and as instructed by the Engineer and seven (7) corrected copies resubmitted.

Unless otherwise directed by the Engineer, when drawings and data are returned marked "APPROVED AS NOTED," the changes shall be made as noted thereon and not less than seven (7) corrected copies shall be furnished. All corrections and changes made on the drawings or data sheets other than those noted by the Engineer shall be clearly identified with a revision symbol and shall be suitably documented on the drawing with a brief description and date.

When drawings are submitted after final review (after being returned marked "APPROVED" or "APPROVED AS NOTED"), one (1) of the copies shall be a reverse reading translucent matte finish mylar reproducible (ozalid process). The Engineer's review of drawings and data submitted by the Contractor will cover only general conformity to the drawings and specifications, external connections, and dimensions which affect the layout. The Engineer's review of drawings returned marked "APPROVED" or "APPROVED AS NOTED" does not indicate a thorough review of all dimensions, quantities, and details of the material, equipment, device, or item shown and shall not in any way be deemed to relieve the Contractor from any responsibility for errors or deviations from the requirements of these Contract Documents or from full responsibility for complete and accurate performance of the work in conformance with these Contract Documents, or from any liability placed upon him by any provisions of these Contract Documents.

All drawings and data, after final processing by the Engineer, shall become a part of these Contract Documents, and the work shown or described thereby shall be performed in conformity therewith unless otherwise authorized by the City.

The schedule of submittals of engineering data and submittals of samples of materials or products, if required, shall be made by the Contractor in accordance with the requirements in the section entitled "Submittals" of the Detailed Specifications.

- 5.11 Oral Statements. It is understood and agreed that the written terms and provisions of these Contract Documents shall supersede all oral statements of representatives of the City, and oral statements shall not be effective or be construed as being a part of these Contract Documents.
- 5.12 Notice and Service Thereof. Any notice to the Contractor from the City or the Engineer relating to any part of these Contract Documents shall be in writing, and shall be considered delivered and the service thereof completed when said notice is mailed to the said Contractor at his last given address, or delivered in person to said Contractor or his authorized representative on the work.
- 5.13 Rejected Work, Materials, or Products. The Contractor, upon written notice from the Engineer, shall remove all work, including materials and products, rejected as defective, unsound, improper, or, in any way, failing to conform to the requirements of these Contract Documents. All removal and replacement work shall be done at the Contractor's

expense. The Contractor shall at his sole expense make good all work damaged by such removal and shall promptly replace materials damaged or improperly worked by him and re-execute his own work in accordance with these Contract Documents. This includes re-executing or replacing the work of any other contractor or the City that is in any way affected by the removal of the defective work. The obligations of the Contractor under this section shall not extend to defective materials or equipment supplied by the City.

Should the Contractor fail or refuse to begin to remove and renew any defective work, or to make any necessary repairs in an acceptable manner and in accordance with the requirements of these Contract Documents within ten (10) days of the written notice, the City may cause the unacceptable or defective work to be removed and replaced, or such repairs as may be necessary, to be made at the Contractor's expense. Any expense incurred by the City in making these replacements or repairs, which the Contractor has failed or refused to make, shall be paid for out of any monies due the Contractor or which may become due under the provisions of these Contract Documents, or may be charged against the Contract Performance Bond. Continued failure or refusal on the part of the Contractor to make any or all necessary repairs promptly, fully, and in an acceptable manner shall be sufficient cause for the City to declare the Contract forfeited, in which case the City, at its option, may contract with any other person, firm, or corporation to perform the work. All costs and expenses incurred thereby shall be charged against the defaulting Contractor and the amount thereof deducted from any monies due, or which may become due him, or shall be charged against the Contract Performance Bond. Any special work performed, as described herein, shall not relieve the Contractor in any way from his responsibility for the work performed by him.

- 5.14 Substantial Completion of the Work. Upon receipt of written notice from the Contractor that the work, or acceptable portion thereof, is substantially complete in conformance with these Contract Documents and submission of a list of items to be completed or corrected, the Engineer, in company with the City, will promptly make an inspection for substantial completion of the work, including any tests of operation, performance tests, material tests, and such other tests as specified or as the Engineer deems necessary, desirable, or proper. After completion of the inspection and tests and preparation of a detailed list of items to be completed or corrected, as determined by the inspection, the Engineer, if all things are satisfactory to him, and if, in his professional judgment and opinion the Contractor's statement appears correct, will inform the City in writing that he has examined the work, that it is substantially complete in conformance with these Contract Documents, and that he recommends the work be accepted as substantially complete. The written recommendation of acceptance of the work as substantially complete from the Engineer shall be accompanied by the list of items to be completed or corrected. It is understood and agreed that such notice from the Engineer does not in any way relieve the Contractor from any duties, responsibilities, and obligations of these Contract Documents.

Should the Engineer consider that the work is not substantially complete, he will immediately notify the Contractor, in writing, stating the reasons for his determination. The Contractor shall complete the work and send another written notice to the Engineer

certifying that the work or designated portion thereof is substantially complete. The Engineer, in company with the City, will reinspect the work.

If the Engineer's recommendation is acceptable to the City, the City will notify the Contractor in writing that the work is accepted as substantially complete and will establish the date of substantial completion after which time charges shall cease, and the City will begin use of the work. It is understood and agreed that said notice from the City shall not in any way be construed to relieve the Contractor from any duties, responsibilities, or obligations of the Contract Documents or from his responsibility to deliver a complete work in accordance with the intent of these Contract Documents.

- 5.15 Final Inspection. Upon receipt of written notice from the Contractor that all items listed for completion or correction during the inspection for substantial completion have been performed and that the work has been completed in conformity with the Contract Documents, the Engineer shall promptly examine the work, in company with the City, making additional tests and investigations as he may deem proper and using due care and judgment normally exercised in the examination of the completed work by a properly qualified and experienced professional engineer and shall satisfy himself that the Contractor's statement appears to be correct. The Engineer shall then inform the City and, when applicable, regulatory agencies that the work is, in his opinion, complete in apparent conformity with these Contract Documents and shall schedule the final inspection.

Should the Engineer consider that the work is not finally complete, he will notify the Contractor in writing, stating reasons for his determination. The Contractor shall take immediate steps to remedy the stated deficiencies and/or conditions and, after correction of the deficiencies and/or conditions, send another written notice to the Engineer certifying that the work is complete. The Engineer, in company with the City, will re-inspect the work.

After the final inspection and after the submission by the Contractor of acceptable Project Record Documents, operation and maintenance data and other items required by these Contract Documents, the Engineer shall notify the City in writing that he has examined the work and that, in his opinion, it appears to conform to these Contract Documents and therefore recommends acceptance of the work and final payment to the Contractor. It is understood and agreed that such statement by the Engineer does not in any way relieve the Contractor or his Sureties from any duties, responsibilities, and obligations under these Contract Documents.

- 5.16 Final Acceptance of the Work. After the Engineer recommends acceptance of the work covered by these Contract Documents and final payment to the Contractor, the City will, if it concurs in the Engineer's recommendation, promptly notify the Contractor in writing that the work is accepted. If the City does not concur in the Engineer's recommendation, the City will promptly notify the Contractor in writing that it does not accept the work as complete and stating the deficiencies and/or conditions that shall be corrected or resolved before final acceptance will be made. After the deficiencies and/or conditions are corrected or resolved and the City is satisfied that the work is complete, the City will

notify the Contractor in writing that the work is considered complete and final acceptance is made. The guarantee period(s), as specified in these Contract Documents, shall begin on the date the Contractor is notified by the City that final acceptance of the work is made. Final acceptance of the work by the City will not be made until the Project Record Documents, operation and maintenance data and other required items are acceptable to the City.

It is understood and agreed that said notice of final acceptance or final payment by the City shall not in any way be construed to relieve the Contractor, or his Sureties from any duties, responsibilities or obligations under or in connection with these Contract Documents.

- 5.17 Discrepancies. The Contractor shall check all dimensions, elevations, and quantities shown on the drawings and schedules. The Contractor shall verbally notify the Engineer immediately confirming the notice in writing soon thereafter of any discrepancy between the drawings and the conditions on the ground or any discrepancies, errors, or ambiguities in, or omissions from, the Drawings, Specifications, or other Contract Documents which he may discover at any time during the performance of the work. The Contractor shall also notify the Engineer of any discrepancies, errors, or ambiguities in the layout as given by stakes, points or instructions which he may discover during the course of the work. The Engineer will promptly investigate the matters and will furnish full instructions in writing correcting such discrepancies, errors, ambiguities, or omissions and the Contractor shall carry out such instructions as if originally specified. If, knowing of such discrepancy, error, ambiguity, or omission and prior to reviewing written instructions from the Engineer regarding correction thereof, the Contractor proceeds with the work, any of the work so done shall not be considered as work done under these Contract Documents and in performance thereof unless and until duly approved and accepted by the Engineer. The Contractor shall not take any advantage of any discrepancy, error, ambiguity, or omission in the Drawings, Specifications, or other Contract Documents.
- 5.18 Equivalent Materials and Equipment. Whenever a material, product, article, or piece of equipment is specified or described in these Contract Documents by using the name of a proprietary product or the name of a particular manufacturer or vendor and catalog number, it is understood and agreed that the specific item is named for the purpose of establishing the type, function, dimension, appearance, quality, durability, performance, or other salient requirements and that other materials, products, articles, or pieces of equipment of equal capacities, quality and function will be considered. The Contractor may request the substitution of material, product, article, or piece of equipment of equal substance and function for those designated in these Contract Documents. The Contractor shall request substitution in writing to the Engineer stating in detail how the substituted product differs in composition and performance from the designated product and furnishing suitable complete data on which the Engineer may make the determination on the merits of the proposed substitution. If, in the opinion of the Engineer, such material, article, or piece of equipment is of equal substance and function to that designated, the Engineer may approve its substitution and use by the Contractor. Any cost differential shall be deductible from the Contract Price, and the Contract Documents shall be appropriately modified by a change order. The Contractor warrants

that if substitutes are approved, no major changes in the function or general design of the project will result. Incidental changes or extra component parts required to accommodate the substitute shall be made by the Contractor without a change in the Contract Price or Contract Time. Requests relative to substitutions for materials, products, articles or pieces of equipment specifically designated on the Drawings or in the Specifications will not be considered until after the award of the Contract.

It is understood and agreed that (1) the Engineer is to use his own judgment whether or not any material, product, article, or piece of equipment proposed to be substituted is equal to that specified; (2) the decision of the Engineer on all such questions of equality shall be final and binding upon the Contractor; and (3) in the event of any decision of the Engineer that is considered adverse by the Contractor, no claim of any sort by the Contractor shall be made or allowed against the City or the Engineer.

- 5.19 Materials. The materials, fixtures, and apparatus furnished shall be new, except as otherwise provided herein, unused and of good quality, and shall be incorporated into the work in an undamaged condition. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials. Whenever materials are sold by the manufacturer in sealed packages, they shall be so delivered to the site of the work. The materials shall be manufactured, handled, and used in a workmanlike manner to provide a completed work in accordance with these Contract Documents.

Materials, products, and equipment designated for permanent installation in the work shall be properly stored by the Contractor in a manner to ensure protection against deterioration of any type. These items shall be so placed as to cause a minimum of interference with the prosecution of the work and to the public. The method of storing shall be so as to facilitate inspection. Deterioration of any kind or to any degree shall be cause for rejection. Stored materials, even though meeting the requirements of these Contract Documents before being stored, shall be inspected prior to incorporation in the work and shall meet the requirements of these Contract Documents at the time of incorporation in the work. If material, products, or equipment stored by the Contractor and paid for under the terms of these Contract Documents is damaged, or otherwise becomes unsuitable, before its permanent incorporation into the work, the amounts paid the Contractor for the damaged material shall be deducted from the next progress payment.

- 5.20 Contractor's Responsibility for Materials. The Contractor shall be responsible for the condition of all materials, products, and equipment which he has furnished, and shall replace at his own expense all such material found to be defective or which has been damaged after delivery. This includes the replacement of material which is found to be defective at any time prior to expiration of the guarantee period.

- 5.21 Testing of Materials and Equipment. The testing of materials shall be made by a competent laboratory or other person selected and paid for by the City. The Contractor shall submit samples of materials for testing as required by the Engineer. The cost of all retests made necessary by the failure of materials to conform to the requirements of these Contract Documents shall be paid by the Contractor.

The testing of equipment and products shall be performed as provided in the Specifications.

5.22 Access to the Work. The Engineer and his authorized representatives shall at all times have access to the work. Authorized representatives of the regulatory agencies shall have access to the work and to the materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The Contractor shall provide proper facilities for such access and observation of the work and records and also for any inspection or testing of the work.

5.23 Uncovering Completed Work. If any work is covered contrary to the written instructions of the Engineer it must, if requested by the Engineer, be uncovered for his observation and replaced at the Contractor's expense.

If the Engineer considers it necessary or advisable that covered work be inspected or tested by others, the Contractor, at the Engineer's request, will uncover, expose, or otherwise make available for observation, inspection, or testing as the Engineer may require that portion of the work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such work is defective, the Contractor will bear all the expenses of such uncovering, exposure, observation, inspection and satisfactory reconstruction. If, however, such work is not found to be defective, the Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time or both, directly attributable to such uncovering, exposure, observation, inspection, testing, and reconstruction, and an appropriate change order shall be issued.

5.24 Minimum Requirement for Materials and Workmanship. Unless otherwise definitely specified, it is a general requirement of these Contract Documents that all materials, products, and workmanship shall meet the requirements of the applicable standard specifications of the American Society for Testing and Materials, or of the Federal Specifications Board as minimum requirements.

5.25 Equipment Operation Experience Clauses. In cases where experience clauses are used for manufacturers or suppliers, in lieu of experience, a bond or cash deposit may be accepted from manufacturers or suppliers which do not meet the specified experience period. The bond or cash deposit provided by the manufacturers shall guarantee replacement of the equipment or process in the event of failure or unsatisfactory service. The period of time for which the bond or cash deposit is required shall be the same as the experience period of time specified.

5.26 Surveys. The City will furnish all boundary surveys and establish all base lines for locating the principal component parts of the work together with a suitable number of bench marks adjacent to the work. From the information provided by the City, unless otherwise specified in these Contract Documents, the Contractor shall develop and make all detailed surveys needed for construction such as slope stakes, batter boards, stakes for pile locations, and all other working points, lines, elevations, and cut sheets.

SECTION 6. LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

6.1 Cooperation with Public Utilities. The Contractor shall notify the owners of adjacent utilities when the prosecution of the work may affect the utility facilities or operation. The Contractor shall perform and carry on the work so as not to interfere with or damage utility facilities in the vicinity of the work. The Contractor shall take every possible precaution to properly protect and preserve, including temporary supports and bracing where necessary, the utility facilities from damage, injury or displacement. The Contractor shall remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the contractor, any Subcontractor or any person directly or indirectly employed or engaged by the Contractor or a Subcontractor or any person for whose acts the Contractor or a Subcontractor is liable.

The City and the Engineer will not be responsible for any delay in performing the work resulting from the existence, removal or adjustment of any utility facilities. Additional costs incurred by the Contractor as a result thereof shall be borne solely by the Contractor.

Utility facilities, such as water mains, gas mains, storm sewers, sanitary sewers, telephone lines, power lines and buried facilities and structures in the vicinity of the work are indicated on the drawings only to the extent such information has been made available to or discovered by the Engineer during the course of preparing the drawings. The actual locations of the utility facilities may vary from the locations shown, and there may be utility facilities existing that are not indicated on the drawings. It is understood and agreed that there is no guarantee as to the accuracy or completeness of the utility information indicated on the drawings, and all responsibility for the accuracy or completeness thereof is expressly disclaimed. Generally, service connections are not indicated on the drawings.

The Contractor shall be solely responsible for locating all existing underground facilities, including service connections, in advance of excavating, trenching or other work, by contacting the owners of the facilities or prospecting. The Contractor shall use his own information and shall not rely upon the information shown on the drawings concerning utility facilities.

In the event of accidental damage to or disruption of utilities by the Contractor or any of his Subcontractors or agents, the Contractor shall immediately take all necessary steps to replace any pieces of damaged equipment and all damaged materials, make all necessary repairs and restore all services to normal. The Contractor shall engage any and all required additional labor, individuals, subcontractors or other outside services which may be deemed necessary, to operate on a continuous "around-the-clock" basis until services are restored. He shall also provide and install all required equipment and materials to maintain temporary emergency services for uninterrupted use of facilities. All costs involved in making the repairs and restoring the disrupted service to normal shall be borne by the Contractor responsible for such disruption of services, and he shall be fully responsible for any and all damage claims resulting from such disruption.

Under no circumstances shall the Contractor or any of his subcontractors or agents disrupt or disconnect any type of facility whatsoever without first obtaining the written permission of the utility owner to do so. Request for disruption or disconnection shall state:

1. The location of the required disconnect and which utility is concerned.
2. The exact date and time at which the disconnect will be required.
3. The duration of the proposed disconnect or interruption.

Where it is necessary to temporarily interrupt services, the Contractor shall notify the utility owner, both before the interruption and again immediately before service is resumed. Before disconnecting any pipes or cables, the Contractor shall obtain permission from the owners thereof, or shall make suitable arrangements for their disconnection by the owners. Where it is necessary to temporarily interrupt house services, the Contractor shall notify the house owner or occupant, both before the interruption and again immediately before service is resumed. Should underground utilities or structures be encountered that are in minor conflict with the alignment or gradient of the proposed work, the proposed work may be adjusted by the Engineer where such adjustment is feasible and will not interfere with the operation of the proposed system. No payment will be made for these adjustments.

Where major conflicts in the proposed work and existing utilities or structures occur and adjustment of the new work is not feasible, then the Engineer may revise the alignment and/or grade to suit these conditions. If, in the opinion of the City, these revisions are necessary and are outside the scope of the bid items, they will be paid for as extra work.

- 6.2 **Railway Crossings.** When the work encroaches upon the right-of-way of any railway, the City will secure for the Contractor all the necessary easements or authority to enter upon such right-of-way for the prosecution and completion of the work. Where railway tracks are to be crossed, the railway company will construct the necessary bridges, trestles, cribs or other structures for safe operations of the trains or cars across any excavation during the time of construction of the work. Where such crossings require a change of grade, such change shall be made by or at the expense of the railway company. Contractor shall, however, take such special precaution for the safety of the work and the traveling public as may be necessary, by sheeting, bracing, and thoroughly supporting the sides of any excavation and supporting and protecting any adjacent structures.
- 6.3 **Protection of Public and Private Property.** The Contractor shall protect from damage all property in the vicinity of the work or that is in any way affected by the work, the removal or destruction of which is not called for by the Contract Documents. This applies to public and private property, utility facilities, trees, grass, shrubs, crops, signs, monuments, fences, pipe, underground structures, public roadways, sidewalks, curb and gutters, driveways and any other natural or man-made terrain features. Whenever such property is damaged due to the Contractor's performance of the work, the Contractor shall immediately restore it to a condition equal to or better than that existing before such

damage or injury was done by the Contractor. The Contractor shall make good all such damage or injury in an acceptable manner at his own expense. In case of failure of the Contractor to restore such property, or to make good such damage or injury, the City may, upon forty-eight (48) hours' notice, under ordinary circumstances and without notice when a nuisance or hazardous condition results, proceed to repair, rebuild or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any monies due or which may become due the Contractor under the terms of these Contract Documents.

Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

The Contractor shall not enter upon private property for any purpose without first obtaining permission, and he shall be responsible for the preservation of all public and private property. The Contractor shall at all times while the work is in progress use extraordinary care to see that adjacent buildings are not endangered in any way by reason of fire, water, or construction operations, and to this end shall take such steps as may be necessary or directed to protect the property therefrom, and the same care shall be exercised by all Contractor's and Subcontractor's employees. The Contractor shall give due notice to any controlling person, department, or public service company, prior to adjusting items to grade and shall be held strictly liable to the City if any such items are disturbed, damaged or covered up during the course of the work. The Contractor shall not disturb, remove or relocate any land monuments and property marks until an authorized agent has witnessed or otherwise referenced their location.

Any temporary drains and drainage which may be required by the Contractor during the construction period shall be furnished, installed and maintained by him. No such drains or drainage systems shall be installed or used without the prior approval of the Engineer. At the completion of the work, all such drains and drainage systems shall be removed and the premises returned to a neat and clean condition.

Fire hydrants on or adjacent to the work shall be kept accessible to the fire-fighting apparatus at all times, and no material or obstruction shall be placed within 10 feet of any hydrant. Adjacent premises must be given access, as far as practicable, and obstruction of sewer inlets, gutters and ditches will not be permitted.

- 6.4 Safety and Protection of Work. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work.

The Contractor shall take all necessary precautions for the safety of employees on the work, and shall comply with all applicable provisions of Federal, State and Local safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the work is being performed. The Contractor shall comply with the

Department of Labor's Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) as amended and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54) as amended. Copies of these regulations may be obtained from the U.S. Government Printing Office, 275 Peachtree Street, N.E., Atlanta, Georgia 30303.

The Contractor shall erect and properly maintain at all times, as required by the conditions and progress of the work, all necessary safeguards, including sufficient lights and danger signals on or near the work; he shall erect suitable railings, barricades, covers, or other protective devices about unfinished work, open trenches, holes, embankments or other hazards and obstructions; where hazards to workmen or the public exist. The Contractor shall provide, at all times, all necessary watchmen on the project, for the safety of employees, delivery personnel, and the general public, and to diligently guard and protect all work and materials, including Owner-furnished equipment. Construction equipment shall be suitably night-marked and lighted as necessary for safety considerations. No separate payment will be made for providing lights on vehicles and equipment, signs, barricades, lights, flags, watchmen and other protective devices, and the costs thereof shall be included in the Contract Price(s).

The Contractor shall comply with all applicable provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, and shall maintain an accurate record of all cases of death and all cases of occupational disease and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on the work under these Contract Documents.

The Contractor shall solely be responsible for the safety, efficiency and adequacy of his plant, appliances and methods and for any damage which may result from their failure or their improper construction, maintenance or operation.

- 6.5 Public Safety and Convenience. The Contractor shall conduct his operations in a manner that will offer the least possible obstruction and inconvenience to the public and he shall not have under construction an amount of work greater than he can prosecute properly with due regard to the rights of the public.

Construction operations shall be conducted in a manner that will cause as little inconvenience as possible to abutting property owners. Convenient access to driveways, houses, buildings or other facilities in the vicinity of the work shall be maintained and temporary access facilities for public roadways shall be provided and maintained in satisfactory condition.

- 6.6 Maintenance of Existing Traffic. Satisfactory facilities shall be provided by the Contractor for maintaining public access and travel, and every effort shall be made to reduce any necessary inconveniences to a minimum.

- 6.7 Emergencies Affecting Property or Safety. In emergencies affecting the safety of persons or the work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or City, shall act to prevent threatened

damage, injury or loss. He will give the Engineer prompt written notice of any significant changes in the work or deviations from these Contract Documents caused thereby, and a Change Order shall thereupon be issued covering the change and deviations involved.

- 6.8 Indemnification. It is understood and agreed that the Contractor shall be deemed and considered an independent contractor in respect to the work covered by these Contract Documents, and shall assume all risks and responsibility for casualties of every description in connection with the work, except that he shall not be held liable or responsible for delays or damage to work caused by acts of God, acts of public enemy, quarantine restrictions, general strikes throughout the trade, or freight embargoes not caused or participated in by the Contractor. The Contractor shall have charge and control of the entire work until completion and final acceptance of the work by the City. The Contractor shall be alone liable and responsible for, and shall pay, any and all loss and damages sustained by any person either during the performance or subsequent to the completion of the work these Contract Documents, by reason of injuries to person and damage to property, buildings and adjacent work, that occur either during the performance or subsequent to the completion of the work covered by these Contract Documents, or that may be sustained as a result or consequence thereof, irrespective of whether or not such injuries or damage be due to negligence or to the inherent nature of the work. The Contractor shall fully indemnify, protect, defend, save and hold harmless the City, the Engineer, and their agents and employees from any and all liability and from all suits and actions of every kind and description brought or which may be brought against them or any of them relative to the performance of the work or other responsibilities of the Contractor under these Contract Documents.
- 6.9 Claims for Labor and Materials. The Contractor shall indemnify and save harmless forever the City from all claims for labor, materials and services furnished under these Contract Documents. When requested by the City, the Contractor shall submit satisfactory evidence that all persons, firms, or corporations who have done work or furnished materials under these Contract Documents, for which the City may become legally liable, have been fully paid or satisfactorily secured. In case such evidence is not furnished or is not satisfactory, an amount will be retained from money due the Contractor which in addition to any other sums that may be retained will be sufficient, in the opinion of the City, to liquidate all such claims. Such sum will be retained until the claims as aforesaid are fully settled or satisfactorily secured.

Before final acceptance of the work by the City, the Contractor shall submit to the Engineer in duplicate a notarized affidavit stating that all subcontractors, vendors, persons, or firms who have furnished labor materials, or services for the work have been fully paid and that all taxes have been paid. A statement from the Surety shall also be submitted consenting to the making of the final payment.

- 6.10 Defense of Suits. In case any action in court is brought against the City or the Engineer, or any officer, agent or employee of any of them, for the failure, omission, or neglect of the Contractor to perform any of the covenants, acts, matters, or things by this contract undertaken; or for injury or damage caused by the alleged negligence of the Contractor or his subcontractors or his or their agents, or in connection with any claim based on lawful

demands of subcontractors, workmen, material-men, or suppliers, the Contractor shall indemnify, defend and save harmless the City and the Engineer and their officers, agents and employees, from all losses, damages, costs, expenses (including attorneys' fees), judgments, or decrees arising out of such action.

- 6.11 Familiarity with Laws. It is understood and agreed that the Contractor shall be familiar with and shall observe and comply with, all Federal, State, County, and City laws, codes, ordinances, regulations, orders, and decrees, including air and water pollution and noise abatement regulations, existing, or enacted subsequent to the execution of the Contract, that in any manner affect those engaged or employed in the work, or the materials or equipment used in the work, or which in any way affect the conduct of the work. The Contractor shall strictly observe all applicable laws and regulations as to public safety, health and sanitation. No pleas of misunderstanding or ignorance on the part of the Contractor will in any way serve to modify or mitigate the provisions of these Contract Documents. The Contractor and his Surety shall indemnify and save harmless the City and the Engineer and all their officers, agents, and servants against any claim or liability arising from, or based on the violation of, any such law, code, ordinance, regulation, order or decree, whether by himself, his agents or his employees.

The Contractor shall give all notices relating to all laws, codes, ordinances, regulations, orders and decrees bearing on the conduct of the work. If the Contractor observes that the Contract Documents are at variance therewith, he shall promptly notify the Engineer, in writing, and any necessary changes shall be adjusted as provided in these Contract Documents for changes in the work. If the Contractor performs any work contrary to such laws, codes, ordinances, regulations, orders, and decrees, and without such notice to the Engineer, he shall bear all costs arising therefrom.

- 6.12 Taxes, Permits and Certification. The Contractor shall pay all applicable taxes levied by Federal, State, and Local Governments and obtain all permits on any part of the work as required by law in connection with the work. It is understood and agreed that the cost of said taxes is included in the Contract Price(s) for the work.

The Contractor shall procure all temporary and permanent permits and licenses, necessary and incidental to the due and lawful prosecution of the work, and shall pay all charges and fees, and all costs thereof shall be deemed to be included in the Contract Price(s) for the work.

- 6.13 Patents and Royalties. Royalties and fees for patents covering materials, articles, apparatus, devices, or equipment (as distinguished from processes) used in the work, shall be included in the Contract Price(s). The Contractor shall satisfy all demand that may be made at any time for such royalties or fees and he shall be liable for any damages or claims for patent infringements. The Contractor shall, at his own cost and expense, defend all suits or proceedings that may be instituted against the City for alleged infringement of any patents involved in the work and, in case of an award of damages, the Contractor shall pay such award. The Contractor, however, will not be held liable for the defense of any suit or other proceeding nor for the payment of any damages or other costs for the infringement of any patented process required by these Contract

Documents; except if the Contractor has information that the process so required is an infringement of a patent, the Contractor shall be liable for any damages or claims in connection therewith unless he promptly notifies the City and Engineer of such infringement.

- 6.14 Requirements for Insurance Coverage. The Contractor shall not commence work under these Contract Documents until he has obtained all insurance required herein, nor shall the Contractor allow any Subcontractor to commence work on his subcontract until similar insurance required of the Subcontractor has been obtained by the Subcontractor. Insurance shall be placed by the Contractor with one or more insurance carriers licensed to do business in the State of Tennessee. Each insurance policy shall be renewed ten (10) days before the expiration date of the policy.

Certificates of insurance shall be filed with the City prior to commencement of the Work. These certificates shall contain a provision that coverage afforded under the policies will not be changed or canceled unless at least fifteen (15) days' written notice has been given to the City. The Contract shall not be binding upon the City until the insurance coverage required herein has been obtained and certificates have been filed with the City.

Adequate insurance coverage shall be maintained by the Contractor at all times. Failure to maintain adequate coverage shall not relieve the Contractor of any responsibilities or obligations under these Contract Documents. In the event any insurance coverage is canceled or allowed to lapse, the Contractor will not be permitted to prosecute the work until adequate and satisfactory insurance has been obtained and Certificates of Insurance furnished to the City. Failure to keep insurance policies in effect will not be cause for any claims for extension of time under these Contract Documents.

All such policies shall be subject to approval by the City Attorney. Should the City Attorney at any time in his sole discretion determine that the insurance policies and certificate provided may not be sufficient to protect the interests of the City because of the insolvency of the insurance company or otherwise, the Contractor shall replace such policies with policies meeting his approval.

The Contractor shall procure and maintain at his own expense, during the Contract Time, insurance as hereinafter specified:

- 6.14.1 Workmen's Compensation Insurance that shall protect the Contractor against all claims under applicable state workmen's compensation laws shall be maintained. The Contractor shall also be protected against claims for injury, disease or death of employees which, for any reason, may not fall within the provisions of a workman's compensation law. This policy shall also include an endorsement providing coverage in all states in which work is performed. The Contractor shall require all Subcontractors to provide similar Workmen's Compensation Insurance for all the Subcontractors' employees on the work unless such employees are covered by the protection afforded by the Contractor. The liability limits shall not be less than that required by statute.

6.14.2 General Public Liability and Property Damage Insurance that shall be written in comprehensive form and shall protect the Contractor against all claims arising from injuries including death, to members of the public or damage to property of others arising out of any act or omission of the Contractor or his agents, employees, or subcontractors. In addition, this policy shall specifically insure the contractual liability assumed by the successful bidder to defend and indemnify the City and Engineer against such claims or suits.

To the extent that the work may require blasting, explosive conditions, or underground operation, the comprehensive general public liability and property damage coverage shall contain no exclusion relative to blasting, explosion, collapse of buildings, or damage to underground property.

The comprehensive general public liability and property damage coverage shall also protect the Contractor against all claims resulting from damage to:

1. Private driveways, walks, shrubbery and plantings
2. Public utility facilities
3. U.S. Government monuments

The liability limits shall not be less than:

Bodily Injury	\$ 500,000 each person 1,000,000 each occurrence
Property Damage	\$ 500,000 each occurrence \$ 2,000,000 aggregate

The general public liability and property damage insurance shall carry an endorsement in form satisfactory to the City to the effect that the Contractor shall save harmless the City from any claims and damage whatsoever, including patent infringement. General public liability and property damage insurance shall be kept in force at all times during the course of the work until such time as the work covered by these Contract Documents has been completed and accepted by the City.

6.14.3 Comprehensive Motor Vehicle Liability and Property Damage Insurance that shall be written in comprehensive form and shall protect the Contractor against all claims for injuries to members of the public and damage to property of others arising from the use of motor vehicles, and shall cover operation on or off the site of all motor vehicles licensed for highway use, whether they are owned, non-owned, or hired.

The liability limits shall not be less than:

Bodily Injury	\$ 250,000 each person \$ 500,000 each occurrence
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Property Damage \$ 100,000 each occurrence

6.14.4 Builder's Risk Insurance that shall be written in completed value form and shall protect the Contractor, the City, and the Engineer against risks of damage to buildings, structures, and materials and equipment not otherwise covered under installation floater insurance, from the perils of fire and lightning, the perils included in the standard extended coverage endorsement, and the perils of vandalism and malicious mischief. The amount of such insurance shall be not less than the insurable value of the work at completion less the value of the materials and equipment insured under installation floater insurance.

Equipment such as pumps, engine-generators, compressors, basin equipment, motors switch-gear, transformers, panel boards, control equipment and other similar equipment shall be insured under installation floater insurance when the aggregate value of the equipment exceeds \$10,000.

If the work does not include the construction of building structures, builder's risk insurance may be omitted providing the installation floater insurance fully covers the work.

Builder's risk insurance shall provide for losses to be payable to the Contractor and the City as their interests may appear and shall contain a waiver of subrogation rights against the insured parties.

6.14.5 Installation Floater Insurance that shall protect the Contractor, the City, and the Engineer from all insurable risks of physical loss or damage to materials, products and equipment not otherwise covered under builder's risk insurance, while in warehouses or storage areas, during installation, during testing, and after the work is completed. It shall be of the "all risks" type, with coverages designed for the circumstances which may occur in the particular work under these Contract Documents. The coverage shall be for an amount not less than the insurable value of the work at completion, less the value of the materials, products and equipment insured under builder's risk insurance. The value shall include the aggregate value of the City-furnished equipment, products and materials to be erected or installed by the Contractor not otherwise insured under builder's risk insurance.

Installation floater insurance shall provide for losses, to be payable to the Contractor and the City as their interests may appear and shall contain a waiver of subrogation rights against the insured parties.

If the aggregate value of the City-furnished and Contractor-furnished equipment is less than \$10,000, such equipment may be covered under builder's risk insurance, and if so covered, this installation floater insurance may be omitted.

Certificates of insurance covering installation floater insurance shall quote the insuring agreement and all exclusions as they appear in the policy; or in lieu of certificates, copies of the complete policy may be submitted.

- 6.15 Sanitary Conditions. The Contractor shall provide and maintain adequate and satisfactory sanitary facilities. All sanitary facilities shall conform to the requirements of the Tennessee Department of Public Health and the Chattanooga-Hamilton County Health Department.
- 6.16 Contract Provisions Required by Law. It is understood and agreed that each and every provision and clause required by Local, State and Federal laws and regulations to be inserted in these Contract Documents shall be deemed to be inserted herein in their entirety and the Contract Documents shall be read and enforced as though they were included herein. If through mistake or otherwise, any such provision or clause is not inserted, or is not correctly inserted, these Contract Documents shall forthwith be physically amended to make such insertion or correction upon the application of either party of the Contract.
- 6.17 Preservation of Monuments and Stakes. The Contractor shall carefully preserve all monuments, bench marks, property markers, reference points, and stakes. In case of his destruction thereof, the Contractor will be charged with the expense of replacement and shall be responsible for any mistake or loss of time that may be caused. Permanent monuments or bench marks which must be removed or disturbed shall be protected until properly referenced for relocation. The Contractor shall furnish materials and assistance for the proper replacement of such monuments or bench marks.

SECTION 7. PROSECUTION AND PROGRESS

- 7.1 Subcontracts. The Contractor shall give his personal attention to the fulfillment of the Contract and shall at all times keep the work under his control.

The Contractor may subcontract portions of the work; however, he shall not award any work to any Subcontractor without prior written approval of the City. The City's approval will not be given until the Contractor submits to the City a satisfactory statement concerning the proposed award to a Subcontractor. The Contractor shall perform with his own organization and employees not less than fifty (50%) percent of the labor costs of the project. The Contractor and each Subcontractor shall provide information to the City concerning labor costs and other employee information on forms provided by the City within one week following each payroll. These forms shall include information concerning total labor costs, job classifications, and the race and sex of each person directly employed on the project.

The Contractor shall be as fully responsible to the City for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for acts or omissions of persons directly employed by him. Nothing contained in these Contract Documents shall create any contractual relation between any Subcontractor and the City. All Subcontractors shall be deemed to be agents of the Contractor.

The approval of the City of any Subcontractor shall not, under any circumstances, operate to relieve the Contractor or his sureties of any of his or their obligations under these Contract Documents. It is understood and agreed that all subcontracts and approvals of Subcontractors shall be based upon the requisite of performance by the Subcontractor in accordance with these Contract Documents; and should any Subcontractor fail to perform his work to the satisfaction of the Engineer, the City shall have the absolute right to rescind his approval at once and to require the performance of such work by the Contractor entirely or in part through other approved subcontractors.

The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bid subcontractors to the Contractor by the terms of these Contract Documents insofar as applicable to the work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the City may exercise over the Contractor under any provisions of these Contract Documents.

The Contractor shall inspect all work performed by Subcontractors for compliance with these Contract Documents.

- 7.2 The Contractor shall not sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of his right, title or interest therein, or his obligations thereunder, without written consent of the City.

The Contractor shall not assign any monies due or to become due to him under this Contract without the prior written consent of the City. In the event that the Contractor undertakes to assign all or any part of any monies due or to become due under this Contract, the instrument of assignment shall contain a provision substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in these Contract Documents.

- 7.3 Beginning of Work. The Contractor shall begin the work within ten (10) days after receiving the Notice to Proceed and shall diligently prosecute the work to completion within the contract time. The Contractor shall notify the City and the Engineer two working (2) days in advance of the date he will begin operations.

- 7.4 Distribution of the Work. The Specifications and other Contract Documents may be arranged in Sections under general titles descriptive of the principal materials or trade practices as far as seems practical without unreasonable complicated or minute breakdown. Under many divisions it has seemed proper to include items of other trades or types of materials, the use or the installation of which is closely related to the principal subject of that division. Such arrangement shall not operate to make the Engineer or the City an arbitrator to establish subcontract limits between Contractor and Subcontractor.

The Contractor and all Subcontractors shall study the Drawings, Specifications and other Contract Documents in sufficient detail to assure that all required items are included. It

shall be the Contractor's responsibility to so arrange and distribute the work that all required items are provided by the proper trades and at the proper times, without controversy as to contract obligations, or as to jurisdiction, and he shall make all necessary adjustments to this end.

- 7.5 Supervision of Work by Contractor. The Contractor shall supervise and direct the work. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor shall employ and maintain on the work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The supervisor shall have full authority to act on behalf of the Contractor, and all communications given to the supervisor shall be as binding as if given to the Contractor. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the work.

The Contractor shall be responsible for complete supervision and control of his Subcontractors as though they were his own forces. Notice to the Contractor shall be considered notice to all affected subcontractors.

- 7.6 Labor. The Contractor shall employ only workmen who are competent to perform the work assigned to them and, in the case of skilled labor, who are adequately trained and experienced in their respective trades and who do satisfactory work.

If any person employed by the Contractor on the work appears to the Engineer to be incompetent or to act in a disorderly or improper manner, the person shall be discharged immediately on the request of the Engineer, and such person shall not again be employed on the work.

All labor described in these Contract Documents or indicated on the Drawings and the work specified shall be executed in a thoroughly substantial and workmanlike manner by persons skilled in the applicable trade. All materials, fixtures and apparatus shall be installed in an undamaged condition.

The Contractor shall enforce strict discipline and good order among his employees. No intoxicating liquor or drugs will be allowed on the project.

The Contractor and all Subcontractors shall comply with all ordinances, laws and regulations applicable to the work regarding labor and mechanics.

- 7.7 Methods of Operation. The Contractor shall inform the Engineer in advance concerning his plans for carrying on each part of the work, but the Contractor alone shall be responsible for the safety, adequacy, and efficiency of his plant, equipment, and methods.

Any method of work suggested by the City or Engineer, but not specified, shall be used at the risk and responsibility of the Contractor; and the City and Engineer will assume no responsibility therefore.

Review by the City or Engineer of any plan or method of work proposed by the Contractor shall not relieve the Contractor of any responsibility therefor, and such review shall not be considered as an assumption of any risk or liability by the City or Engineer, or any officer, agent, or employee thereof. The Contractor shall have no claim on account of the failure or inefficiency of any plan or method so reviewed.

The sequence of the work performed under these Contract Documents will be left to the Contractor unless otherwise specified herein. Should the Engineer order the Contractor to increase his forces or working hours in order to maintain the progress of the work consistent with the required progress necessary for completion of the work within the Contract time, the Contractor shall comply with such order without additional cost to the City.

- 7.8 Lands and Right-of-Way. Prior to the issuance of the Notice to Proceed, the City will have obtained most of the land and rights-of-way, including easements, necessary for carrying out and for the completion of the work to be performed pursuant to these Contract Documents, unless mutually agreed or specified in the Specifications.

The City will provide to the Contractor information which delineates and describes the lands owned and rights-of-way, including easements, acquired.

The Contractor shall provide, at his own expense and without liability to the City, any additional land and access thereto that the Contractor may acquire for temporary construction facilities, or for storage of materials.

In the event all land and rights-of-way have not been obtained as herein contemplated before construction begins, the Contractor shall begin the work upon such land and rights-of-way as the City may have previously acquired, and no claim for damages whatsoever will be allowed by reason of the delay in obtaining the remaining land and rights-of-way. Should the City be prevented or enjoined from proceeding with the work, or from authorizing its prosecution, either before or after the commencement, by reason of any litigation, or by reason of its inability to procure any lands or rights-of-way for the work, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay, or to withdraw from the contract except by consent of the City; but time for completion of the work will be extended to such time as the City determines will compensate for the time lost by such delay, such determination to be set forth in writing.

- 7.9 No Waiver of Legal Rights. Neither the inspection by the City or Engineer or any of their officials, employees, or agents, nor any order by the City or Engineer for payment of money, or any payment for, or acceptance of, the whole or any part of the work by the City or Engineer, nor any extension of time, nor any possession taken by the City or its employees, shall operate as a waiver of any provision of these Contract Documents, or of any power herein reserved to the City, or any right to damages herein provided, nor shall any waiver of any breach in this Contract be held to be a waiver of any other or subsequent breach.

Any waiver of any provisions of these Contract Documents shall be specific, shall apply only to the specified item or matter concerned and shall not apply to other similar or dissimilar items or matters.

- 7.10 Project Record Documents. The Contractor shall prepare and maintain at the site of the work complete and detailed Project Record Documents of the completed work. Throughout the course of the work, the Contractor shall make all measurements and record the work as actually constructed on the Drawings and shall record on the record set of Specifications and other Contract Documents all materials or other items of construction actually used. The Project Record Documents shall represent the work as actually constructed. The Project Record Documents shall be submitted to and be acceptable to the Engineer before the final payment will be made to the Contractor.

The City will furnish the Contractor one set of reverse reading translucent matte finish mylar reproducible (ozalid process) copies of the contract drawings for the Contractor's use in preparing the record drawings.

- 7.11 Changes in the Work. The City reserves the right to make at any time, without prior notice to the Surety, such alterations in the drawings or in the character of the work as the City may consider necessary or desirable to complete the proposed work in a satisfactory manner and consistent with the intent of these Contract Documents. Notice of every such alteration or change shall be given in writing to the Contractor by the Engineer, and no such alteration or change shall be considered as constituting a waiver of any of the provisions of these Contract Documents, or as nullifying or invalidating any of such provisions. Should any such alteration or change result in an increase or decrease in the quantity or the cost of the work or materials described in these Contract Documents, the total amount payable under the Contract will be accordingly modified. If alterations or changes result in additional time being needed by the Contractor to complete the work, the Contract Time will be correspondingly modified, if the Contractor so requests, before commencing the work attributable to such alterations or changes.

- 7.12 Extra Work and Changes in Contract Price. The Contract Price may be changed only by a Change Order.

7.12.1 It is understood and agreed that the Contractor shall perform all extra work that may be ordered in writing by the Engineer acting on the specific authority of the City arising out of the modification of the specifications or drawings made or approved by the City. For this extra work, the Contractor shall be compensated as provided hereinafter and in the Change Order covering the extra work.

Extra work is defined as: (1) that additional work of a different character or function and for which no basis of payment is prescribed in these Contract Documents; or (2) that work involving revisions of the details of the work in such manner as to render inequitable payment under items upon which the Contractor bid; or (3) that additional work of a similar nature and character as that done under the negotiated price named in these Contract Documents.

No claim for extra work will be considered unless said extra work was ordered in writing as aforesaid, and the claim presented in writing to the Engineer within 30 days after receipt by the Contractor of the written order to perform said extra work.

If the performance of the extra work results in additional time being required by the Contractor to complete the work covered by these Contract Documents, said Change Order will provide for an equitable extension in the Contract time.

7.12.2 The Contractor shall be compensated for said extra work in accordance with one of the following methods and as set forth in the Change Order:

7.12.2.1 At the unit prices bid for items of work of a similar nature and character as set forth in the Bid Schedule on the Bid Proposal of these Contract Documents or as set forth in a previous Change Order.

7.12.2.2 At new unit prices for new items of work as negotiated and mutually agreed upon by the City and the Contractor prior to proceeding with the extra work.

7.12.2.3 For the lump sum price for the complete extra work as negotiated and mutually agreed upon by the City and the Contractor prior to proceeding with the extra work.

7.12.2.4 At the actual cost for labor, direct overhead, materials, supplies, equipment and other services necessary to complete the extra work plus an amount to cover the cost of general overhead and profit negotiated and agreed upon by the City and the Contractor prior to proceeding with the extra work.

7.12.3 When compensation for extra work is provided under paragraph 7.12.2.4 above, the Contractor's representative and the Engineer shall compare records of extra work done at the end of each day. Such records shall be made in duplicate upon a form provided for such purpose by the Engineer and shall be signed by both the representatives referred to herein, one copy being submitted to the Engineer and the other being retained by the Contractor.

7.12.4 The compensation provided herein shall be received and accepted by the Contractor as payment in full for all extra work done.

7.13 Time for Completion. The date of beginning and the time for completion of the work are essential conditions of these Contract Documents, and the work embraced shall be commenced within 10 days of the date of the Notice to Proceed.

The Contractor will proceed with the work at such rate of progress to insure full completion within the Contract Time. It is understood and agreed that the contract time for the completion of the work described herein is a reasonable time, taking into

consideration the average climatic and economic conditions and other factors prevailing in the locality of the work.

- 7.14 Extensions of Time. Extensions of time will be granted to the Contractor upon receipt of written request for such extensions, provided that such delays were occasioned by the City or by causes judged by the Engineer, subject to the City's concurrence, to be entirely beyond the Contractor's control or anticipation. In the even additional time is earned by the Contractor under the terms of these Contract Documents, or is granted by the City, such fact shall not be interpreted as a waiver of the full obligation on the part of the Contractor to complete the work within the extended time. Requests for extension of time made after ten (10) days following the event occasioning the delay, will not be considered by the City.
- 7.15 Suspension of the Work. The Contractor shall not suspend the work and shall not remove any equipment, tools, supplies, materials, or other items without the written permission of the City.

The City shall have the authority to suspend the work wholly or in part, for such period as may be necessary, due to unsuitable weather, such other conditions as are considered unfavorable for the suitable prosecution of the work; or due to the failure on the part of the Contractor to carry out orders given, supply sufficient skilled workmen, supply suitable material, prosecute the work satisfactorily and in a workmanlike manner, make prompt payments to Subcontractors or for labor, materials, or equipment, or to perform any obligations or requirements of these Contract Documents. The Contractor shall immediately comply with the written order of the City to suspend the work wholly or in part. The suspended work shall be resumed when conditions are favorable and methods are corrected, as ordered or approved in writing by the City.

In the event that a suspension of the work is ordered by the City, the Contractor shall, at his expense, do all the work necessary to secure the work and the area affected by the work and to protect all previously completed work as specified herein or as directed by the City. The suspension of the work by the City shall not relieve the Contractor of any duties, obligations, or responsibilities set forth in these Contract Documents. In the event the Contractor fails to secure and protect the work and area as specified or as ordered, the City will perform, or cause to be performed, all work considered necessary, and the cost thereof will be deducted from monies due or to become due the Contractor under the terms of these Contract Documents.

- 7.16 Liquidated Damages for Delay in Completion of the Work. As time is of the essence in this Contract, should the Contractor fail to complete the work, or specified portion thereof, sufficient for acceptance as substantially complete by the City within the Contract Time and extensions thereof, it is understood and agreed that the Contractor shall pay the City, as acknowledged liquidated damages, an amount determined, affixed and agreed (as stipulated in the Contract hereof) per calendar day that he is delinquent. The amount of liquidated damages shall be reported by the Engineer and shall be paid by the Contractor to the City or shall be deducted and withheld by the City from the monies due or to become due the Contractor under the terms of these Contract Documents.

The number of days used in determining the amount of liquidated damages to be paid by the Contractor for delay in completing the work shall be determined by subtracting the Contract Time, and any time extensions thereof, from the time actually required for the completion of the work. The time actually required for the completion of the work is defined as the total number of calendar days from the date 10 days after the date of the Notice to Proceed to the date of substantial Completion.

This provision for liquidated damages shall be effective between the parties ipso facto without necessity for demand or putting in default by any notice or other means than by the terms of these Contract Documents, the Contractor hereby waiving any such other notice of default and acknowledging that the Contractor shall be deemed to be in default by the mere act of his failure to complete the work within the Contract Time, or within any valid extension of such time hereunder.

It is understood and agreed that these liquidated damages are not a penalty, but constitute liquidated damages for loss to the City because of increases in expenses for administration, legal counsel, accounting, engineering, construction supervision, inspection, and any other expenses incurred directly as a result of the delay of the Contractor in completing the work.

7.17 Liability for Failure to Satisfy Guarantees and Warranties. Should the Contractor fail to furnish equipment, materials, and products meeting the guarantees and warranties specified herein, the Contractor shall be in default under the Contract and subject to all of the remedies of the City, including payment to the City of the additional operation and/or construction costs resulting from the system's nonperformance in the amounts specified in these Contract Documents and recourse for such payments to the Performance Bond. It is understood and agreed that these payments are not a penalty, but constitute reimbursement for loss to the City because of increased expenses of operation and/or construction of the project as a result of the failure of the Contractor to furnish equipment, materials, and products in conformance with these Contract Documents.

7.18 Equipment and Construction Plant. All equipment and construction plant shall be suitable to produce the quality of work and materials required for the satisfactory completion of the work within the Contract Time and shall be satisfactory to the Engineer. The Contractor shall provide adequate and suitable equipment and construction plant to meet the requirements of the work as specified in these Contract Documents. The Contractor shall remove unsuitable equipment from the work and add to the construction plant when ordered to do so by the Engineer.

The Contractor shall obtain written permission from the City prior to constructing temporary buildings or other structures on land owned or leased by the City. If a permit is granted, said buildings or other structures shall comply with all applicable regulations regarding their construction and maintenance and shall be satisfactory to the City.

7.19 Relations with Other Contractors. The Contractor shall cooperate with all other contractors who may be performing work in behalf of the City and workmen who may be

employed by the City on any work in the vicinity of the work to be done under these Contract Documents, and he shall so conduct his operations as to interfere to the least possible extent with the work of such contractors or workmen. The Contractor shall promptly make good, at his own expense, any injury or damages that may be sustained by other contractors, the City or employees of the City at his hands. Any difference or conflict which may arise between the Contractor and other contractors or between the Contractor and workmen of the City in regard to their work shall be adjusted as determined by the Engineer. If the work of the Contractor is delayed because of any acts or omissions of any other contractor, the Contractor shall have no claim against the City on that account other than an extension of time.

Whenever there is interference with work under other contracts, the Engineer shall decide the manner in which the work shall proceed under each contract.

7.20 Unfavorable Construction Conditions. During unfavorable weather, wet ground, or other unsuitable construction conditions, the Contractor shall confine his operations to work which will not be affected adversely thereby. No portion of the work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by the Contractor to perform the work in a proper and satisfactory manner.

7.21 Sunday, Holiday and Night Work. No work shall be done between 6:00 p.m. and 7:00 a.m. nor on Sundays or locally observed national holidays without the written permission of the Engineer. However, emergency work may be done without prior permission. Night work will not be established as a regular procedure, excluding emergencies, except with written permission. Such permission, if granted, shall be upon such terms and conditions deemed appropriate in the Engineer's sole discretion.

7.22 Sewage, Surface, Subsurface and Flood Flows. The Contractor shall furnish all necessary equipment, materials and labor, at his expense, for handling, passing and disposing of all sewage, seepage, surface, subsurface and flood flows encountered at any time during the prosecution of the work. It is understood and agreed that the Contractor shall bear all risks associated with said flows; shall indemnify the City and the Engineer from any liabilities resulting from said flows; and shall not make any claim for additional compensation for delays or damage resulting from said flows. The manner of providing for these flows shall be satisfactory to the Engineer and in conformance with all applicable laws and regulations.

SECTION 8. MEASUREMENT AND PAYMENT

8.1 Scope of Payment. The Contractor shall accept compensation provided in these Contract Documents as full payment for furnishing all labor, materials, supplies, tools, equipment, taxes, fees, contingencies, and other items necessary or convenient to the completed work and for performing all work contemplated and embraced in these Contract Documents; also for loss or damage arising from the nature of the work, or from the action of the elements, or from any unforeseen difficulties which may be encountered during the prosecution of the work until the acceptance by the City and for all risks of

every description connected with the prosecution of the work; also for all expenses incurred in consequence of the suspension or discontinuance of the work as provided in these Contract Documents; and for completing the work in accordance with these Contract Documents. Neither the payment of any estimate nor of any retained percentage shall relieve the Contractor of any obligation to make good any defective work or material or of any provisions of these Contract Documents.

No compensation will be made in any case for loss of anticipated profits.

8.2 Basis of Payment. The basis of payment shall be the Contract Unit Prices and/or Contract Lump Sum Price(s) named in these Contract Documents.

8.3 Measurement of Quantities. The measurement of quantities shall be made by the Engineer in accordance with the Specifications and other Contract Documents.

If the Contract is based on a Unit Price Bid, the items of work to be measured and the units of measurement shall be as set forth in the Bid Proposal Form. Only net quantities of finished work will be measured. Any items of work not set forth in the Bid Proposal Form, but necessary or convenient for the satisfactory completion of the work under the terms of these Contract Documents, shall not be measured separately and shall be considered a part of said items of work set forth in the Bid Proposal Form.

If the Contract is based on a Lump Sum Bid, the measurement of quantities for progress estimates and progress payments requests will be made by the Contractor, subject to the Engineer's approval, and will be based on items of work and the value thereof contained in the Contractor's Schedule of Values. A final measurement of quantities will not be required.

8.4 Progress Payment Requests and Partial Payments. On the first day of each month the Contractor may submit to the Engineer, on forms furnished by the Engineer, a progress payment request for the amount of work accomplished, products finished, and products stored at the site (See 01630-1.02,B) during the previous month. Ten (10) signed copies of each request shall be furnished.

The progress payment request shall be signed by the Contractor and be supported by such data as the Engineer may reasonably require. If payment is requested for products not incorporated in the work but delivered and suitably stored at or near (See 01630 1.02,B) the site, the progress payment request shall also be accompanied by such supporting data, satisfactory to the City, as will establish the City's title to said products and protect its interest therein, including appropriate insurance. The Contractor shall furnish a proper and duly executed written authorization designating those persons who will be authorized to sign and/or certify progress payment requests for the Contractor.

The Engineer will, within ten (10) days after receipt of each progress payment request, either indicate in writing his approval of the progress payment request and present it to the City, or return the progress payment request to the Contractor, indicating in writing his reasons for refusing to approve it.

The City will, within thirty (30) days after receipt of the approved progress payment request, pay the Contractor a partial payment on the basis of the approved progress payment request, less the retainage and other deductions pursuant to the terms of these Contract Documents.

The City will retain five (5%) percent of the total amount of partial payments for the work covered by these Contract Documents until substantial completion. After the work is accepted as substantially complete, the City, at its sole discretion and with the full knowledge and consent of the Contractor's surety, may reduce the retainage to an amount sufficient, in the Engineer/Architect's opinion, to complete the work should the Contractor default. A cash bond or an irrevocable letter of credit, provided by the Contractor and satisfactory to the City Attorney, may be accepted by the City in lieu of all or part of the cash retainage specified herein.

It is understood and agreed that the approval of the progress payment request and the paying of a partial payment shall not be construed as acceptance of any work, materials, or products and shall not relieve the Contractor in any way from his responsibilities and obligations under these Contract Documents.

A partial payment will not be made when, in the judgment of the City or the Engineer, the work is not proceeding in accordance with any of the provisions of these Contract Documents.

8.5 Retainage Held as Security. Notwithstanding any other provision of this Contract to the contrary, in the event the City shall have reasonable grounds to suspect that:

- (a) The Contractor or associated person has breached the Affidavit of No Collusion contained in these Contract Documents or has breached such an affidavit in any other contract which Contractor may have with City; or
- (b) The Contractor or associated person has violated or participated in a violation of the Sherman Act (15 U.S.C. Sec. 1-2), or the Racketeer Influenced and Corrupt Organizations Act (18 U.S.C. Sec.1961-1968), or the Hobbs Act (18 U.S.C. Sec. 1951), or the mail or wire fraud statutes (18 U.S.C. Sec. 1341, 1343), the false statements statement (18 U.S.C. Sec. 1001), or other similar provision of Federal or State law in connection with this Contract or with any other contract which the Contractor or associated person has, had, or shall have with the City (including without limitation the submission of bids on such a contract); then the City shall have the right to withhold and retain any retainage described in this section as security for any damage claim arising from such action.

For purposes of this section, the term "associated person" shall include (a) in the case of a corporation: the corporation, its officers, directors, shareholders, employees and agents, and its parents, subsidiaries or affiliates, whether in existence at the time of the violation or subsequently formed or acquired; (b) in the case of a partnership or joint venture: the partnership or joint venture, its general or limited partners and joint venturers, its

officers, employees and agents; and (c) in the case of a sole proprietorship: the individual proprietor, and his employees and agents. Where a partner or joint venturer is a corporation, the partnership or joint venture shall have attributed to it the actions of persons attributable to the corporation under paragraph (a) of this subsection.

The City shall promptly notify the Contractor in writing of the exercise of its right to retain such amounts. In the event the work is more than fifty (50%) percent complete and the City has reduced its retainage to five (5%) percent, then following such notice the City shall thereafter retain ten (10%) percent from progress payments.

The City shall have the right to retain such funds until the City's damage claims are finally determined. The claim shall be "finally be determined" when a court of competent jurisdiction enters judgment on the merits of any claim made for damages by the City (unless City appeals that judgment, in which event, when the appeal is decided). In the event that City voluntarily waives his damage claim by written instrument signed on City's behalf, then such claim shall be "finally determined" at the time such waiver is effective. City covenants that it will commence an action for damages with respect to its damage claim as soon as practicable after it exercises its right for retaining such amounts for the causes set forth in this paragraph.

In the event such a claim is finally determined in favor of City, any amount of retainage for such claim shall be applied to satisfy the judgment. Any excess of retainage hereunder over the amount of such judgment, or in the event that a damage claim is finally determined in favor of Contractor or its associated person, the amount shall be promptly paid to Contractor, together with interest, at the applicable rate for post-judgment interest set forth in T.C.A. Sec. 47-14-121, provided that interest shall not be paid upon amounts which City could have otherwise properly retained under other provisions of this Contract.

Any claim, dispute, or other matter arising out of or relating to City's retention of payment for a damage claim under this section shall not be subject to arbitration. The City's failure to retain all or a portion of any payment due under this Contract pursuant to this section, even if grounds for such retention exists, shall not constitute a waiver of any of City's rights under this section.

- 8.6 Final Payment. Upon completion of the work and after final acceptance of the work by the City, the Engineer will be authorized to prepare a final estimate of the work performed by the Contractor under these Contract Documents and to prepare a final payment request. Preparation of the final estimate and final payment request will not be authorized until the affidavits, releases of liens, certificate of occupancy issued by City of East Ridge Inspection Department and other statements and certifications required of the Contractor under these Contract Documents have been received by the City. The Contractor shall also file the Notice of Completion with the appropriate office at the Hamilton County Tennessee Courthouse. The Engineer will submit to the City the final estimate and the final payment request, together with a certification stating that the work is complete and in substantial conformance with these Contract Documents. The entire balance found to be due the Contractor, including retained percentages, but except such

sums as may be retained under any provisions of these Contract Documents, will be paid to the Contractor.

Final payment to the Contractor by the City shall not serve to release the Contractor or his sureties from their obligations or responsibilities under or in connection with these Contract Documents.

8.7 Acceptance of Final Payment as Release. The acceptance by the Contractor of final payment shall be and shall operate as a release to the City of all claims and all liability to the Contractor other than claims in stated amounts as may be specifically excepted by the Contractor for all things done or furnished in connection with the work under these Contract Documents and for every act and neglect of the City and others relating to or arising out of this work.

8.8 Contractor's Schedule of Values. If the Contract is based on a lump sum bid, or contains one or more lump sum items for which progress payments are desired, the Contractor shall prepare and submit to the Engineer a schedule of values covering each lump sum item. The schedule of values, showing the value of each kind of work, shall be acceptable to the Engineer before any progress payment estimate and progress payment request are prepared. Such items as bond premium, temporary construction facilities, and plant may be listed separately in the schedule of values, provided the costs can be substantiated.

The sum of the items listed in the schedule of values shall equal the contract lump sum price(s). Overhead and profit shall not be listed as separate item.

An unbalanced schedule of values providing for overpayment of the Contractor on items of work which would be performed first will not be accepted. The schedule of values shall be revised and resubmitted until acceptable to the Engineer.

8.9 Changes/Extra Work for Lump Sum Contracts. The basis for payment for alterations on additions or extra work or decrease in scope of work shall be based on the Schedule of Values provided by the Contractor under para. 8.8 (above) or may be based upon the latest publication "Bid Data on Current Municipal Works." The maximum payment shall not be greater than an average of Contractor's Schedule of Values and the publication's average of the lowest bids.

SECTION 9. MISCELLANEOUS SPECIAL PROVISIONS

9.1 Use of Work by City. Prior to substantial completion, the City may use any completed or substantially completed portions of the work, provided that such use will not substantially affect the Contractor's rights and obligations under the contract. It is understood and agreed that said use shall not constitute an acceptance of any such portions of the work.

The City, or another Contractor under contract to the City, shall have the right to enter the premises for the purpose of doing work not covered by these Contract Documents. This provision shall not be construed as relieving the Contractor of the sole responsibility

for the care and protection of the work, or the restoration of any damaged work except such as may be caused by agents, employees, or other contractors of the City.

- 9.2 Inspection by Public Agencies. Authorized representatives of the Environmental Protection Agency, Department of the Interior, Tennessee Department of Public Health, and other governmental agencies having jurisdiction over the work or any part thereof shall have access to the work and any records relevant to the prosecution and progress of the work. The Contractor shall provide proper facilities for such access and inspection.
- 9.3 Chemicals. All chemicals used during project construction, or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with the manufacturer's or Engineer's instructions.
- 9.4 Siltation and Bank Erosion. The Contractor shall take necessary steps to minimize siltation and soil erosion during construction to the satisfaction of the Engineer.
- 9.5 Contractor Licensing Act. The "Contractor Licensing Act of 1976," as amended, T.C.A. Sec. 62-6-101, et seq, in its entirety is to be considered a part of these Contract Documents and incorporated herein as though specifically set forth. Copies of this Act can be obtained from the Contractor's Licensing Board, Nashville, Tennessee. Among other provisions, this Act requires that any contractor undertaking to construct, erect, alter, or repair any structure or municipal work, including sewerage and drainage systems, highways, roads, bridges, and similar structures or projects where the cost of the completed work will be equal to or in excess of Fifty Thousand (\$50,000.00) Dollars shall be licensed as required by the Act. Subcontracts involving Fifty Thousand (\$50,000.00) Dollars or more of electrical work, plumbing work, masonry work, or heating, ventilating or air conditioning work must be done by licensed contractors. The Contractor is required to be a licensed general contractor, and where required by the Act, subcontractors must be licensed.
- 9.6 Hindrances and Delays. The Contractor expressly agrees that the construction period named in these Contract Documents includes allowance for all hindrances and delays incident to the work. It is understood and agreed that no claim shall be made by the Contractor for hindrances or delays from any cause during the progress of the work, except as provided otherwise under the terms of these Contract Documents.
- 9.7 Losses from Natural Causes. It is understood and agreed that all loss or damage arising out of the nature of the work, or from the action of the elements, or from floods or overflows, or from ground water, or from seepage, or from any unusual obstruction or difficulty, or from any other natural or existing circumstance either known or unforeseen, which may be encountered in the prosecution of the work, shall be sustained and borne by the Contractor at his own cost and expense.
- 9.8 New Job Opportunities. The Contractor shall, to the maximum extent practicable, follow hiring and employment practices that will insure the availability of new job opportunities

for unemployed and underemployed persons. The Contractor shall insert, or cause to be inserted, a similar provision in each contract with Subcontractors or Suppliers.

END OF DOCUMENT

EQUAL EMPLOYMENT OPPORTUNITIES SPECIFICATIONS

Following is the standard language which must be incorporated into all solicitations for offers and bids on all construction contracts or subcontracts in excess of \$10,000 to be performed in designated geographical areas:

"Minority" includes:

- a. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
- b. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
- c. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
- d. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

END OF DOCUMENT

EQUAL EMPLOYMENT OPPORTUNITY CLAUSE

The City of East Ridge is an equal opportunity employer and during the performance of this contract, the Contractor agrees to abide by the equal opportunity goals of the City of East Ridge as follows:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following:
Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.
3. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. In all construction contracts or subcontracts in excess of \$10,000 to be performed for the City of East Ridge, any Contractor and/or subcontractor is further required to file in duplicate within ten (10) days of being notified that it is the lowest responsible bidder, an affirmative action plan with the EEO Director of the City of East Ridge. This plan shall state the Contractor's goals for minority and women utilization as a percentage of the work force on this project.
5. This Plan or any attachments thereto shall further provide a list of employees annotated by job function, race and sex who are expected to be utilized on this project. This plan or attachment thereto shall further describe the methods by which the Contractor or subcontractor will utilize to make good faith efforts at providing employment opportunities for minorities and women.
6. The Contractor will include the portion of the sentence immediately preceding Paragraph 1 and the provisions of Paragraphs 1 through 6 in every subcontract so that such provisions will be requested of each subcontractor. The Contractor agrees to notify the City of East Ridge of any subcontractor who refuses or fails to comply

with these equal opportunity provisions. Any failure or refusal to comply with these provisions by the Contractor and/or subcontractor shall be a breach of this contract.

END OF DOCUMENT

PROGRESS PAYMENT REQUEST

PAY ESTIMATE NUMBER: _____

PERIOD: FROM _____ **TO** _____

CONTRACT NUMBER: _____

P.O. NUMBER: _____

PROJECT NAME: _____

SUBMITTED BY: _____

According to the best of our knowledge and belief, we certify that all items and amounts shown on the face of this periodic estimate for partial payment are correct, that all work has been performed and/or materials supplied in full accordance with the requirements of the referenced contract, and/or duly authorized deviations, substitutions, alterations, and/or additions that the foregoing is a true and correct statement of the contract account up to and including the last day of the period covered by this periodic estimate and that no part of the Balance Due in this payment has been received.

As per contract specification requirements we understand and agree that the approval of this progress payment shall not be construed as acceptance of any work, material, or products and shall not relieve us in any way from our responsibilities and obligations under this contract, including but not limited to, a final reconciliation of quantities and related costs.

TOTAL INVOICE AMOUNT _____

RETAINAGE WITHOLDING _____

NET AMOUNT DUE _____

SIGNED BY _____

SIGNATURE _____

DATE: _____

TITLE _____

APPROVALS

I certify that the above process payment request appears to be accurate and is in general compliance with the amount of work completed during progress payment period.

REVIEWED BY _____
(Print Name)

(Print Name)

**SIGNATURE
& DATE**

TITLE _____
Inspector

Engineer

APPROVED FOR PAYMENT

BY: _____

DATE: _____

CITY OF EAST RIDGE

SECTION 01010
SUMMARY OF WORK

PART 1 – GENERAL

1.1 Section Includes

- A. Description of Work
- B. Items regulating the execution of the Work.

1.2 Description of the Work

The scope of work shall consist of the following major elements including but not limited to the following:

Furnishing all labor and material for the grading, drainage, paving, concrete sidewalk and dog park amenity pads, fencing, restroom facilities, utilities, and landscaping associated with project.

- A. The City Engineer reserves the right to substitute, add, delete, increase, decrease in any form or fashion as necessary the scope of work under the provisions of this Contract, including the projects noted above.
- B. This project shall be assigned a unique project number by the Engineer. The Contractor shall execute this project in complete compliance with the requirements of this contract. All records of the Contractor shall conspicuously identify them to be associated with the unique project number assigned by the Engineer.
- C. The Engineer shall provide a set of standard City details, as needed, which shall be applicable to this project. The Contractor shall be called in for a Pre-Construction meeting at which time the Engineer shall issue notice to proceed. Unless otherwise agreed to, the Contractor shall have ten (10) days from the date of the Notice to Proceed to begin the work.

1.3 Items Regulating the Execution of the Work.

A. Attention to Work

For this project, the Contractor shall give his personal attention to and shall supervise the work to the end that it shall be prosecuted faithfully; and, when he is not personally present on the work, he shall at all times be represented by a competent superintendent or foreman who shall be present at the work and who shall receive and obey all instruction or orders given under this Contract, and who shall have full authority to execute the same, and to supply materials, tools and labor without delay, and who shall be the legal representative of the

Contractor. The Contractor shall be liable for the faithful observance of any instructions delivered to him or to his authorized representatives.

B. Access to Work

The Contractor shall, at all times, provide proper facilities for access and inspection of the work by representatives of the Owner and of such official Governmental agencies as may be designated by the Owner as having jurisdictional rights to inspect the work.

C. No Parking Signs

The Contractor shall place "NO PARKING" signs 48 hours prior to beginning work at a project location. The Contractor shall notify the City's designated Inspector/ Project Manager when the signs have been placed and if vehicles have not been moved at such time as work is scheduled to begin. No additional cost shall be paid to the Contractor while the Owner is making arrangements to get the vehicle moved or towed.

D. Work on State Highway

Where the work on this project encroaches upon the right-of-way of any State or Interstate Highway right-of-way, the owner will execute a contract with proper authorities for the proposed work.

The Contractor shall notify the proper authorities prior to entering upon such right-of-way and shall be responsible for all damage and for satisfying the requirements of these authorities.

E. Work on Private Property

Where the work on this project encroaches upon private property, the Owner shall provide easements and/or right-of-entry in or onto said property. Work performed in such easements is subject to the provisions of the easement agreement on file with the City of East Ridge.

The Contractor shall be responsible for obtaining any additional agreements which may be deemed necessary for the storage of equipment or materials outside of public easements or rights of ways for this project. The Contractor shall obtain a written agreement between the Contractor and Land Owner and forward it to the Engineer prior to use of said property.

The Contractor shall be responsible for the preservation of and shall use every precaution to prevent damage to all trees, shrubbery, fences, culverts, mailboxes, bridges, pavements, driveways, sidewalks, houses or building and all water, sewer, gas, telephone and electric lines thereto and all other private and public property along or adjacent to the work.

Any damage that occurs will be restored to a like condition as existed prior to construction, in the Contract Documents, unless otherwise indicated or specified.

Forty-eight (48) hours prior to construction on any easement or streets the Contractor shall notify in writing the affected property owners in the area. This notification shall include the Contractor's name and the name and phone number of the contact person.

F. Weekly Job Site Meetings

Once a week, on a date mutually agreed upon by the Contractor and the Engineer, a job site meeting shall be held for review of the Project, including, but not limited to: The construction schedule, traffic control, pending submittals, and any other issues that may arise. This meeting shall be used to review the contractor's monthly applications for payment.

G. Contract Working Hours

All work shall be performed during regular working hours unless mutually agreed upon and approved in writing by the City Engineer. The Contractor will not work on Sundays or any legal holiday without the Owner's written consent given after prior 24 hour written notice to the Engineer. Saturday work shall also require prior 24 hour written notice. Regular working hours are Monday through Friday from 7:00 A.M. to 8:00 P.M. The actual costs of the Owner's and Engineer's inspection of the work performed outside of regular working hours will be billed to the Contractor and deducted from the Contractor's application for payment as they occur.

END OF DOCUMENT

SECTION 01025
LUMP SUM CONTRACT PRICE

1.01 LUMP SUM CONTRACT PRICE

- A. Lump Sum Price is the price for complete work.

- B. Lump Sum Price for the Base Bid and Add Alternate Bids includes all labor, material, overhead, profit, all applicable taxes, waste and all other incidentals for all Contractors and Subcontractors involved in the Work. Bid prices for each Lump Sum unit shown in the bid schedule shall include the cost of any and all incidental work. This includes, but is not limited to, traffic control, replacement of traffic control markings, temporary construction signs and devices, utility ring and cover adjustments, saw cutting, removal and disposal of excavated materials, etc.

END OF DOCUMENT

SECTION 01080
APPLICABLE CODES AND STANDARDS

1.01 GENERAL

A. All materials, equipment, fabrication, and installation practices shall comply with the following applicable codes and standards, except in those cases where the Contractor's quality standards establish more stringent quality requirements, as determined by the Engineer.

1. Pressure Piping and Tubing
ANSI (American National Standards Institute)
API (American Petroleum Institute)
ASME (American Society of Mechanical Engineers)
AWWA (American Water Works Association)
NSF (National Sanitation Foundation)
2. Materials
AASHTO (American Association of State Highway and
Transportation Officials)
ANSI (American National Standards Institute)
ASTM (American Society for Testing and Materials)
3. Painting and Surface Preparation
NACE (National Association of Corrosion Engineers)
SSPC (Steel Structures Painting Council)
4. Gear Reducers and Bearings
AFBMA (Anti-Friction Bearing Manufacturers Association)
AGMA (American Gear Manufacturers Association)
5. Ventilating Fans
AMCA (Air Moving and Conditioning Association)
PFMA (Power Fan Manufacturer Association)
6. Electrical and Instrumentation
EIA (Electronic Industries Association)
IEEE (Institute of Electronic Electrical Engineers)
IPC (Institute of Printed Circuits)
IPCEA (Insulated Power Cable Engineers Association)
ISA (Instrument Society of America)
NEMA (National Electrical Manufacturers Association)
NFPA (National Fire Protection Association)
UL (Underwriter's Laboratories)
7. Aluminum Structures
AA (Aluminum Association)

AAMA (Architectural Aluminum Manufacturer's Association)

8. Steel Structures
AISC (American Institute of Steel Construction)
9. Concrete Structures
ACI (American Concrete Institute)
10. Welding
ASME (American Society of Mechanical Engineers)
AWS (American Welding Society)
11. Safety
OSHA (Occupational Safety and Health Administration)
MUTCD (Manual on Uniform Traffic Control Devices)
12. General Building Construction
FM (Factory Mutual Fire Insurance Company)
NFPA (National Fire Protection Association)
SBC (Southern Building Code)
13. Subgrades and Pavement
SSRBC (Standard Specifications for Road and Bridge
Construction, Tennessee Department of Transportation)
14. Ductwork and Sheet Metal Work
SMACNA (Sheet Metal and Air Conditioning Contractors
National Association)
15. Plumbing
AGA (American Gas Association)
NSF (National Sanitation Foundation)
PDI (Plumbing Drainage Institute)
SPC (SBCC Standard Plumbing Code)
16. Refrigerating, Heating, and Air Conditioning
ARI (American Refrigeration Institute)
ASHRAE (American Society of Heating, Refrigeration, and
Air Conditioning Engineers)
17. Pressure Vessels
ASME (American Society of Mechanical ENGINEERS)

In addition, all work shall comply with the applicable requirements of local codes, utilities, and other authorities having jurisdiction.

- B. All material and equipment, for which a UL Standard, an AGA approval, or an

ASME requirement is established, shall be so approved and labeled or stamped. Label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.

END OF DOCUMENT

SECTION 01090 ABBREVIATIONS

1.01 GENERAL

Wherever in these Specifications and Contract Documents the abbreviations, or pronouns in place of them are used, the intent and meaning shall be interpreted as specified herein.

1.02 ABBREVIATIONS

AA	- Aluminum Association
AAMA	- Architectural Aluminum Manufacturer's Association
AASHTO	- American Association of State Highway and Transportation Officials
ACI	- American Concrete Institute
ACPA	- American Concrete Pipe Association
AEIC	- Association of Edison Illuminating Companies
AFBMA	- Anti-Friction Bearing Manufacturers Association
AGA	- American Gas Association
AGMA	- American Gear Manufacturers Association
AIA	- American Institute of Architects
AIEE	- American Institute of Electrical Engineers
AISC	- American Institute of Steel Construction
AITC	- American Institute of Time Construction
ANSI	- American National Standards Institute
AMCA	- Air Moving and Conditioning Association
APA	- American Plywood Association
APHA	- American Public Health Association
API	- American Petroleum Institute
APWA	- American Public Works Administration
ARC	- Appalachian Regional Commission
AREA	- American Railroad Engineering Association
ASA	- American Standards Association
ASCE	- American Society of Civil Engineers
ASHRAE	- American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	- American Society of Mechanical Engineers
ASTM	- American Society for Testing and Materials
AWS	- American Welding Society
AWWA	- American Water Works Association
BFF	- Best Friends Forever
CFR	- Code of Federal Regulations
CRSI	- Concrete Reinforcing Steel Institute
CTI	- Cooling Tower Institute
DEMA	- Diesel Engine Manufacturers Association
EDA	- Economic Development Administration
EPA	- Environmental Protection Agency
FmHA	- Farmers Home Administration

FS	- Federal Specifications
HEI	- Heat Exchange Institute
IEEE	- Institute of Electronic and Electrical Engineers
IES	- Illuminating Engineering Society
IPCEA	- Insulated Power Cable Engineers Association
IPC	- Institute of Printed Circuits
ISA	- Instrument Society of America
MBMA	- Metal Building Manufacturers Association
MSS	- Manufacturers Standardization Society of the Valve and Fitting Industry
MUTCD	- Manual on Uniform Traffic Control Devices
NAAMM	- National Association of Architectural Metal Manufacturers
NACE	- National Association of Corrosion Engineers
NBFU	- National Board of Fire Underwriters
NBS	- National Bureau of Standards
NCPI	- National Clay Pipe Institute
NEC	- National Electric Code
NEMA	- National Electrical Manufacturers Association
NFPA	- National Fire Protection Association
NRMA	- National Ready-Mix Association
OSHA	- Occupational Safety and Health Administration
PCA	- Portland Cement Association
PCI	- Prestressed Concrete Institute
SBC	- Southern Building Code
SMACNA	- Sheet Metal and Air Conditioning Contractors National Association
SSPC	- Steel Structures Painting Council
TCA	- Tile Council of America
TDEC	- Tennessee Department of Environment and Conservation
TEMA	- Tubular Exchangers Manufacturers Association
UBC	- Uniform Building code
UL	- Underwriters Laboratories
USDC	- United States Department of Commerce
WBCF	- Water Pollution Control Federation

END OF DOCUMENT

SECTION 01730

GUARANTEES AND WARRANTIES

1.01 GENERAL WARRANTY

- A. The Contractor shall warrant all equipment, materials, products, and workmanship provided by the Contractor under these Contract Documents for a period of twelve (12) months after the date of final acceptance of the work by the OWNER.
- B. If, during the warranty period (a) any equipment, materials or products furnished and/or installed by the Contractor are found to be defective in service by reason of the Contractor's faulty process, structural and/or mechanical design or specification, or (b) any equipment, materials, or products furnished and/or installed by the Contractor are found to be defective by reason of defects in material or workmanship, the Contractor shall, as soon as possible after receipt of written notice from the OWNER, repair or cause to be repaired such defective equipment, materials or products, or replace such defective equipment, materials, or products.
- C. In the event of multiple equipment failures of major consequence prior to the expiration of the one-year warranty described above the affected equipment shall be disassembled, inspected, and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the equipment failure shall be replaced. A new twelve (12) month warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item of equipment is reassembled and placed back into operation. As used herein, multiple equipment failures shall be interpreted to mean two (2) or more successive failures of the same kind in the same item of equipment or failures of the same kind in two (2) or more items of equipment. Major equipment failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts or structural members, broken or chipped gear teeth overheating, premature bearing failure, excessive wear, or excessive leakage around the seals. Equipment failures which are directly and clearly traceable to operator abuse, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over or under lubrication and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the one-year warranty. Should multiple equipment failures occur in a given item or type of equipment, all equipment of the same size and type shall be disassembled, inspected, modified or replaced, as necessary, and re-warranted for one year.
- D. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability with the law of the place of Construction.

- E. Submit guarantees for manufactured materials or units used in this project.

1.02 START-UP OF OPERABLE COMPONENTS

- A. Because of the need to maintain operation during construction, it will be necessary to accept and start-up operable components of the project at various times prior to the completion and final acceptance of the entire project.
- B. A component of the project, as used herein, shall mean a complete process subsystem and shall include all associated structures, equipment, piping, controls, etc.
- C. When a component of the project has been completed, checked out, field tested, and made ready for operation, the Contractor shall notify the ENGINEER in writing that the component is substantially complete and request an inspection for substantial completion. The ENGINEER will schedule the inspection within 10 days of the Contractor's request. If he concurs in the Contractor's statement, the ENGINEER will notify the Contractor in writing that the component is accepted as Substantially complete. At the same time, the ENGINEER will submit to the Contractor a list of items that must be completed or corrected before final acceptance can be given.
- D. If a component of the project is needed in order to maintain operation during construction and if it has been accepted as substantially complete, the Contractor shall start up the component when directed by the ENGINEER. Once the component has achieved stable and satisfactory operation (minimum 95 percent availability over a 7-day period), the Contractor shall request beneficial occupancy by the OWNER. The OWNER, if he concurs in the Contractor's statement that stable and satisfactory operation has been achieved, will notify the Contractor in writing within 10 days that he is assuming beneficial occupancy of the component.
- E. On the date that the OWNER assumes beneficial occupancy, the following shall occur, if it is not contrary to the General or Supplemental General Conditions:
 - 1. The one-year warranties for the component specified in Part 1.01 of the Section will begin; and
 - 2. The OWNER will assume responsibility for operating and maintaining the component.

END OF DOCUMENT

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

B. Related Requirements:

1. Section 033816 "Unbonded Post-Tensioned Concrete" for reinforcing related to post-tensioned concrete.
2. Section 034100 "Precast Structural Concrete" for reinforcing used in precast structural concrete.
3. Section 034500 "Precast Architectural Concrete" for reinforcing used in precast architectural concrete.
4. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.
5. Section 321316 "Decorative Concrete Paving" for reinforcing related to decorative concrete pavement and walks.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Epoxy repair coating.
3. Zinc repair material.
4. Bar supports.
5. Mechanical splice couplers.

B. Sustainable Design Submittals:

1. Third-Party Certifications: For each product.
 2. Third-Party Certified Life Cycle Assessment: For each product.
- C. Shop Drawings: Comply with ACI SP-066:
1. Include placing drawings that detail fabrication, bending, and placement.
 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
 3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.
- D. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
1. Location of construction joints is subject to approval of Architect.
- E. Delegated Design Submittal: For structural thermal break insulated connection system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For delegated design engineer testing and inspection agency .
- B. Delegated Design Engineer Qualifications: Include the following:
1. Experience providing delegated design engineering services of the type indicated.
 2. Documentation that delegated design engineer is licensed in the jurisdiction in which Project is located.
- C. Welding certificates.
1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.
- D. Material Certificates: For each of the following, signed by manufacturers:
1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
 2. Dual-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
- E. Material Test Reports: For the following, from a qualified testing agency:
1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

2. Mechanical splice couplers.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.
- C. Mockups: Reinforcing for cast-concrete formed surfaces, to demonstrate tolerances and standard of workmanship.
1. Build panel approximately 100 sq. ft. for formed surface in the location indicated on Drawings or, if not indicated, as directed by Architect.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage and to avoid damaging coatings on steel reinforcement .
1. Store reinforcement to avoid contact with earth.
 2. Do not allow epoxy-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
 3. Do not allow dual-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
 4. Do not allow stainless steel reinforcement to come into contact with uncoated reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 , deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- D. Galvanized Reinforcing Bars:

- E. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, **Grade 60** , deformed bars, assembled with clips.
- F. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- H. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, **Grade 60**, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
 - b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - c. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - d. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
 - e. For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- C. Mechanical Splice Couplers: **ACI 318** Type 1 , same material of reinforcing bar being spliced; tension-compression type .
- D. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than **0.0508 inch** in diameter.
 - 1. Finish: Plain .
- E. Stainless Steel Tie Wire: ASTM A1022/A1022M, not less than **0.0508 inch** in diameter.
- F. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775/A775M.
- G. Zinc Repair Material: ASTM A780/A780M.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than **1 inch**, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with **ACI 318**.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or **24 inches**, whichever is greater.
 - 2. Stagger splices in accordance with **ACI 318**.
 - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
 - 4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install structural thermal break insulated connection system in accordance with manufacturer's instructions.
- H. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed **12 inches**.
 2. Lap edges and ends of adjoining sheets at least one wire spacing plus **2 inches** for plain wire and **8 inches** for deformed wire.
 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 4. Lace overlaps with wire.
- I. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating in accordance with ASTM D3963/D3963M.
 - J. Dual-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating in accordance with ASTM D3963/D3963M.
 - K. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material in accordance with ASTM A780/A780M.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 1. Place joints perpendicular to main reinforcement.
 2. Continue reinforcement across construction joints unless otherwise indicated.
 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with **ACI 117**.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:

1. Steel-reinforcement placement.
 2. Steel-reinforcement mechanical splice couplers.
 3. Steel-reinforcement welding.
- D. Manufacturer's Inspections: Engage manufacturer of structural thermal break insulated connection system to inspect completed installations prior to placement of concrete, and to provide written report that installation complies with manufacturer's written instructions.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete standards.
2. Concrete materials.
3. Repair materials.
4. Concrete mixture materials.
5. Concrete mixture class types.
6. Concrete mixing.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 033300 "Architectural Concrete" for general building applications of specially finished formed concrete.
4. Section 033543 "Polished Concrete Finishing" for concrete floors scheduled to receive a polished concrete finish.
5. Section 035300 "Concrete Topping" for concrete floor toppings.
6. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
7. Section 321313 "Concrete Paving" for concrete pavement and walks.
8. Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement or blended hydraulic cement alone or in combination with one or more of the following:

1. Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cementitious Materials (w/cm) Ratio: The ratio by weight of mixing water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Require representatives of each entity directly concerned with cast-in-place

concrete to attend, including the following:

- a. Contractor's superintendent.
- b. Independent testing agency responsible for inspections and acceptance testing of concrete at Project site.
- c. Ready-mix concrete manufacturer.
- d. Concrete Subcontractor.
- e. Special concrete finish Subcontractor.

2. Review the following:

- a. Special inspection and testing and inspecting agency procedures for field quality control.
- b. Construction joints, control joints, isolation joints, and joint-filler strips.
- c. Semirigid joint fillers.
- d. Vapor-retarder installation.
- e. Anchor rod and anchorage device installation tolerances.
- f. Cold- and hot-weather concreting procedures.
- g. Concrete finishes and finishing.
- h. Curing procedures.
- i. Forms and form-removal limitations.
- j. Shoring and reshoring procedures.
- k. Methods for achieving specified floor and slab flatness and levelness.
- l. Floor and slab flatness and levelness measurements.
- m. Concrete repair procedures.
- n. Concrete protection.
- o. Initial curing of standard-cured and field curing of field-cured test cylinders (ASTM C31/C31M.)
- p. Protection of field cured field test cylinders.
- q. Distribution of test reports.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Ground calcium carbonate and aggregate mineral fillers.
10. Admixtures:
 - a. Include limitations of use. Admixtures that do not comply with reference ASTM International requirements must be submitted with test data for approval.

11. Color pigments.
12. Fiber reinforcement.
13. Vapor retarders.
14. Floor and slab treatments.
15. Liquid floor treatments.
16. Curing materials.
 - a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.
17. Joint fillers.
18. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Compressive strength at 28 days or other age as specified.
3. Compressive strength required at stages of construction.
4. Durability exposure classes for Exposure Categories F, S, W, and C.
5. Maximum w/cm ratio.
6. Calculated equilibrium and fresh density for lightweight concrete.
7. Slump or slump flow limit.
8. Air content.
9. Nominal maximum aggregate size.
10. Steel-fiber reinforcement content.
11. Synthetic microfiber content.
12. Synthetic macrofiber content.
13. Intended placement method.
14. Submit adjustments to design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.

D. Samples: For manufacturer's standard colors for color pigment vapor retarder .

E. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixture Class Types" Article, including the following:

1. Concrete class designation.
2. Location within Project.
3. Exposure class designation.
4. Formed surface finish designation and final finish.
5. Final finish for floors.
6. Floor treatment, if any.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Testing Agency: Include documentation indicating compliance with ASTM E329 or ASTM C1077 and copies of applicable ACI certificates for testing technicians or ACI Concrete Construction Special Inspector - MH, ASCC.

B. Material Certificates: For each of the following:

1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

C. Material Test Reports: For the following:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Ground calcium carbonate and aggregate mineral filler.
10. Admixtures.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances in accordance with ACI 117 and in compliance with **ASTM E1155**.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC's Acceptance Criteria AC380.

F. Preconstruction Test Reports: For each mix design.

G. Field quality-control reports.

H. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified Installer who employs Project personnel qualified as an ACI-certified Concrete Flatwork Associate and Concrete Flatwork Finisher and a supervisor who is a certified ACI Advanced Concrete Flatwork Finisher/Technician or an ACI Concrete Flatwork Finisher with experience installing and finishing concrete.
 - 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer's production facilities and delivery vehicles certified in accordance with NRMCA's certification requirements or equivalent approval by a State DOT.
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing that performs duties on behalf of the Architect/Engineer.
 - 1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Level 1. Testing agency laboratory supervisor tests to be an ACI-certified Concrete Laboratory Testing Technician, Level 2.
- D. Field Quality-Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
 - 1. Personnel conducting field tests on plastic concrete properties are to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with policies from ACI CPP 610.1 or an equivalent certification program.
- E. Mockups: Cast concrete slab-on-ground and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship. Provide up to two batches of concrete to demonstrate the number of required mockups.
 - 1. Slab-on-Ground: Build panel in the location indicated or, if not indicated, as directed by Architect.
 - a. Divide panel into four equal panels to demonstrate saw joint cutting.
 - 2. Formed Surfaces: Build panel in the location indicated or, if not indicated, as directed by Architect.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.
 - f. Evaluation of permeability-reducing admixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and **ACI 301**.

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with **ACI 301** as follows:
1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 2. When air temperature has fallen to, or is expected to fall below **40 deg F** during the protection period, maintain delivered concrete mixture temperature within the temperature range required by **ACI 301**.
 3. Do not use frozen materials or materials containing ice or snow.
 4. Do not place concrete in contact with surfaces less than **35 deg F**, other than reinforcing steel.
- B. Hot-Weather Placement: Comply with **ACI 301** and **ACI 305.1**, and as follows:
1. Maintain concrete temperature at time of discharge to not exceed **95 deg F**.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE STANDARDS

- A. ACI Publications: Comply with **ACI 301** unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

- A. Source Limitations:

- 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
- 2. Obtain each type of admixture from single source from single manufacturer.

- B. Cementitious Materials:

- 1. Portland Cement: ASTM C150/C150M, Type I Type II Type III , gray white .
- 2. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, portland blast-furnace slag Type IP, Portland-pozzolan cement.
- 3. Performance-Based Hydraulic Cement: ASTM C1157/C1157M: Type GU, general use .
- 4. Pozzolans: ASTM C618, Class C, F, or N.
- 5. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- 6. Ground Glass Pozzolan: ASTM C1866/C1866M, Type GS or GE.
- 7. Silica Fume: ASTM C1240.

- C. Normal-Weight Aggregates:

- 1. Coarse Aggregate: ASTM C33/C33M, Class 3S
- 2. Maximum Coarse-Aggregate Size: **1-1/2 inches** nominal.
- 3. Fine Aggregate: ASTM C33/C33M.
- 4. Recycled Aggregate: Provide documentation of characteristics of recycled aggregate and mechanical properties and durability of proposed concrete, which incorporates recycled aggregate to conform to applicable requirements for the class of concrete.
- 5. Alkali-Silica Reaction: Comply with one of the following for each aggregate used:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567. Do not use this option with fly ash with an alkali content greater than 4.0 percent. Submit supporting data for each aggregate showing expansion in excess of 0.10 percent when tested in accordance with ASTM C1260.
 - c. Alkali Content in Concrete: Not to exceed **4 lb./cu. yd.** for aggregate with expansion greater than or equal to 0.04 percent and less than 0.12 percent or **3 lb./cu. yd.** for aggregate with expansion greater than or equal to 0.12

percent and less than 0.24 percent. Test aggregate reactivity in accordance with ASTM C1293. Calculate alkali content of concrete in accordance with **ACI 301**. Do not use this option with natural pozzolan or fly ash that has a calcium oxide content greater than 18 percent or an alkali content greater than 4.0 percent; or for an aggregate with expansion at one year greater than or equal to 0.24 percent when tested in accordance with ASTM C1293.

- D. Ground Calcium Carbonate or Aggregate Mineral Filler: ASTM C1797. Unless otherwise permitted, do not use mineral filler derived from carbonate sources in concrete for members assigned to Exposure Class S1, S2, or S3.

2.3 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260/C260M.
- B. Chemical Admixtures: Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete .
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.
 - 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
 - 6. Admixtures with special properties, with documentation of claimed performance enhancement, ASTM C494/C494M, Type S.
- C. Mixing Water for Concrete Mixtures and Water Used to Make Ice: ASTM C1602/C1602M. Include documentation of compliance with limits for alkalis, sulfates, chlorides, or solids content of mixing water from Table 2 in ASTM C1602/C1602M.

2.4 FLOOR AND SLAB TREATMENTS

- A. Emery Dry-Shake Floor Hardener: Pigmented Unpigmented , factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.
 - 1. Color: As selected by Architect from manufacturer's full range .
- B. Metallic Dry-Shake Floor Hardener: Pigmented Unpigmented , factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.
 - 1. Color: As selected by Architect from manufacturer's full range .

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately **9 oz./sq. yd.** when dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below 50 deg F (10 deg C): Black.
 - b. Ambient Temperature between 50 and 85 deg F (10 and 29 deg C): Any color.
 - c. Ambient Temperature Above 85 deg F (29 deg C): White.
- C. Water: Potable water that does not cause staining of the surface.

2.6 ACCESSORIES

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber .
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.
- C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
 - 1. Types IV and V, load bearing , for bonding hardened or freshly mixed concrete to hardened concrete.

2.7 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from **1/8 inch** and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, **1/8 to 1/4 inch** or coarse sand, as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than **4100 psi** at 28 days when tested in accordance with ASTM C109/C109M.
- B. Repair Overlay: Cement-based, polymer-modified, self-leveling product that can

be applied in thicknesses from **1/4 inch** and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, **1/8 to 1/4 inch** or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than **5000 psi** at 28 days when tested in accordance with ASTM C109/C109M.

2.8 CONCRETE MIXTURE MATERIALS

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with **ACI 301**.
 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland or hydraulic cement in concrete assigned to Exposure Class F3 as follows:
 1. Fly Ash or Other Pozzolans: 25 percent by mass.
 2. Slag Cement: 50 percent by mass.
 3. Silica Fume: 10 percent by mass.
 4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
 5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
 1. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
 2. Use permeability-reducing admixture in concrete mixtures where indicated.

2.9 CONCRETE MIXTURE CLASS TYPES

- A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
 1. Exposure Class: **ACI 318** Class F3 Class S1 Class W1 Class C2 .
 2. Minimum Compressive Strength: **4000 psi** at 28 days.
 3. Maximum w/cm Ratio: 0.45 .
 4. Slump Limit: **4 inches**, plus or minus **1 inch** for concrete **<Insert limits>** .
 5. Air Content:

- a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing **3/4-inch** nominal maximum aggregate size .
 - b. Exposure Classes F2 and F3: 6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing **3/4-inch** nominal maximum aggregate size .
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cementitious materials.
 7. Compressive strength or alternative methods of estimating in-place strength of concrete by maturity or other nondestructive testing with acceptable correlation between test results and concrete compressive strength **<Insert strength and age for construction stages>** .
- B. Class B: Normal-weight concrete used for foundation walls.
1. Exposure Class: **ACI 318** Class F0 Class S1 Class W1 Class C1 .
 2. Minimum Compressive Strength: **4000 psi** at 28 days.
 3. Maximum w/cm Ratio: 0.45 .
 4. Air Content:
 - a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing **3/4-inch** nominal maximum aggregate size .
 - b. Exposure Classes F2 and F3: 6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing **3/4-inch** nominal maximum aggregate size .
 5. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
 6. Compressive strength or alternative methods of estimating in-place strength of concrete by maturity or other nondestructive testing with acceptable correlation between test results and concrete compressive strength **<Insert strength and age for construction stages>** .
- C. Class C: Normal-weight concrete used for interior slabs-on-ground.
1. Exposure Class: **ACI 318** Class F3 Class S1 Class W1 Class C2 .
 2. Minimum Compressive Strength: **3000 psi** at 28 days.
 3. Maximum w/cm Ratio : 0.45 .
 4. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
 5. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
 6. Synthetic Microfiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of **1.5 lb/cu. yd.** .

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish delivery ticket.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of **1 cu. yd.** or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than **1 cu. yd.**, increase mixing time by 15 seconds for each additional **1 cu. yd.**.
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.
 - 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
 - 4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 TOLERANCES

- A. Comply with **ACI 117**.

3.4 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install reglets to receive waterproofing and through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.5 INSTALLATION OF CAST-IN-PLACE CONCRETE

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
 - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Water addition in transit or at the Project site must be in accordance with ASTM C94/C94M and must not exceed the permitted amount indicated on the concrete delivery ticket.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with **ACI 301**.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least **6 inches** into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within

limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.6 INSTALLATION OF JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 3. Form keyed joints as indicated. Embed keys at least **1-1/2 inches** into concrete.
 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 6. Space vertical joints in walls as indicated on Drawings . Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
 7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least **[one-fourth]<Insert depth>** of concrete thickness as follows:
 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of **1/8 inch**. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut **1/8-inch** wide joints into concrete when

cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 2. Terminate full-width joint-filler strips not less than **1/2 inch** or more than **1 inch** below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.
- F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.7 APPLICATION OF FINISHING FLOORS AND SLABS

- A. Trowel Finish:
1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 4. Do not add water to concrete surface. Use of an approved finishing aid is acceptable.
 5. Do not apply troweled finish to concrete, which has a total air content greater than 3 percent.
 6. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system .
 7. Finish surfaces to the following tolerances, in accordance with **ASTM E1155**, for a randomly trafficked floor surface:
 - a. Slabs on Ground:
 - 1) Specified overall values of flatness, FF 35; and of levelness, FL 25; with minimum local values of flatness, FF 24; and of levelness, FL 17.
- B. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and

locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with a fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.8 APPLICATION OF FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than **3/4 inch** wide or **1/2 inch** deep.
 - b. Remove projections larger than **1/4 inch**.
 - c. Patch tie holes.
 - d. Surface Tolerance: **ACI 117**, Class B.
 - e. Locations: Apply to concrete surfaces exposed to public view, .

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling in:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to match color and texture with in-place construction exposed to view.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases **4 inches** high unless otherwise indicated on Drawings, and extend base not less than **6 inches** in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: **4000 psi** at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch** centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.

6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
 1. Cast-in inserts and accessories, as shown on Drawings.
 2. Screed, tamp, and trowel finish concrete surfaces.

3.10 APPLICATION OF CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 1. Comply with **ACI 301** for cold weather protection during curing.
 2. Comply with **ACI 301** and **ACI 305.1** for hot-weather protection during curing.
 3. Maintain moisture loss no more than **0.2 lb/sq. ft. x h**, calculated in accordance with ACI 305R, before and during finishing operations.

- B. Curing Formed Surfaces: Comply with **ACI 308.1** as follows:
 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 3. If forms remain during curing period, moist cure after loosening forms.
 4. If removing forms before end of curing period, continue curing for remainder of curing period as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.

- C. Curing Unformed Surfaces: Comply with **ACI 308.1** as follows:
1. Begin curing after finishing concrete.
 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than **12 inches**.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least **12 inches**, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following not in cold weather:
 - a) Water.
 - b) Continuous water-fog spray.
 - b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than **12 inches**.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least **12 inches**, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period,

- using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
 - c. Floors to Receive Polished Finish: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than **12 inches**.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
 - d. Floors To Receive Chemical Stain:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
 - 2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
 - 3) Butt sides of curing paper tight; do not overlap sides of curing paper.
 - 4) Leave curing paper in place for duration of curing period, but not less than 28 days.
 - e. Floors To Receive Urethane Flooring:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped **6 inches** and sealed in place.
 - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
 - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

- f. Floors To Receive Curing Compound:
 - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period.
 - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

- g. Floors To Receive Curing and Sealing Compound:
 - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 INSTALLATION OF JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least six month(s).
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least **2 inches** deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.12 INSTALLATION OF CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 - 1. Repair and patch defective areas when approved by Architect.
 - 2. Remove and replace concrete that cannot be repaired and patched to meet specification requirements.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a **No. 16** sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities,

cracks in excess of **0.01 inch** spalls, air bubbles exceeding surface finish limits, honeycombs, rock pockets, fins and other projections on the surface exceeding surface finish limits, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than **1/2 inch** in any dimension to solid concrete.
 - a. Limit cut depth to **3/4 inch**.
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and match surrounding surface.
3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance, as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of **0.01 inch** wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by adding patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
 - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

- b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of **1/4 inch** to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes **1 inch** or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a **3/4-inch** clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes **1 inch** or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 1. Testing agency to be responsible for providing curing facility for initial curing of strength test specimens on-site and verifying that test specimens are cured in accordance with standard curing requirements in ASTM C31/C31M.
 2. Testing agency to immediately report to Architect, Contractor, and concrete

- manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and **ACI 301**, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results of fresh concrete, including slump or slump flow, air content, temperature and density.
 - 13) Information on storage and curing of samples at the Project site, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
 4. Provide a space and source of power or other resources for curing and access to test specimens by the testing agency.
- C. Delivery Tickets: comply with ASTM C94/C94M.
- D. Inspections:
1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding **5 cu. yd.**, but less than **25 cu. yd.**, plus one set for each additional **150 cu. yd.** or fraction thereof.

- a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M:
 - a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests as needed.
3. Slump Flow: ASTM C1611/C1611M:
 - a. One test at point of delivery for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests as needed.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; .
 - a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is **40 deg F** and below or **80 deg F** and above, and one test for each composite sample when strength test specimens are cast.
6. Concrete Density: ASTM C138/C138M:
 - a. One test for each composite sample when strength test specimens are cast.
7. Unit Weight: ASTM C138/C138M density of fresh structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture. The fresh density should be consistent with that associated with the equilibrium density within a tolerance of plus or minus 4 lb/ft.³.
8. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and standard cure two sets of three **6 inches** by **12-inches** or **4-inch** by **8-inch** cylindrical specimens for each composite sample.
 - b. Cast, and field cure two sets of three standard cylindrical specimens for each composite sample.
9. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of two standard cured specimens at seven days and one set of two specimens at 28 **[other age]** days.

- b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
 - c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 10. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 11. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than **500 psi** if specified compressive strength is **5000 psi**, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than **5000 psi**.
 12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 13. Additional Tests:
 - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength to be in accordance with **ACI 301**, Section 1.7.6.3.
 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with **ASTM E1155** within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.14 PROTECTION

- A. Protect concrete surfaces as follows:
 1. Protect from petroleum stains.
 2. Diaper hydraulic equipment used over concrete surfaces.
 3. Prohibit vehicles from interior concrete slabs.
 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
 5. Prohibit placement of steel items on concrete surfaces.
 6. Prohibit use of acids or acidic detergents over concrete surfaces.
 7. Protect liquid floor treatment from damage and wear during the remainder of

- construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using floor slab protective covering.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Lintels.
3. Mortar and grout materials.
4. Reinforcement.
5. Mortar and grout mixes.

B. Products Installed, but Not Furnished, under This Section:

1. Cast-stone trim in unit masonry.
2. Stone trim units in unit masonry.
3. Steel lintels in unit masonry.
4. Steel shelf angles for supporting unit masonry.
5. Cavity wall insulation adhered to masonry backup.

C. Related Requirements:

1. Section 014339 "Mockups" for integrated exterior mockup requirements.
2. Section 019119.43 "Exterior Enclosure Commissioning."
3. Section 033000 "Cast-in-Place Concrete" for installing dovetail or channel slots for masonry-veneer anchors.
4. Section 042300 "Glass Unit Masonry" for glass block.
5. Section 042613 "Masonry Veneer" for unit masonry set as veneer.
6. Section 044200 "Exterior Stone Cladding" for stone trim secured with stone anchors.
7. Section 044313.13 "Anchored Stone Masonry Veneer" for thin stone trim set as anchored veneer.
8. Section 044313.16 "Adhered Stone Masonry Veneer" for thin stone trim set as adhered veneer.
9. Section 047200 "Cast Stone Masonry" for cast stone trim units.
10. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
11. Section 071900 "Water Repellents" for water repellents topically applied to unit masonry assemblies.
12. Section 072100 "Thermal Insulation" for cavity wall insulation.
13. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
14. Section 089516 "Wall Vents" for wall vents (brick vents).
15. Section 096313 "Brick Flooring" for interior brick flooring.
16. Section 096313.35 "Chemical-Resistant Brick Flooring" for chemical-resistant, interior brick flooring.

17. Section 097519 "Stone Trim" for interior stone window stools.
18. Section 321400 "Unit Paving" for exterior unit masonry paving.
19. Section 323223 "Segmental Retaining Walls" for dry-laid, concrete unit retaining walls.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Exposed: Weather-exposed side of a constructed wall.
- C. Reinforced Masonry: Masonry containing reinforcing steel within grouted cells.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings:
 1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI PRC 315R. Indicate elevations of reinforced walls.
 3. Lintel design and types required.
 4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
 1. Low carbon CMUs: Small-scale units .
 2. Colored Mortar: Full range of manufacturer's standard colors.
 3. Weep/cavity vents.
- D. Samples for Verification: For each type and color of the following:
 1. Low carbon CMUs: Small-scale units .
 2. Colored mortar.
 3. Weep/cavity vents.
 4. Special Masonry Shapes: One of each unique shape.
 5. Pigmented Mortar: Make Samples using same sand and mortar ingredients to be used on Project.
 6. Colored-Aggregate Mortar: Make Samples using same sand and mortar ingredients to be used on Project.
 7. Cavity drainage material.

8. Accessories embedded in masonry.
- E. Delegated Design Submittals: For masonry anchors and ties , including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Sustainable Design Submittals:
 1. Third-Party Certifications: For each product.
 2. Third-Party-Certified Life-Cycle Assessment: For each product.

1.5 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Material Certificates: For each type of the following:
 1. Masonry units.
 - a. Include data on material properties material test reports substantiating compliance with requirements .
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
 - d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing in accordance with ASTM C67/C67M .
 - e. For masonry units used in structural masonry , include data and calculations establishing average net-area compressive strength of units.
 2. Integral water repellent used within CMUs.
 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 4. Mortar admixtures.
 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 6. Grout mixes. Include description of type and proportions of ingredients.
 7. Reinforcing bars.
 8. Joint reinforcement.
 9. Anchors, ties, and metal accessories.
- C. Mix Designs: For each type of mortar and grout . Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

D. Qualification Statements: For testing agency.

E. Delegated Design Engineer Qualifications: For masonry anchors and ties .

F. Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements for cold weather.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.

B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

C. Testing Agency: Qualified in accordance with ASTM C1093 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of **24 inches** down both sides of walls, and hold cover securely in place.
 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of **24 inches** down face next to unconstructed wythe, and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F** and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain exposed masonry units cementitious mortar components and mortar aggregate from single source producer or manufacturer .
- B. For exposed masonry units and cementitious mortar components , obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Masonry to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7 .

- B. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with TMS 402/602.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 402/602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within **20 ft.** vertically and horizontally of a walking surface .
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units are listed by UL or a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs : ASTM C90, normal weight .
 - 1. Size (Width): Manufactured to dimensions **3/8 inch** less than nominal dimensions.
 - 2. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 - 3. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.5 CLAY MASONRY UNITS

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with

exposed surfaces finished.

2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing where shapes produced by sawing would result in sawed surfaces being exposed to view .

2.6 STRUCTURAL CLAY FACING TILE

- A. General: Provide solid, multicored, or hollow units, with shape and direction of cores optional unless otherwise indicated.
 1. Where reinforced masonry is indicated, provide multicored units designed for use in reinforced, grouted masonry, either with vertical cores and with webs notched to receive horizontal reinforcement, or with horizontal cores and with holes in bed shells for placement of grout and to receive vertical reinforcement.
 2. Where indicated for exterior applications, provide units recommended by manufacturer for exterior use in Project's location.
 3. Provide special shapes where required for corners, jambs, coved bases, sills, and other special conditions indicated, including applications that cannot be produced by sawing standard units.
 - a. Provide coved internal corners.
 - b. Provide recessed, coved base units.
 4. Where direct application of plaster is indicated or where bonded to backup masonry, provide units with rough, combed, or scored faces.

2.7 LINTELS

- A. Masonry Lintels : Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.8 MORTAR AND GROUT MATERIALS

- A. General: Provide mortar and grout materials to achieve performance requirements as specified in mortar and grout mixes.
- B. Colored Mortar: Packaged blend made from portland cement-lime mix or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 2. Pigments do not exceed 10 percent of portland cement by weight.
 3. Pigments do not exceed 5 percent of masonry cement or mortar cement by

weight.

- C. Preblended Dry Mortar Mix: Packaged blend complying with ASTM C1714/C1714M.
- D. Water: Potable.

2.9 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars : ASTM A615/A615M or ASTM A996/A996M, **Grade 60**.

2.10 TIES AND ANCHORS

- A. General: Ties and anchors extend at least **1-1/2 inches** into veneer but with at least a **5/8-inch** cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A641/A641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B coating.
 - 3. Stainless Steel Wire: ASTM A580/A580M, Type 304 .
 - 4. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, **G60** zinc coating.
 - 5. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 - 6. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666/A666M, Type 304 .
 - 7. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 - 8. Stainless Steel Bars: ASTM A276 or ASTM A666/A666M, Type 304.

2.11 ADJUSTABLE MASONRY-VENEER ANCHORS

- A. General: Provide anchors that allow vertical adjustment but resist a **100 lbf** load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of **1/16 inch**.
- B. Fabricate sheet metal anchor sections and other sheet metal parts from **0.1084-inch-thick** steel sheet, galvanized after fabrication .
- C. Fabricate wire ties from **0.187-inch-** diameter, hot-dip galvanized-steel wire unless otherwise indicated.
- D. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.

2.12 EMBEDDED FLASHING

- A. Preformed Corners, End Dams, and Seaming Shapes for Flashing: Flashing manufacturer's standard products or products recommended by flashing manufacturer for waterproofing openings.
- B. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 1. Elastomeric Sealant: ASTM C920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.
- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- D. Termination Bars for Flexible Flashing:
 - 1. Material: Stainless steel .
 - 2. Size: **1/8 by 1 inch** .
- E. Termination Bars for Flexible Flashing, Flanged:
 - 1. Material: Stainless steel sheet **0.019 by 1-1/2 inches** .
 - 2. Fabricate with a **3/8-inch** flange at top and bottom .

2.13 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene .
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).
- D. Masonry Cell Fill: Foamed-in-place masonry cell fill .

2.14 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.

2. Use portland cement-lime masonry cement or mortar cement mortar unless otherwise indicated.
 3. For exterior masonry, use portland cement-lime masonry cement or mortar cement mortar.
 4. For reinforced masonry, use portland cement-lime masonry cement or mortar cement mortar.
 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry .
1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type S Type N .
 3. For mortar parge coats, use Type S or Type N .
 4. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
 5. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored mortar cement .
1. Pigments do not exceed 10 percent of portland cement by weight.
 2. Pigments do not exceed 5 percent of masonry cement or mortar cement by weight.
 3. Mix to match Architect's sample.
 4. Application: Use pigmented mortar for exposed mortar joints with the following units: **<Insert masonry unit types>** .
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
1. Mix to match Architect's sample.
 2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units: **<Insert masonry unit types>** .
- F. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 402/602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C476, or paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than **2000 psi** .

3. Provide grout with a slump of **8 to 11 inches** as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds **30 g/30 sq. in.** per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus **1/2 inch** or minus **1/4 inch**.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus **1/2 inch**.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus **1/4 inch** in a story height or **1/2 inch** total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than **1/4 inch in 10 ft.**, or **1/2-inch** maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than **1/8 inch in 10 ft.**, **1/4 inch in 20 ft.**, or **1/2-inch** maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than **1/4 inch in 10 ft.**, **3/8 inch in 20 ft.**, or **1/2-inch** maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/8 inch in 10 ft.**, **1/4 inch in 20 ft.**, or **1/2-inch** maximum.
5. For lines and surfaces, do not vary from straight by more than **1/4 inch in 10 ft.**, **3/8 inch in 20 ft.**, or **1/2-inch** maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than **1/4 inch in 10 ft.**, or **1/2-inch** maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than **1/16 inch** except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch**, with a maximum thickness limited to **1/2 inch**.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than **1/8 inch**.
3. For head and collar joints, do not vary from thickness indicated by more than plus **3/8 inch** or minus **1/4 inch**.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch**. Do not vary from adjacent bed-joint and head-joint thicknesses by more than **1/8 inch**.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than **1/16 inch** from one masonry unit to the next.

3.4 INSTALLATION OF MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and,

where possible, at other locations.

- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond ; do not use units with less-than-nominal **4-inch** horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than **4 inches** . Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal **4-inch** horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-In Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout **24 inches** under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Rigid, Cellular Thermal Insulation, CMUs: Install molded-polystyrene insulation units into masonry unit cells before laying units.
- J. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of hollow CMUs solidly around plastic tubes of anchors, and push tubes down into grout to provide **1/2-inch** clearance between end of anchor rod and end of tube. Space anchors **48 inches** o.c. unless otherwise indicated.
 - 3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 INSTALLATION OF MORTAR BEDDING AND JOINTING

- A. General: Lay masonry units as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Solid Masonry Units: Lay units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Structural Clay Facing Tiles: Lay units as follows:
1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
 2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
 3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with **1/4- to 3/8-inch-** thick joints.
- D. Trim Units: Set stone cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Allow cleaned surfaces to dry before setting.
 3. Wet joint surfaces thoroughly before applying mortar.
 4. Rake out mortar joints for pointing with sealant.
- E. Rake out mortar joints at prefaced CMUs to a uniform depth of **1/4 inch** and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
- F. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
1. For glazed masonry units, use a nonmetallic jointer **3/4 inch** or more in width.
- G. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- H. Cut joints flush where indicated to receive waterproofing cavity wall insulation air barriers unless otherwise indicated.

3.6 INSTALLATION OF ANCHORED MASONRY VENEERS

- A. Masonry-veneer anchors to comply with the following requirements:
1. Fasten screw-attached and seismic anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 2. Embed tie sections in masonry joints.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than **18 inches** o.c. vertically and **24 inches** o.c. horizontally, with not less than one anchor for each **2 sq. ft.** of wall area. Install additional anchors within **12 inches** of openings and at intervals, not exceeding **8 inches**, around perimeter.
 5. Space anchors as indicated, but not more than **16 inches** o.c. vertically and **25 inches** o.c. horizontally, with not less than one anchor for each **2.67 sq. ft.** of wall area. Install additional anchors within **12 inches** of openings and at intervals, not exceeding **36 inches**, around perimeter.
 6. Space anchors as indicated, but not more than **18 inches** o.c. vertically and horizontally. Install additional anchors within **12 inches** of openings and at intervals, not exceeding **24 inches**, around perimeter.
- B. Provide not less than **2 inches** of airspace between back of masonry veneer and face of sheathing .
1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 INSTALLATION OF MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch** on exterior side of walls, **1/2 inch** elsewhere. Lap reinforcement a minimum of **6 inches**.
1. Space reinforcement not more than **16 inches** o.c.
 2. Space reinforcement not more than **8 inches** o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than **8 inches** above and below wall openings and extending **12 inches** beyond openings in addition to continuous reinforcement .
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING OF MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
1. Provide an open space not less than **1 inch** wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than **24 inches** o.c. vertically and **36 inches** o.c. horizontally.

3.9 INSTALLATION OF CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Indicate locations of joints on Drawings. Form control joints in concrete masonry as follows:
1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick as follows:
1. Build flanges of metal expansion strips into masonry. Lap each joint **4 inches** in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 3. Build in compressible joint fillers where indicated.
 4. Form open joint full depth of brick wythe and of width indicated, but not less than **3/8 inch** for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than **3/8 inch**.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 INSTALLATION OF LINTELS

- A. Provide lintel types where indicated on Drawings and where openings of more than **12 inches** for brick-size units and **24 inches** for block-size units are indicated without structural steel or other supporting lintels.
- B. Provide minimum bearing of **8 inches** at each jamb unless otherwise indicated.

3.11 INSTALLATION OF REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 402/602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 402/602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than **60 inches**.

3.12 INSTALLATION OF MASONRY CELL FILL

- A. Loose-Fill Insulation: Pour into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than **20 ft.**
- B. Lightweight-Aggregate Fill: Pour into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than **20 ft.**
- C. Foamed-in-Place Masonry Cell Fill: Drill holes in mortar bed joints at spacing as indicated in writing by foamed-in-place masonry fill manufacturer, and inject foam to fill masonry cell voids.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified

requirements will be at Contractor's expense.

- B. Inspections: Special inspections in accordance with Level 2 in TMS 402/602.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each **5000 sq. ft.** of wall area or portion thereof.
- E. Concrete Masonry Units: Test each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- F. Clay Masonry Units: Test each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.
- G. Mortar Aggregates: Ratio test (Proportion Specification) for each mix provided, in accordance with ASTM C780.
- H. Mortar: Test each mix provided in accordance with ASTM C780. Test mortar for mortar air content and compressive strength .
- I. Grout: Test each mix provided in accordance with ASTM C1019.
- J. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at 28 days.

3.14 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of **3/4 inch**. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of **1/8 inch per foot**. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.15 REPAIRING AND POINTING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and

completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

3.16 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean concrete masonry by applicable cleaning methods indicated in TEK 08-04A.
 - 7. Clean masonry with a proprietary acidic masonry cleaner applied in accordance with manufacturer's written instructions.

3.17 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than **4 inches** in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within **18 inches** of finished grade.
- C. Masonry Waste Recycling: Return broken masonry units not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 044313.16 - ADHERED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stone masonry adhered to concrete backup.
2. Stone masonry adhered to unit masonry backup.
3. Stone masonry adhered to wood framing and sheathing.
4. Stone masonry adhered to cold-formed metal framing and sheathing.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for concealed flashing.

1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>** .

1.3 ACTION SUBMITTALS

- ##### A. Product Data: For each variety of stone, stone accessory, and manufactured product.

- ##### B. Samples for Initial Selection: For colored mortar and other items involving color selection.

C. Samples for Verification:

1. For each stone type indicated. Include at least **[two][three][four][five]<Insert number>** Samples in each set, and show the full range of color and other visual characteristics in completed Work.
2. For each color of mortar required. **[Label Samples to indicate types and amounts of pigments used.]**

1.4 INFORMATIONAL SUBMITTALS

- ##### A. Qualification Data: For Installer.

- ##### B. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, supply sources, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.

1. Neither receipt of list nor approval of mockups constitutes approval of deviations

from the Contract Documents contained in mockups unless Architect approves such deviations in writing.

C. Material Test Reports:

1. Stone Test Reports: For [each] stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous [three][five]<Insert number> years.
2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer, indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.

1.6 MOCKUPS

- A. Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
1. Build mockup of typical wall area as indicated on Drawings.
 2. Build mockups for [each type of stone masonry][typical exterior wall] in sizes approximately [48 inches][60 inches][72 inches][96 inches]<Insert dimension> long by [48 inches][60 inches][72 inches]<Insert dimension> high by full thickness, including face and backup construction and accessories.
 - a. Include stone coping at top of mockup.
 - b. Include a sealant-filled joint at least 16 inches long in mockup.
 - c. Include through-wall flashing installed for a 24-inch length in corner of mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit stone masonry above half of flashing).
 - d. Include [metal][wood] studs, sheathing, building paper or wrap [, drainage material] , and flashing in exterior masonry-veneer wall mockup.
 3. Protect accepted mockups from the elements with weather-resistant membrane.
 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 079200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

1.9 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
 - 1. Extend cover a minimum of **24 inches** down both sides, and hold cover securely in place.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter, using coverings spread on the ground and over the wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F** and above and will remain so until masonry has dried, but not less than seven days after completing cleaning.

- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.10 COORDINATION

- A. Advise installers of other work about specific requirements for placement of flashing and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Stone: Obtain [**each variety of**] stone, [**regardless of finish,**] from single quarry [, **whether specified in this Section or in another Section of the Specifications,**] with resources to provide materials of consistent quality in appearance and physical properties.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.
- C. Varieties and Sources: Subject to compliance with requirements, provide stone of varieties and from sources complying with Section 044200 "Exterior Stone Cladding."

2.2 GRANITE

- A. Material Standard: Comply with ASTM C615/C615M.
- B. Description: Uniform, [**fine**][**medium**] -grained, [**white**][**pink**][**gray**][**black**] <Insert color> stone [**without veining**] .
- C. Varieties and Sources: Subject to compliance with requirements, [**provide the following**][**provide one of the following**][**available stone varieties that may be incorporated into the Work include, but are not limited to, the following**] :
 - 1. <Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers> .
- D. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.3 LIMESTONE

- A. Material Standard: Comply with ASTM C568/C568M.
 - 1. Classification: [**I Low Density**][**II Medium Density**][**II Medium Density, except as follows: absorption, 5 percent by weight maximum; density, 150 lb/cu. ft.**

minimum; compressive strength, 8000 psi minimum; and modulus of rupture 800 psi minimum][III High Density] .

- B. Description: **[Dolomitic][Oolitic][Shell] limestone.**
- C. Material: Subject to compliance with requirements, **[provide the following][provide one of the following][available stone varieties that may be incorporated into the Work include, but are not limited to, the following] :**
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers> .**
- D. Varieties and Sources: Indiana limestone quarried in Lawrence, Monroe, or Owen Counties, Indiana.
 - 1. Indiana Limestone Grade and Color: **[Select, buff][Select, gray][Standard, buff][Standard, gray][Rustic, buff][Rustic, gray][Variegated] ,** according to grade and color classification established by ILI.
- E. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.4 QUARTZ-BASED STONE

- A. Material Standard: Comply with ASTM C616/C616M **[, Classification I Sandstone][, Classification II Quartzitic Sandstone][, Classification III Quartzite][, except for minimum free silica content] .**
- B. Varieties and Sources: Subject to compliance with requirements, **[provide the following][provide one of the following][available stone varieties that may be incorporated into the Work include, but are not limited to, the following] :**
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers> .**
- C. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.5 OTHER STONE

- A. Material Standards:
 - 1. Maximum Absorption according to ASTM C97/C97M: **[7.5][3]<Insert number>** percent.
 - 2. Minimum Compressive Strength according to ASTM C170/C170M: **[4000 psi][7500 psi]<Insert required value> .**
- B. Varieties and Sources: Subject to compliance with requirements, **[provide the following][provide one of the following][available stone varieties that may be incorporated into the Work include, but are not limited to, the following] :**

1. <Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers> .
- C. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.6 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.
1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Aggregate: ASTM C144 and as follows:
1. For pointing mortar, use aggregate graded with 100 percent passing **No. 16** sieve.
 2. White Aggregates: Natural white sand or ground white stone.
 3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
 - a. Match Architect's sample.
- D. Water: Potable.

2.7 STONE TRIM ANCHORS

- A. Materials: Fabricate anchors from stainless steel, ASTM A240/A240M or ASTM A666, [Type 304][Type 316] . Fabricate dowels from stainless steel, ASTM A276, [Type 304][Type 316] .
- B. Fasteners for Stone Trim Anchors: Annealed stainless steel bolts, nuts, and washers; **ASTM F593** for bolts and **ASTM F594** for nuts, **Alloy Group 1**.
- C. Postinstalled Anchor Bolts for Fastening Stone Trim Anchors: [Chemical anchors][Torque-controlled expansion anchors][or][undercut anchors] made from stainless steel components, complying with **ASTM F593 and ASTM F594, Alloy Group 1 or 2** for bolts and nuts; ASTM A666 or ASTM A276, Type 304 or Type 316, for anchors.

2.8 EMBEDDED FLASHING MATERIALS

- A. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.

2. Where flashing is indicated to be turned down at or beyond wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at wall face, use metal flashing [with a drip edge][with a sealant stop][or flexible flashing with a metal drip edge][or elastomeric thermoplastic flashing with drip edge][or flexible flashing with a metal sealant stop] .
4. Where flashing is fully concealed, use [metal flashing][or][flexible flashing] .

B. Solder and Sealants for Sheet Metal Flashings: [As specified in Section 076200 "Sheet Metal Flashing and Trim."]

1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
2. Solder for Copper: ASTM B32, Grade Sn50.
3. Elastomeric Sealant: ASTM C920, chemically curing [urethane][polysulfide][silicone] sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

C. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from [neoprene][urethane][or][PVC] .
- B. Cementitious Dampproofing: [For Limestone.] Cementitious formulation recommended by ILI and nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.
- C. Weep Products: Use [one of] the following unless otherwise indicated:
 1. Wicking Material: Absorbent rope, made from [cotton][or][UV-resistant synthetic fiber] , 1/4 to 3/8 inch in diameter.
- D. Expanded Metal Lath: 3.4 lb/sq. yd., self-furring, diamond-mesh lath complying with ASTM C847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G60.
- E. Woven-Wire Lath: ASTM C1032, fabricated into 1-1/2-inch hexagonal-shaped mesh with minimum 0.0510-inch- diameter, galvanized-steel wire.
- F. Welded-Wire Lath: ASTM C933, fabricated into 2-by-2-inch mesh with minimum 0.0625-inch- diameter, galvanized-steel wire.
- G. Lath Attachment Devices: Material and type required by ASTM C1063 for installations indicated.

2.10 FABRICATION

- A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.
1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 2. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
- B. [Cut][Split][Select] stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.
1. Shape stone specified to be laid in three-course, random range ashlar pattern with [sawed][split] beds.
- C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
- D. Cut and drill sinkages and holes in stone for anchors and supports.
- E. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
1. Clean sawed backs of stone to remove rust stains and iron particles.
- F. Gage backs of stones for adhered veneer if more than **81 sq. in.** in area.
- G. Thickness of Stone: Provide thickness indicated, but not less than the following:
1. Thickness: **1 inch** plus or minus [**1/8 inch**][**1/4 inch**].
- H. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples [and mockups] .
1. Finish: [Split face][Rock face (pitched face)][Natural cleft][Mixed split face and seam face][Mixed split face, seam face, and rock face (pitched face)][Smooth][Sand rubbed][As indicated] .
 2. Finish for Sills: [Smooth][Sand rubbed][Split face with sand-rubbed washes][Rock face (pitched face) with sand-rubbed washes][Rock face (pitched face) with tooled (boasted) washes] .
 3. Finish for Lintels: [Smooth][Sand rubbed][Split face][Rock face (pitched face)] .
 4. Finish for Copings: [Smooth][Sand rubbed][Split face][Rock face (pitched face), front and back; sand-rubbed top][Rock face (pitched face), front and back; tooled (boasted) top] .
 - a. Finish exposed ends of copings same as front and back faces.

2.11 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents,

accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride.
 2. Use **[portland cement-lime][masonry cement][or][mortar cement]** mortar unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
 4. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Stone Masonry: Comply with ASTM C270, **[Proportion][Property]** Specification.
1. Mortar for Setting Stone: **[Type S][Type N]** .
 2. Mortar for Pointing Stone: **[Type N][Type O]** .
- D. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.
- E. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.
1. For latex-modified portland cement, setting-bed mortar, substitute latex admixture for part or all of water, according to latex-additive manufacturer's written instructions.
- F. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.
- G. Mortar for Scratch Coat over Unit Masonry: 1 part portland cement, 1 part lime, 7 parts loose damp sand, and enough water to produce a workable consistency.
- H. Pigmented Mortar: Use colored cement product **[or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products]** .
1. Pigments do not exceed 10 percent of portland cement by weight.
 2. Pigments do not exceed 5 percent of **[masonry cement][or][mortar cement]** by weight.

3. Mix to match Architect's sample.
- I. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary.
 1. Mix to match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING STONE MASONRY

- A. Perform necessary field cutting and trimming as stone is set.
 1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
 2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
 3. Pitch face at field-split edges as needed to match stones that are not field split.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones in range ashlar pattern with course heights as indicated, **[uniform][random]** lengths, and uniform joint widths, with offset between vertical joints as indicated.
- D. Arrange stones in broken-range ashlar pattern with uniform course heights, random lengths, and uniform joint widths.
- E. Arrange stones in three-course, random-range ashlar pattern with random course heights, random lengths (interrupted coursed), and uniform joint widths.

- F. Arrange stones in polygonal (mosaic) pattern with uniform joint widths.
- G. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
- H. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
- I. Maintain uniform joint widths, except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than **1/4 inch**[**3/8 inch**] at narrowest points or more than **3/8 inch**[**1/2 inch**][**5/8 inch**][**1 inch**][**1-1/2 inches**] at widest points.
- J. Provide sealant joints of widths and at locations indicated.
 - 1. Keep sealant joints free of mortar and other rigid materials.
 - 2. Sealing joints are specified in Section 079200 "Joint Sealants."
- K. Install metal expansion strips in sealant joints at locations indicated. Build flanges of expansion strips into masonry by embedding in mortar between stone masonry and backup wythe. Lap each joint **4 inches** in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
- L. Install embedded flashing [**and weep holes**] at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - 1. At stud-framed walls, extend flashing through stone masonry, up sheathing face at least **8 inches**[**12 inches**][**16 inches**] , and behind weather barrier.
 - 2. At multiwythe masonry walls, extend flashing through stone masonry, turned up a minimum of **4 inches**[**8 inches**][**12 inches**][**16 inches**] , and extend into or through inner wythe to comply with requirements in Section 042000 "Unit Masonry."
 - 3. At concrete backing, extend flashing through stone masonry, turned up a minimum of **4 inches**[**6 inches**][**8 inches**][**12 inches**] , and insert in reglet. [**Reglets are specified in Section 076200 "Sheet Metal Flashing and Trim."**]
 - 4. At lintels and shelf angles, extend flashing full length of angles but not less than **6 inches** into masonry at each end.
 - 5. At sills, extend flashing not less than **4 inches** at ends.
 - 6. At ends of head and sill flashing, turn up not less than **2 inches** to form end dams.
 - 7. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than **1-1/2 inches** or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 8. Install metal [**drip edges**][**and**][**sealant stops**] with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 9. Extend sheet metal flashing **1/2 inch** beyond masonry face at exterior, and turn

- flashing down to form a drip.
10. Install metal drip edges beneath flexible flashing at exterior wall face. Stop flexible flashing **1/2 inch** back from exterior wall face, and adhere flexible flashing to top of metal drip edge.
 11. Install metal flashing termination beneath flexible flashing at exterior wall face. Stop flexible flashing **1/2 inch** back from exterior wall face, and adhere flexible flashing to top of metal flashing termination.
 12. Cut flexible flashing flush with wall face after completing masonry wall construction.
- M. Coat limestone with cementitious dampproofing as follows:
1. Stone at Grade: Beds, joints, and back surfaces to at least **12 inches** above finish-grade elevations.
 2. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
 3. Allow cementitious dampproofing formulations to cure before setting dampproofed stone. Do not damage or remove dampproofing in the course of handling and setting stone.
- N. Place weep holes in joints where moisture may accumulate, including above shelf angles and at flashing.
1. Use **[wicking material][mesh weep holes][or][open head joints]** to form weep holes.
 2. Use wicking material to form weep holes above flashing in stone sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 3. Space weep holes [**16 inches**][**24 inches**] o.c.
 4. Trim wicking material used in weep holes flush with exterior wall face after mortar has set.
- 3.4 CONSTRUCTION TOLERANCES
- A. Variation from Plumb: For vertical lines and surfaces, do not exceed **1/4 inch in 10 feet**, **3/8 inch in 20 feet**, or **1/2 inch in 40 feet** or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed **1/4 inch in 20 feet** or **1/2 inch in 40 feet** or more.
 - B. Variation from Level: For [**bed joints and**] lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed **1/4 inch in 20 feet** or **1/2 inch in 40 feet** or more.
 - C. Variation of Linear Building Line: For position shown in plan, do not exceed **1/2 inch in 20 feet** or **3/4 inch in 40 feet** or more.
 - D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.
 - E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

- F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 INSTALLATION OF ADHERED STONE MASONRY VENEER

- A. Install flashing over sheathing and behind building paper or wrap [**and drainage material**] by fastening through sheathing into framing.
- B. Install lath over building paper or wrap [**and drainage material**] by fastening through sheathing into framing to comply with ASTM C1063.
- C. Install lath over unit masonry and concrete to comply with ASTM C1063.
- D. Install scratch coat over metal lath **3/8 inch** thick to comply with ASTM C926.
- E. Coat backs of stone units and face of [**scratch coat**][**masonry backup**] with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar, so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and [**scratch coat**][**masonry backup**] .
- F. Rake out joints for pointing with mortar to depth of not less than [**1/2 inch**][**3/4 inch**] before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than **3/8 inch** deep until a uniform depth is formed.
- B. Point stone joints by placing and compacting pointing mortar in layers of not more than **3/8 inch** deep. Compact each layer thoroughly, and allow to it become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - 1. Joint Profile: [**Concave**][**Smooth, flat face slightly below edges of stone**][**Smooth, flat face recessed 1/4 inch below edges of stone (raked joint)**][**Flush, with a 3/8-inch half-round raised bead in middle of joint**][**As indicated**] .

3.7 ADJUSTING

- A. Remove and replace stone masonry of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.

2. Defective joints.
 3. Stone masonry not matching approved samples and mockups.
 4. Stone masonry not complying with other requirements indicated.
- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

3.8 CLEANING

- A. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
 5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
 6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.
 7. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.9 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.
- B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
1. Crush masonry waste to less than **4 inches** in greatest dimension.
 2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 3. Do not dispose of masonry waste as fill within **18 inches** of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044313.16

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural-steel materials.
2. Bolts and connectors.
3. Rods.
4. Forged-steel structural hardware.
5. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
3. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.
4. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting requirements.
5. Section 099114 "Exterior Painting (MPI Standards)" and Section 099124 "Interior Painting (MPI Standards)" for painting requirements.
6. Section 133419 "Metal Building Systems" for structural steel.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A6/A6M with flanges thicker than **1-1/2 inches**.
2. Welded built-up members with plates thicker than **2 inches**.
3. Column base plates thicker than **2 inches**.

D. Protected Zone: Structural members or portions of structural members indicated as "protected zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

- E. Demand-Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the seismic-load-resisting system and which are indicated as "demand critical" or "seismic critical" on Drawings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 - 5. Identify members and connections of the seismic-load-resisting system.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand-critical welds.
 - 8. Identify members not to be shop primed.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing , including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand-critical welds.
- D. Delegated Design Submittals: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation .

1.5 INFORMATIONAL SUBMITTALS

- A. Welding Certificates: For specified shop and field welding.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop

primers, certifying that shop primers are compatible with topcoats.

- C. Mill Test Reports: For structural-steel materials, including chemical and physical properties.
- D. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
- E. Source Quality Control Reports: For structural-steel framing.
- F. Field Quality Control Reports: For specified tests and inspections.
- G. Qualification Statements: For Installer fabricator .

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE .
- C. Shop-Painting Applicator Qualifications: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3.
- D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds are to pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G are to be considered separate processes for welding personnel qualification.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 341.
 - 3. ANSI/AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
 - 1. Option 1: Connection designs have been completed and connections indicated on the Drawings.
 - 2. Option 2: Fabricator's experienced steel detailer selects or completes connections in accordance with ANSI/AISC 303.
 - a. Select and complete connections using schematic details indicated and ANSI/AISC 360 .
 - b. Use Allowable Stress Design; data are given at service-load level .
 - 3. Option 3 and 3A: Design connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer. Member reinforcement at connections is indicated on Drawings.
 - a. Use Allowable Stress Design; data are given at service-load level .
 - 4. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.
 - a. Use Allowable Stress Design; data are given at service-load level .
- C. Moment Connections: Type FR, fully restrained.
- D. Construction: Combined system of moment frame and shear walls .

2.2 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. W-Shapes: ASTM A992/A992M .
- C. Channels, Angles, M-Shapes: ASTM A36/A36M .
- D. Channels, Angles, S-Shapes: ASTM A36/A36M .
- E. Plate and Bar: ASTM A36/A36M ASTM A572/A572M, **Grade 50** .
- F. Corrosion-Resisting (Weathering) Structural-Steel Shapes, Plates, and Bars: ASTM A588/A588M, **50 ksi**.
- G. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.
- H. Corrosion-Resisting (Weathering), Cold-Formed Hollow Structural Sections: ASTM A847/A847M structural tubing.
- I. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
 - 1. Weight Class: Standard .
 - 2. Finish: Black except where indicated to be galvanized .
- J. Steel Castings: ASTM A216/A216M, Grade WCB, with supplementary requirement S11.
- K. Steel Forgings: ASTM A668/A668M.
- L. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A325**, Type 1, heavy-hex steel structural bolts; **ASTM A563, Grade DH**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F959/F959M, **Type 325-1**, compressible-washer type with plain finish.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A490**, Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends ; **ASTM A563, Grade DH**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F959/F959M, **Type 490-1**, compressible-

washer type with plain finish.

- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A325**, Type 1, heavy-hex steel structural bolts; **ASTM A563, Grade DH**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Mechanically deposited zinc coating .
 - 2. Direct-Tension Indicators: ASTM F959/F959M, **Type 325-1**, compressible-washer type with mechanically deposited zinc coating finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, round head assemblies, consisting of steel structural bolts with splined ends; **ASTM A563, Grade DH**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Mechanically deposited zinc coating .
- E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

- A. Unheaded Anchor Rods: ASTM F1554, Grade 36 .
 - 1. Configuration: Straight .
 - 2. Nuts: **ASTM A563** heavy- hex carbon steel.
 - 3. Plate Washers: ASTM A36/A36M carbon steel.
 - 4. Washers: **ASTM F436**, Type 1, hardened carbon steel.
 - 5. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C .
- B. Headed Anchor Rods: ASTM F1554, Grade 36 , straight.
 - 1. Nuts: **ASTM A563** heavy- hex carbon steel.
 - 2. Plate Washers: ASTM A36/A36M carbon steel.
 - 3. Washers: **ASTM F436**, Type 1, hardened carbon steel.
 - 4. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C .
- C. Threaded Rods: ASTM A36/A36M .
 - 1. Nuts: **ASTM A63** heavy- hex carbon steel.
 - 2. Washers: **ASTM F436**, Type 1, hardened carbon steel.
 - 3. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C .

2.5 PRIMER

- A. Steel Primer:
 - 1. Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 SHRINKAGE-RESISTANT GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- F. Welded-Steel Door Frames: Build up welded-steel doorframes attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than **10 inches** o.c. unless otherwise indicated on Drawings.
- G. Holes: Provide holes required for securing other work to structural steel and for other

work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened .
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches**.
 2. Surfaces to be field welded.
 3. Surfaces of high-strength bolted, slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces unless indicated to be painted .
 6. Corrosion-resisting (weathering) steel surfaces.
 7. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
1. SSPC-SP 2.
 2. SSPC-SP 3.
 3. SSPC-SP 7 (WAB)/NACE WAB-4.
 4. SSPC-SP 14 (WAB)/NACE WAB-8.
 5. SSPC-SP 11.
 6. SSPC-SP 6 (WAB)/NACE WAB-3.
 7. SSPC-SP 10 (WAB)/NACE WAB-2.
 8. SSPC-SP 5 (WAB)/NACE WAB-1.
 9. SSPC-SP 8.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop

priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16 .

- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of **1.5 mils**. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 2. Bolted Connections: Inspect [**and test**] shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165/E165M.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94/E94M.
 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
 - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
 5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.
 - 1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION OF STRUCTURAL-STEEL FRAMING

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Rods: Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Shrinkage-Resistant Grout: Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces

that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection .
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
1. Joint Type: Snug tightened .
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs , back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.
- C. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.5 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-

SP 3 power-tool cleaning.

2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting."
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
 - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3) Ultrasonic Inspection: ASTM E164.
 - 4) Radiographic Inspection: ASTM E94/E94M.
 3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - b. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

END OF SECTION 051200

SECTION 051213 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architecturally exposed structural steel (AESS).
2. Section 051200 "Structural Steel Framing" requirements that also apply to AESS.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for **[steel lintels and shelf angles not attached to structural-steel frame][miscellaneous steel fabrications][and][other metal items]** not defined as structural steel.
2. **[Section 099113 "Exterior Painting"]****[Section 099123 "Interior Painting"]****[and]****[Section 099600 "High-Performance Coatings"]** for surface preparation and priming requirements.

1.2 DEFINITIONS

A. AESS: Architecturally exposed structural steel.

B. Category AESS 1: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 1 and may be designated AESS 1 or Category AESS 1 in the Contract Documents.

C. Category AESS 2: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 2 and is designated as AESS 2 or Category AESS 2 in the Contract Documents.

D. Category AESS 3: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 3 and is designated as AESS 3 or Category AESS 3 in the Contract Documents.

E. Category AESS 4: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 4 and is designated as AESS 4 or Category AESS 4 in the Contract Documents.

F. Category AESS C: Structural steel with custom characteristics that is categorized by ANSI/AISC 303, Section 10, as AESS C and is designated as AESS C or Category AESS C in the Contract Documents.

G. SEAC/RMSCA Guide Specification: SEAC/RMSCA's "Sample Specification, Section 05 02 13: Architecturally Exposed Structural Steel."

1.3 COORDINATION

- A. Coordinate surface preparation requirements for shop-primed items.
- B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>** .

1.5 ACTION SUBMITTALS

- A. Product Data:
 - 1. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 2. Corrosion-resisting (weathering steel), tension-control, high-strength, bolt-nut-washer assemblies.
 - 3. Filler.
 - 4. Primer.
 - 5. Galvanized-steel primer.
 - 6. Etching cleaner.
 - 7. Galvanized repair paint.
- B. Shop Drawings: Show fabrication of AESS components. [**Shop Drawings for structural steel may be used for AESS.**]
 - 1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
 - 2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 3. Include embedment Drawings.
 - 4. Indicate orientation of mill marks and HSS seams.
 - 5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. [**Indicate grinding, finish, and profile of welds.**]
 - 6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
 - 7. Indicate exposed surfaces and edges and surface preparation being used.
 - 8. Indicate special tolerances and erection requirements.
 - 9. Indicate weep holes for HSS [**and vent holes for galvanized HSS**] .
 - 10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.
- C. Samples: Submit Samples to set quality standards for AESS.

1. Two steel plates, **3/8 by 8 by 4 inches**, with long edges joined by a groove weld [**and with weld ground smooth**] .
2. Steel plate, **3/8 by 8 by 8 inches**, with one end of a short length of rectangular steel tube, **4 by 6 by 3/8 inches**, welded to plate with a continuous fillet weld [**and with weld ground smooth and blended**] .
3. Round steel tube or pipe, minimum **8 inches** in diameter, with end of another round steel tube or pipe, approximately **4 inches** in diameter, welded to its side at a 45-degree angle with a continuous fillet weld [**and with weld ground smooth and blended**] .

D. Sustainable Design Submittals:

1. Third-Party Certifications: For each product.
2. Third-Party-Certified Life-Cycle Assessment: For each product.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [Installer][fabricator][shop-painting applicator] .
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172) and is experienced in fabricating AESS similar to that indicated on this Project.
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program, is designated an AISC-Certified Erector, [Category ACSE][Category CSE] , and is experienced in erecting AESS similar to that indicated on this Project.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint [Endorsement P1][Endorsement P2][Endorsement P3] or SSPC-QP 3.

1.8 MOCKUPS

- A. Build mockups of AESS to set quality standards for fabrication and installation.
 1. Build mockup of typical portion of AESS as indicated on Drawings.
 2. Coordinate painting requirements with [Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."]
 3. Coordinate high-performance coatings requirements with Section 099600 "High-Performance Coatings."
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.
 - 1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.10 FIELD CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

2.2 STRUCTURAL-STEEL MATERIALS

- A. As specified in Section 051200 "Structural Steel Framing."
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, round-head assemblies consisting of steel structural bolts with splined ends; **ASTM A563, Grade DH**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: **[Plain][Mechanically deposited zinc coating]** .
- B. Corrosion-Resisting (Weathering) Steel, Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 3, round-head assemblies consisting of steel structural bolts with splined ends; **ASTM A563, Grade DH3**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 3, hardened carbon-steel washers.

2.4 FILLER

- A. Polyester filler intended for use in repairing dents in automobile bodies.

2.5 PRIMER

- A. Steel Primer:

1. Comply with [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]
2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

- B. Galvanized-Steel Primer: [MPI#26][MPI#80][MPI#134] .

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: [MPI#18, MPI#19, or SSPC-Paint 20][ASTM A780/A780M] .

2.6 FABRICATION

- A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.

- B. Category AESS 1:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with **3/8-inch** closure plates.
6. Limit butt and plug weld projections to **1/16 inch**.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.

11. Remove backing and runoff tabs, and grind welds smooth.

C. Category AESS 2:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with **3/8-inch** closure plates.
6. Limit butt and plug weld projections to **1/16 inch**.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.

D. Category AESS 3:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with **3/8-inch** closure plates.
6. Limit butt and plug weld projections to **1/16 inch**.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.

13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.
17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
19. Orient HSS seams as indicated or away from view.
20. Align and match abutting member cross sections.
21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of **1/8 inch**. At closed joints, maintain uniform contact within **1/16 inch**.
22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.

E. Category AESS 4:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with **3/8-inch** closure plates.
6. Limit butt and plug weld projections to **1/16 inch**.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.
17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
19. Orient HSS seams as indicated or away from view.
20. Align and match abutting member cross sections.
21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of

- 1/8 inch.** At closed joints, maintain uniform contact within **1/16 inch.**
22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.
 23. Treat HSS seams to appear seamless.
 24. Contour and blend welds and weld transitions between members, removing splatter exposed to view.
 25. Fill surface imperfections with filler and sand smooth to achieve surface quality approved by Architect.
 26. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
- F. Erection marks, painted marks, and other marks are permitted on **[galvanized-][corrosion-resisting (weathering)]** steel surfaces of completed structure.
- G. Cleaning Corrosion-Resisting (Weathering) AESS: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6 (WAB)/NACE WAB-3.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: **[Snug tightened][Pretensioned][Slip critical]** .
- B. Weld Connections: Comply with AWS D1.1/D1.1M **[and AWS D1.8/D1.8M]** for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 3. Galvanize AESS **[lintels]<Insert description>** attached to structural-steel frame and located in exterior walls.

2.9 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches.**
 2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Corrosion-resisting (weathering) steel surfaces.
 5. Galvanized surfaces [**unless indicated to be painted**] .
- B. Surface Preparation: Clean nongalvanized surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 2.
 2. SSPC-SP 3.
 3. SSPC-SP 7 (WAB)/NACE WAB-4.
 4. SSPC-SP 14 (WAB)/NACE WAB-8.
 5. SSPC-SP 11.
 6. SSPC-SP 6 (WAB)/NACE WAB-3.
 7. SSPC-SP 10 (WAB)/NACE WAB-2.
 8. SSPC-SP 5 (WAB)/NACE WAB-1.
 9. SSPC-SP 8.
- C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner [**or according to SSPC-SP 16**] .
- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of **1.5 mils**. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and eased edges.
 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.
- B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

- A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.

1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
2. Grind tack welds smooth.
3. Remove backing and runoff tabs, and grind welds smooth.
4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
5. Remove erection bolts in [Category AESS 4]<Insert category> AESS, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
6. Fill weld access holes in [Category AESS 4]<Insert category> AESS with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
7. Conceal fabrication and erection markings from view in the completed structure.

- B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.

1. Erection of [Category AESS 1][and Category AESS 2] :
 - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
 - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 - c. Remove weld spatter, slivers, and similar surface discontinuities.
 - d. Grind off butt and plug weld projections larger than **1/16 inch**.
 - e. Continuous welds are to be of uniform size and profile.
 - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
 - g. Splice members only where indicated on Drawings.
 - h. No torch cutting or field fabrication is permitted.
2. Erection of Category AESS 3:
 - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303

- for non-AESS.
 - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 - c. Remove weld spatter, slivers, and similar surface discontinuities.
 - d. Grind off butt and plug weld projections larger than **1/16 inch**.
 - e. Continuous welds are to be of uniform size and profile.
 - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
 - g. Splice members only where indicated on Drawings.
 - h. No torch cutting or field fabrication is permitted.
 - i. Weld profiles, quality, and finish are to be as approved by Architect.
 - j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.
3. Erection of Category AESS 4:
- a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
 - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 - c. Remove weld spatter, slivers, and similar surface discontinuities.
 - d. Grind off butt and plug weld projections larger than **1/16 inch**.
 - e. Continuous welds are to be of uniform size and profile.
 - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
 - g. Splice members only where indicated on Drawings.
 - h. No torch cutting or field fabrication is permitted.
 - i. Weld profiles, quality, and finish are to be as approved by Architect.
 - j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.
 - k. Grind welds smooth.
 - l. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
 - m. Oversize welds where ground, contoured, or blended, and grind to provide a smooth transition, matching profile approved by Architect.
4. Erection of Category AESS C: **<Insert requirements>** .

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: [**Snug tightened**][**Pretensioned**][**Slip critical**] .
- B. Weld Connections: Comply with AWS D1.1/D1.1M [**and AWS D1.8/D1.8M**] for

tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

3.5 REPAIR

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and touchup galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting, to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Cleaning and touchup painting are specified in [Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."]
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to inspect AESS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.
- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

END OF SECTION 051213

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Noncomposite roof deck.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 035216 "Lightweight Insulating Concrete" for lightweight insulating concrete fill over steel deck.
3. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
4. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding Certificates: For structural welding of steel.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.
2. Acoustical roof deck.

D. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

- E. Field Quality Control Reports: For specified tests and inspections.
- F. Qualification Statements: For welding personnel and testing agency .

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:
 - 1. AWS D1.1/D1.1M.
 - 2. AWS D1.3/D1.3M.
- B. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL Solutions' Product iQ or from listings of another qualified testing agency.

2.2 STEEL ROOF DECKS

- A. Roof Deck:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following :

- a. Vulcraft/Verco Group; a division of Nucor Corp.
2. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI SD and with the following:
 - a. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade **80** minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - 1) Color: Manufacturer's standard .
 - b. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade **80** , **G90** zinc coating.
 - c. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade **80** , **G60** zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - 1) Color: Manufacturer's standard .
 - d. Aluminum-Zinc-Alloy-Coated Steel Sheet: ASTM A792/A792M, Structural Steel (SS), Grade **33** minimum, **AZ50** aluminum-zinc-alloy coating.
 - e. Deck Profile: Long span .
 - f. Cellular Deck Profile: **[As indicated on Drawings][Type WR, wide rib][Type 3DR, deep rib][Long span]** , with bottom plate.
 - g. Profile Depth: As indicated on Drawings .
 - h. Design Uncoated-Steel Thickness: As indicated on Drawings .
 - i. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated on Drawings .
 - j. Span Condition: Double span .
 - k. Side Laps: Overlapped .

2.3 ACCESSORIES

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, **No. 10** minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of **33,000 psi**, not less than **0.0359-inch** design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of **33,000 psi**, of same material and finish as deck, and of thickness and profile indicated .

- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, **0.0598 inch** thick, with factory-punched hole of **3/8-inch** minimum diameter.
- J. Shear Stud Connectors: ASTM A108, AISI C through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- K. Roof Flat Sump Plates: Single-piece steel sheet, **0.0747 inch** thick, of same material and finish as deck. For drains, cut holes in the field.
- L. Roof Recessed Sump Pans: Single-piece steel sheet, **0.0747 inch** thick, of same material and finish as deck, with **3-inch-** wide flanges and sloped recessed pans of **1-1/2-inch** minimum depth. For drains, cut holes in the field.
- M. Galvanizing Repair Paint: ASTM A780/A780M .
- N. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF STEEL DECKING, GENERAL

- A. Install deck panels and accessories in accordance with SDI SD as applicable; manufacturer's written instructions; and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical Fasteners: Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.
- J. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.3 INSTALLATION OF STEEL ROOF DECKS

- A. Roof-Deck Panels: Fasten to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than **1-1/2 inches** long, and as follows:
 - 1. Weld Diameter: **5/8 inch** , nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds **18 inches** apart, maximum .
 - 3. Weld Washers: Install weld washers at each weld location.
- B. sfd
- C. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or **36 inches** , and as follows:
 - 1. Mechanically fasten with self-drilling, **No. 10** diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with a minimum of **1-1/2-inch-** long welds.
- D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of **1-1/2 inches**, with end joints as follows:
 - 1. End Joints: Lapped **2 inches** minimum .
- E. Roof Recessed Sump Pans: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than

12 inches apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten .
- F. Roof Flat Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than **12 inches** apart with at least one fastener at each corner.
1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten .
- G. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.
1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- H. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.
- I. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified in **<Insert Section number and title>** .

3.4 REPAIR OF STEEL DECK FINISHES

- A. Galvanizing Repair Paint: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.
- B. Repair Paint: Prepare and repair damaged finish coatings on both surfaces of deck with repair paint as follows:
1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting." Section 099114 "Exterior Painting (MPI Standards)" and Section 099124 "Interior Painting (MPI Standards)."
 4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.
 - a. Field welds will be subject to inspection.
 - 2. Steel decking will be considered defective if it does not pass tests and inspections.
 - 3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors that are already tested.
- C. Prepare test and inspection reports.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished, but Not Installed, under This Section:

1. Loose steel lintels.
2. Cast-in-Place Anchors in Concrete: Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 051200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.
3. Section 077200 "Roof Accessories" for manufactured metal roof walkways and metal roof stairs.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings: Show fabrication and installation details. [**Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.**] Provide for the following:
1. Miscellaneous Framing and Supports: For applications where framing and supports are not specified in other Sections.
 2. Elevator machine beams, hoist beams, and divider beams.
 3. Steel Shapes: For supporting elevator door sills.

4. Prefabricated building columns.
5. Shelf angles.
6. Metal ladders.
7. Alternating tread devices.
8. Metal ships' ladders.
9. Metal pipe crossovers.
10. Elevator pit sump covers.
11. Structural-steel door frames.
12. Metal bollards.
13. Loose steel lintels.
14. Vehicular barrier cable systems.

- C. Samples for Verification: For each type and finish of extruded [nosing][and][tread] .
- D. Delegated Design Submittals: For [metal ladders][alternating tread devices][and][vehicular barrier cable systems] , including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Sustainable Design Submittals:
1. Third-Party Certifications: For each product.
 2. Third-Party-Certified Life-Cycle Assessment: For each product.

1.4 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Research Reports: For post-installed anchors.
- E. Delegated design engineer qualifications.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other

construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design [metal ladders][alternating tread devices][and][vehicular barrier cable systems] .
- B. Structural Performance of Metal Ladders: Ladders [, including landings,] are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.
- C. Structural Performance of Alternating Tread Devices: Alternating tread devices are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: **100 lbf/sq. ft.**
 - 2. Concentrated Load: **300 lbf** applied on an area of **4 sq. in.**
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Comply with applicable railing loadings in Section 055213 "Pipe and Tube Railings."
- D. Structural Performance of Vehicular Barrier Cable Systems: Design vehicular barrier cable systems to resist a single [6000 lbf]<Insert value> service load and [10,000 lbf]<Insert load> ultimate load applied horizontally in any direction to the cable system, with anchorages or attachments capable of transferring this load to the structure. Limit deflection to **18 inches**. Design is to assume loads are applied at a height of [18 inches]<Insert height> above the floor or ramp surface on an area not to exceed **1 sq. ft.**
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: [120 deg F, ambient; 180 deg F, material surfaces]<Insert temperature change> .

2.2 METAL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide

materials without seam marks, roller marks, rolled trade names, or blemishes.

- C. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- D. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, [Type 304][Type 316L] .
- E. Stainless Steel Bars and Shapes: ASTM A276/A276M, [Type 304][Type 316L] .
- F. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- G. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- H. Zinc-Coated Steel Wire Rope: ASTM A741.
 - 1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- I. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.
 - 1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- J. Steel Prestressing Strand: ASTM A416/A416M, **Grade 270**, low-relaxation, seven-wire, with **0.9 lb/sq. ft.** zinc coating.
 - 1. Steel Prestressing Strand Fittings: Hot-dip galvanized-steel anchors and connectors with capability to sustain, without failure, a load equal to minimum breaking strength of steel prestressing strand with which they are used.
- K. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- L. Aluminum Plate and Sheet: **ASTM B209**, Alloy 6061-T6.
- M. Aluminum Extrusions: **ASTM B221**, Alloy 6063-T6.
- N. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
- O. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
- P. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or UNS No. C84400 (leaded semired brass).
- Q. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.
- R. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel

bronze).

2.3 FASTENERS

- A. Fasteners, General: Unless otherwise indicated, provide [Type 304][Type 316] stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
1. Provide stainless steel fasteners for fastening [aluminum][stainless steel][or][nickel silver] .
 2. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, **ASTM A307, Grade A**; with hex nuts, **ASTM A563**; and, where indicated, flat washers.
- C. Steel High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A325**, Type 3, heavy-hex steel structural bolts; **ASTM A563, Grade DH3**, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, **ASTM F593**; with hex nuts, **ASTM F594**; and, where indicated, flat washers; Alloy [Group 1][Group 2] .
- E. Steel Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, **ASTM A563**; and, where indicated, flat washers.
1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. Post-Installed Anchors: [Torque-controlled expansion anchors][or][chemical anchors] .
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [Group 1][Group 2] stainless steel bolts, **ASTM F593**, and nuts, **ASTM F594**.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with [Section 099113 "Exterior Painting."][Section 099114 "Exterior Painting (MPI Standards)."][Section 099123 "Interior Painting."][Section 099124 "Interior Painting (MPI Standards)."][Section 099600 "High-Performance Coatings."][Section 099601 "High-Performance Coatings (MPI Standards)."]
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion-type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of **3000 psi**.

2.5 FABRICATION OF METAL, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing [**and contour of welded surface matches that of adjacent surface**] .
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, **1/8 by 1-1/2 inches**, with a minimum **6-inch** embedment and **2-inch** hook, not less than **8 inches** from ends and corners of units and **24 inches** o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Miscellaneous Framing and Supports, General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with [**zinc-rich primer**][**primer specified in Section 099600 "High-Performance Coatings"**] where indicated.

2.7 SHELF ANGLES

- A. Galvanize [**and prime**] shelf angles located in exterior walls.
- B. Prime shelf angles located in exterior walls with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]
 - 1. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

- A. Metal Ladders, General:
 - 1. Comply with ANSI/ASC A14.3 [, **except for elevator pit ladders**] .
 - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders :
 - 1. Space siderails [**16 inches**][**18 inches**] apart unless otherwise indicated.
 - 2. Siderails: Continuous, [**3/8-by-2-1/2-inch**][**1/2-by-2-1/2-inch**] steel flat bars, with eased edges.
 - 3. Rungs: [**3/4-inch- diameter**][**3/4-inch- square**][**1-inch- diameter**][**1-inch- square**] , steel bars.
 - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 - 6. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.
 - 7. Provide platforms as indicated, fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than [**1/2 inch**][**3/4 inch**] in least dimension.
 - 8. Support each ladder [**at top and bottom and not more than 60 inches o.c.**] with welded or bolted steel brackets.
 - 9. Galvanize [**and prime**][**exterior**] ladders, including brackets.
 - 10. Prime [**exterior**] ladders, including brackets and fasteners, with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.9 ALTERNATING TREAD DEVICES

- A. Galvanize [**and prime**][**exterior**] steel alternating tread devices, including treads, railings, brackets, and fasteners.
- B. Prime [**exterior**] steel alternating tread devices, including treads, railings, brackets, and fasteners, with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.10 METAL SHIPS' LADDERS

- A. Galvanize [**and prime**][**exterior**] steel ships' ladders, including treads, railings, brackets, and fasteners.
- B. Prime [**exterior**] steel ships' ladders, including treads, railings, brackets, and fasteners, with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.11 METAL PIPE CROSSOVERS

- A. Galvanize [**and prime**][**exterior**] steel pipe crossovers, including treads, railings, brackets, and fasteners.
- B. Prime [**exterior**] steel pipe crossovers, including treads, railings, brackets, and fasteners, with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.12 STRUCTURAL-STEEL DOOR FRAMES

- A. Galvanize [**and prime**][**exterior**] steel frames.
- B. Prime [**exterior**] steel frames with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.13 MISCELLANEOUS STEEL TRIM

- A. Galvanize [**and prime**][**exterior**] miscellaneous steel trim.
- B. Prime [**exterior**] miscellaneous steel trim with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.14 METAL BOLLARDS

- A. Prime steel bollards with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.15 PIPE AND DOWNSPOUT GUARDS

- A. Galvanize [**and prime**] steel [**pipe**][**downspout**] guards.
- B. Prime steel [**pipe**][**downspout**] guards with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.16 ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS

- A. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- B. Drill for mechanical anchors and countersink. Locate holes not more than **4 inches** from ends and not more than **12 inches** o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended in writing by manufacturer.
 - 1. Provide two rows of holes for units more than **5 inches** wide, with two holes aligned at ends and intermediate holes staggered.

2.17 CAST-IRON WHEEL GUARDS

- A. Prime cast-iron wheel guards with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.18 METAL DOWNSPOUT BOOTS

- A. Prime cast-iron downspout boots with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.19 LOOSE BEARING AND LEVELING PLATES

- A. Galvanize bearing and leveling plates.
- B. Prime plates with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.20 LOOSE STEEL LINTELS

- A. Galvanize [**and prime**] loose steel lintels located in exterior walls.
- B. Prime loose steel lintels located in exterior walls with [**zinc-rich primer.**][**primer specified in Section 099600 "High-Performance Coatings."**]

2.21 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.22 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items [**not indicated to be galvanized**] unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with [universal shop primer][or] primers specified in [Section 099113 "Exterior Painting"][Section 099114 "Exterior Painting (MPI Standards)"][Section 099123 "Interior Painting"][Section 099124 "Interior Painting (MPI Standards)"] unless [zinc-rich primer is][primers specified in Section 099600 "High-Performance Coatings" are][primers specified in Section 099601 "High-Performance Coatings (MPI Standards)" are] indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with [SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."][SSPC-SP 3, "Power Tool Cleaning."][requirements indicated below:]
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 - 5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.23 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL FABRICATIONS, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil** dry film thickness.
 - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in **[Section 099113 "Exterior Painting."][Section**

099114 "Exterior Painting (MPI Standards)."[Section 099123 "Interior Painting."][Section 099124 "Interior Painting (MPI Standards)."]

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas; repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Dimension lumber framing.
4. Miscellaneous lumber.
5. Plywood backing panels.

B. Related Requirements:

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than **2 inches nominal** size in least dimension.
- B. Dimension Lumber: Lumber of **2 inches nominal** size or greater but less than **5 inches nominal** size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. SBX: An inorganic boron used to prevent termites and fungal decay.
- E. Lumber grading agencies, and abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. RIS: Redwood Inspection Service.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of specified product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. For products receiving a waterborne treatment, include statement that moisture

content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.5 DELIVERY, STORAGE, AND HANDLING

- ##### A.
- Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD LUMBER, GENERAL

- ##### A.
- Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency .
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 19 percent.
2. Dimension Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- ##### A.
- Wood-Preservative-Treated Lumber by Pressure Process: AWP A U1, use categories as follows:

1. UC2, Interior/Damp: Interior construction protected from weather, but may be subject to sources of moisture. Include the following items:
 - a. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - c. Wood floor plates that are installed over concrete slabs-on-grade.
 2. UC3A, Above Ground, Protected (Commodity Specification A): Coated wood products in exterior construction not in contact with ground but exposed to all weather cycles including intermittent wetting. Include the following items:
 - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 3. UC3B, Above Ground, Exposed (Commodity Specification A): Uncoated wood products in exterior construction not in contact with ground, exposed to all weather cycles including intermittent wetting, but with sufficient air circulation for wood to dry. Include the following items:
 - a. Wood framing members that are less than **18 inches** above the ground in crawlspaces or unexcavated areas.
 - b. Exposed decorative dimensional lumber where indicated on the drawings.
 4. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 5. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
 6. After treatment, redry boards dimension lumber to 19 percent maximum moisture content.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency .
- D. Application: Treat all rough carpentry unless otherwise indicated.
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed

- members in contact with masonry or concrete.
- 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
- 4. Wood framing members that are less than **18 inches** above the ground in crawlspaces or unexcavated areas.
- 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Ceiling Joists:

- 1. Grade: Construction or No. 2 .
- 2. Species:
 - a. Hem-fir (north); NLGA.
 - b. Southern pine or mixed southern pine; SPIB.
 - c. Spruce-pine-fir; NLGA.
 - d. Hem-fir; WCLIB or WWPA.
 - e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 - f. Northern species; NLGA.
 - g. Eastern softwoods; NeLMA.
 - h. Western woods; WCLIB or WWPA.

B. Exposed Framing: Hand-select material indicated to receive a stained or natural finish for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

- 1. Species and Grade:
 - a. Southern pine; No. 1 grade; SPIB.
 - b. Douglas fir-larch; No. 1 grade; WCLIB or WWPA.
 - c. Spruce-pine-fir; No. 1 grade; NLGA.
 - d. Hem-fir; No. 1 grade; WCLIB or WWPA.
 - e. Spruce-pine-fir (south); No. 1 grade; NeLMA, WCLIB, or WWPA.
 - f. Eastern hemlock-balsam fir or eastern hemlock-tamarack; No. 1 grade; NeLMA.

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

- 1. Blocking.
- 2. Nailers.
- 3. Rooftop equipment bases and support curbs.
- 4. Cants.
- 5. Furring.
- 6. Grounds.

7. Utility shelving.

B. Dimension Lumber Items:

1. Grade: Construction or No. 2 .
2. Species: Any of the following species:
 - a. Hem-fir (north); NLGA.
 - b. Mixed southern pine or southern pine; SPIB.
 - c. Spruce-pine-fir; NLGA.
 - d. Hem-fir; WCLIB or WWPA.
 - e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 - f. Eastern softwoods; NeLMA.

C. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.

D. Wood Blocking: For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. Wood Furring: For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1.

1. Grade: Exterior, A-C .
2. Thickness: As indicated on the drawings or, if not indicated, not less than **3/4-inch** nominal thickness.

2.6 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than **1-1/2 inches** into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel .

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

2.7 ACCESSORIES

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.025 inch**.
 - 1. Compound Material: Butyl rubber .
- B. Water-Repellent Preservative: Formulation containing 3-iodo-2-propynyl butylcarbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION OF ROUGH CARPENTRY, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate [**furring,**] nailers, blocking, [**grounds,**] and similar supports to comply with requirements for attaching other construction.
- C. Plywood Backing Panels: Install backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than **16 inches** o.c.
- F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Field Application of Preservative Treatment: Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron (SBX) for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- H. Flexible Flashing: Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal

decking.

- I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. Table 2304.10.1, "Fastening Schedule," in ICC's "International Building Code" (IBC).
 2. ICC-ES evaluation report for fastener.
- J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF ROOFING NAILERS

- A. Install roofing nailers where indicated on Drawings and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.
- C. Securely attach roofing nailers to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with SPRI ED-1, Tables A6 and A7.

3.3 INSTALLATION OF WOOD BLOCKING

- A. Install wood blocking where indicated on Drawings and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

3.4 INSTALLATION OF WOOD FURRING

- A. Install wood furring level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install **1-by-3-inch nominal**- size furring horizontally and vertically at **24 inches** o.c.

3.5 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

- A. Ceiling Joists: Install with crown edge up. Face nail to ends of parallel rafters.

END OF SECTION 061000

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Medium-build air barriers, vapor permeable.
- B. Related Requirements:

1.2 DEFINITIONS

- A. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- B. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.
- C. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>** .
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
 - 1. Medium-build air barriers, vapor permeable.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining

- construction.
- 3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer to be licensed by ABAA in accordance with ABAA's Quality Assurance Program and to employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution .
 - 1. Build integrated mockups of exterior wall assembly , 150 sq. ft. , incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane , building corner condition, .
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

- B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain primary air-barrier materials and air-barrier accessories from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum **0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft.**, when tested in accordance with ASTM E2357.
- C. Air Permeance: Maximum **0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft.** pressure difference; ASTM E2178.
- D. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.
- E. Adhesion to Substrate: Minimum **16 lbf/sq. in.** when tested in accordance with ASTM D4541.
- F. UV Resistance: Can be exposed to sunlight for 90 days in accordance with manufacturer's written instructions.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of **16 to 34**

mils over smooth, void-free substrates.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. W. R. Meadows, Inc: Air-Shield LMP
2. Vapor Permeance: Minimum **5 perms** ; ASTM E96/E96M, Procedure A, Desiccant Method .

2.4 ACCESSORY MATERIALS

- A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, **0.0187 inch** thick, and Series 300 stainless steel fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 3. Verify that substrates are visibly dry and free of moisture.
 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

3.3 INSTALLATION OF ACCESSORIES

- A. Install accessory materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of **3 inches** of coverage is achieved over each substrate.
 - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of **3 inches** of coverage is achieved over each substrate. Maintain **3 inches** of full contact over firm bearing to perimeter frames, with not less than **1 inch** of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional **6-inch-** wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending **6 inches** beyond repaired areas in strip direction.

3.4 INSTALLATION OF PRIMARY AIR-BARRIER MATERIAL

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier in accordance with air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements , applied in one or more equal coats . Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
- C. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Air-barrier dry film thickness.
 - 3. Continuous structural support of air-barrier system has been provided.
 - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 5. Site conditions for application temperature and dryness of substrates have been maintained.
 - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 7. Surfaces have been primed, if applicable.
 - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 9. Termination mastic has been applied on cut edges.
 - 10. Strips and transition strips have been firmly adhered to substrate.
 - 11. Compatible materials have been used.
 - 12. Transitions at changes in direction and structural support at gaps have been provided.
 - 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 14. All penetrations have been sealed.
- C. Tests: As determined by testing agency from among the following tests:
 - 1. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate in accordance with ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.
- D. Air barriers will be considered defective if they do not pass tests and inspections.
 - 1. Apply additional air-barrier material, in accordance with manufacturer's written instructions, where inspection results indicate insufficient thickness.
 - 2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials in accordance with air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reveal-joint, concealed-fastener metal wall panels.

B. Related Requirements:

1. Section 072726 "Fluid-Applied Membrane Air Barriers" for air barriers and sealing penetrations in barriers resulting from installation of wall panel support system.

1.2 DEFINITIONS

- A. Wall Panel Assembly: Assembly consisting of wall panels, support systems, cavities, weather barriers, air barriers, and sheathing substrate that has been shown to comply with assembly testing and performance requirements.

1.3 COORDINATION

- A. Coordinate installation of wall panels and support system with insulation, weather barriers, air barriers, flashings, and other adjoining construction to ensure proper sequencing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. For formed metal wall panels, include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than **1-1/2 inches per 12 inches**.

- C. Samples for Initial Selection: Manufacturer's standard color charts, showing full range of available colors for each type of exposed finish.

1. Include Samples of trim and accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

- A. Roll-Forming Equipment: Certificates for portable roll-forming equipment.
- B. Product Test Reports: For each specified metal wall panel, for tests performed by a qualified testing agency .
- C. Wall Panel Assembly Test Reports: Certified test reports showing system compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
- D. Field Quality Control Reports: For specified tests and inspections.
- E. Qualification Statements: For Installer , testing agency, .
- F. Sample Warranties: For specified special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For formed metal wall panels.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: An agency acceptable to authorities having jurisdiction.
- C. Portable Roll-Forming Equipment Certification: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Build mockup of typical metal wall panel assembly as indicated on Drawings , including soffits, supports, attachments, flashing and trim, and accessories.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

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

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal wall panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal wall panel systems, including associated support system, capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E1592 or ASTM E330/E330M:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings .
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Not more than **0.06 cfm/sq. ft.** when tested in accordance with ASTM E283/283M at the following test-pressure difference:
 - 1. Test-Pressure Difference: **1.57 lbf/sq. ft.** .
- C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: **2.86 lbf/sq. ft.** .
- D. Thermal Movement: Allow for thermal movement from ambient and surface temperature changes.
 - 1. Temperature Change: **120 deg F** , ambient; **180 deg F** , material surfaces .

2.2 LAP-SEAM METAL WALL PANELS

- A. Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
- B. Reveal-Joint, Concealed-Fastener Metal Wall Panels:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. ATAS International, Inc.: Design Wall DSH
 - 2. Metal Wall Panels: Formed with vertical panel edges and a flat pan between panel edges; with narrow reveal joint between panels.
 - a. Material: Metallic-coated steel .
 - b. Panel Coverage: **[12 inches]**<Insert dimension> .
 - c. Panel Height: **1.5 inches** .
 - d. Reveal: 1 inch.

2.3 METAL WALL PANEL MATERIALS

- A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
1. Nominal Thickness: **0.028 inch** .
 2. Exterior Finish: Two-coat fluoropolymer .
 3. Color: As selected by Architect from manufacturer's full range .

2.4 ACCESSORIES

- A. Structural Performance: Provide support system for metal wall panels capable of withstanding and transferring design loads to building structure within limits and under conditions indicated.
- B. Metal Subframing and Furring: ASTM C955, cold-formed, metallic-coated steel members, ASTM A653/A653M, **G90** hot-dip galvanized coating designation or ASTM A792/A792M, **Class AZ50** aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- C. Wall Panel Assembly Accessories, General: Provide components required for a complete, weathertight wall panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated on Drawings.
1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended in writing by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch**- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated on Drawings or necessary to ensure weathertight construction.
- D. Flashing and Trim: Provide flashing and trim formed from same material as metal wall panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.
- E. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

- F. Panel Sealants: Provide sealant types recommended in writing by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch** wide and **1/8 inch** thick.
 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.5 FABRICATION

- A. Fabricate and finish metal wall panels and accessories at the factory, by panel manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal wall panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate in accordance with equipment manufacturer's written instructions and to comply with details indicated on Drawings.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with panel manufacturer's written recommendations that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels specified, with exposed edges folded back to form hems.
 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with manufacturer's written recommendations.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended in writing by metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Metallic-Coated Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of the Work.
1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install steel subframing, furring, and other miscellaneous support system members and anchorages in accordance with metal wall panel manufacturer's written instructions.

3.3 INSTALLATION OF FORMED METAL WALL PANELS, GENERAL

- A. Install in accordance with metal wall panel manufacturer's written instructions in orientation, sizes, and locations indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide watertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. **Metallic-Coated Steel Panels:** Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

3.4 INSTALLATION OF LAP-SEAM METAL WALL PANELS

A. Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended in writing by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
3. Flash and seal panels with weather closures at perimeter of all openings.

3.5 INSTALLATION OF ACCESSORIES

A. Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.

B. Flashing and Trim: Comply with performance requirements and panel manufacturer's written installation instructions. Provide concealed fasteners where possible and set

units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve watertight performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 ft.** with no joints allowed within **24 inches** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than **1 inch** deep, filled with mastic sealant concealed within joints.

3.6 INSTALLATION TOLERANCES

- A. Shim and align metal wall panel units within installed tolerance of **1/4 inch in 20 ft.**, non-accumulative, on level, plumb, and location lines as indicated on Drawings, and within **1/8-inch** offset of adjoining faces and of alignment of matching profiles.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel assembly, including accessories.
 1. After testing, repair leaks, repeat tests, and make further repairs until wall panel assembly installation is watertight.
 - a. Cost of retesting is Contractor's responsibility.
- B. Remove and replace metal wall panel assembly where tests and inspections indicate that it does not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, will be required to determine if replaced or additional work complies with specified requirements.
- D. Prepare test and inspection reports.

3.8 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of panel installation, clean finished surfaces as recommended in writing by metal wall panel manufacturer.
- B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.9 PROTECTION

- A. Maintain metal wall panels in a clean condition during the remainder of construction.
- B. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13

SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic polyolefin (TPO) roofing system.
2. Accessory roofing system materials.
3. Roof insulation and accessories.
4. Cover board.

B. Related Requirements:

1. Section 053100 "Steel Decking" for roof deck panels .
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
4. Section 077100 "Roof Specialties" for roof edge fasciae roof edge flashings .
5. Section 077200 "Roof Accessories" for manufactured roof curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
6. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 DEFINITIONS

- ##### A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's " Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site .

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 1. Layout and thickness of insulation.
 2. Base and sheet flashings and membrane termination details.
 3. Flashing details at penetrations.
 4. Roof plan showing orientation of roof deck and orientation of roofing membrane, fastening spacings, and pattern for corner, perimeter, and field-of-roof locations.
 5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 6. Crickets, saddles, and tapered edge strips, including slopes.
- C. Samples for Verification: For the following products:
 1. Roofing membrane and flashings, of color required.
- D. Wind-Uplift-Resistance Submittal: For roofing system indicating compliance with wind-uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roofing membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with specified performance requirements.
 2. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- B. Product Test Reports: For roofing membrane and insulation, tests performed by an independent qualified testing agency indicating compliance with specified requirements.
- C. Research Reports: For components of roofing system, from an agency acceptable to

authorities having jurisdiction showing compliance with specified performance requirements.

- D. Field Quality Control Reports: For specified tests and inspections.
- E. Qualification Statements: For roofing system Installer .
- F. Sample Warranties: For specified special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.
- B. Roofing System Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 1. Certified Roofing System Installer: Entity that employs a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified thermoplastic system installers .

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
 - 1. Protect stored liquid material from direct sunlight.
 - 2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
 - 1. Store in a dry location.
 - 2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written installation instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty to include all components of roofing system, such as roof insulation, fasteners, adhesives, cover board, roofing membrane, base flashing sheet, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: Submit roofing system Installer's warranty, on warranty form at end of this Section, signed by roofing system Installer, covering the Work of this Section, including all components of roofing system, such as roof insulation, fasteners, adhesives, cover board, roofing membrane, base flashing sheet, and other components of roofing system.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain components for roofing system from roofing membrane manufacturer .

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and flashings to remain watertight.
 - 1. Accelerated Weathering: Roofing membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roofing membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test in FM Approvals 4470.
- B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

- C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:
1. Zone 1' (Roof Area Interior): <Insert lbf/sq. ft.> .
 2. Zone 1 (Roof Area Field): <Insert lbf/sq. ft.> .
 3. Zone 2 (Roof Area Perimeter): <Insert lbf/sq. ft.> .
 - a. Location: From roof edge to <Insert dimension> inside roof edge.
 4. Zone 3 (Roof Area Corners): <Insert lbf/sq. ft.> .
 - a. Location: <Insert dimension> in each direction from each building corner.
- D. SPRI's "Directory of Roof Assemblies" Listing: Roofing membrane, base flashings, and component materials to comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's "Directory of Roof Assemblies" for roof assembly identical for that specified for this Project.
1. Wind-Uplift Load Capacity: [60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity> .
- E. Energy Performance: Roofing system to have an initial solar reflectance index (SRI) of not less than [0.70]<Insert value> and an emissivity of not less than [0.75]<Insert value> when tested in accordance with CRRS S100.

2.3 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING SYSTEM

- A. TPO Roofing Membrane Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, TPO sheet.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. [Carlisle SynTec Systems; a Carlisle Company]
 - b. [Cooley Group]
 - c. [Custom Seal Inc.]
 - d. [Elevate; Amrize Building Envelope LLC]
 - e. [Flex Membrane International Corp.]
 - f. [GAF]
 - g. [GenFlex Roofing Systems]
 - h. [IKO Innovati; IKO Industries Inc.]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Mule-Hide Products Co., Inc]
 - k. [Siplast]
 - l. [Versico Roofing Systems; a Carlisle Company]
 - m. <Insert manufacturer's name>
 2. Membrane Option: Manufacturer's standard .
 3. Thickness: 60 mils , nominal.

4. Exposed Face Color: White .

2.4 ACCESSORY ROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.
 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Base and Sheet Flashings: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as roofing membrane.
- C. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.
- D. Roof Vents: As recommended in writing by roofing membrane manufacturer.
 1. Size: Not less than **4-inch** diameter.
- E. Bonding Adhesive: Roofing membrane manufacturer's standard [, **water based**] .
- F. Slip Sheet: [**ASTM D2178/D2178M, Type IV; glass fiber; asphalt-impregnated felt**][**Manufacturer's standard, of thickness required for application**] .
- G. Asphalt-Coated, Glass-Fiber-Mat, Venting Base Sheet: ASTM D4897/D4897M, Type II; nonperforated, asphalt impregnated, fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.
- H. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately **1 by 1/8 inch** thick; with anchors.
- I. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately **1 inch wide by 0.05 inch thick**, prepunched.
- J. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing system components to substrate; tested for required pullout strength, and acceptable to roofing membrane manufacturer.
- K. Safety Accessories: Roofing membrane manufacturer's standard yellow seaming tape for designating safety perimeters and rooftop hazards.
- L. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.

2.5 VAPOR RETARDER

- A. Butyl-Rubber-Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum **30-mil** total thickness; maximum permeance rating of **0.1 perm**; cold applied, with slip-resisting surface and release paper backing.

Provide primer when recommended by vapor retarder manufacturer.

2.6 ROOF INSULATION AND ACCESSORIES

- A. General: Preformed roof insulation boards manufactured [or approved] by roofing membrane manufacturer, approved for use in [FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"] listed roof assemblies.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, [Class 1 felt facer][Class 2 coated glass-fiber facer][Class 3 uncoated glass-fiber facer] on both major surfaces.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle SynTec Systems; a Carlisle Company]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Amrize Building Envelope LLC]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle Company]
 - g. [IKO Innovati; IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
 2. Compressive Strength: Grade 3, 25 psi .
 3. Size: 48 by 96 inches .
 4. Thickness:
 - a. Base Layer: 1-1/2 inches .
 - b. Upper Layer: <Insert thickness> .
- C. Roof Insulation Accessories, General: As recommended in writing by insulation manufacturer for intended use and compatibility with other roofing system components.
1. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate to another insulation layer as follows:
 - a. Modified asphaltic, asbestos-free, cold-applied adhesive.
 - b. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 - c. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
 2. Insulation Fasteners: Insulation manufacturer's standard factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance

provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.7 COVER BOARD

- A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.
- B. Cellulosic-Fiber Insulation Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi**.
 - 1. Thickness: **1/2 inch** .
 - 2. Surface Finish: Primed one side .
- C. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.

2.8 BALLAST

- A. Aggregate Ballast: [**Smooth, washed, riverbed gravel or other acceptable smooth-faced stone**][**Crushed gravel or crushed stone**] that withstands weather exposure without significant deterioration and does not contribute to membrane degradation, of the following size:
 - 1. Size: ASTM D448, [**Size 2, ranging in size from 1-1/2 to 2-1/2 inches**][**Size 3, ranging in size from 1 to 2 inches**][**Size 4, ranging in size from 3/4 to 1-1/2 inches**]**<Insert size>** .
- B. Ballast Retaining Bar: Perimeter securement system consisting of a slotted extruded-aluminum retention bar with an integrated compression fastening strip.
 - 1. Fasteners: **1-1/2-inch** stainless steel fasteners with neoprene washers.

2.9 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway [**pads**][**or**][**rolls**] , approximately **3/16 inch** thick and acceptable to roofing system manufacturer.
 - 1. Size: Approximately **36 by 60 inches**.
 - 2. Color: Contrasting with roofing membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for

compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of **1/16 inch** out of plane relative to adjoining deck.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Perform fastener-pullout tests in accordance with roofing system manufacturer's written instructions.
 1. Submit test result within 24 hours after performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING SYSTEM

- A. Install roofing system materials and components in accordance with roofing system manufacturer's written installation instructions, **[FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"]** listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.
- C. Coordinate installation and transition of roofing system component serving as an air barrier with wall system air barrier specified under Section 072726 "Fluid-Applied Membrane Air Barriers."
- D. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints,

entering building, or damaging roofing system components or adjacent building construction.

3.4 INSTALLATION OF ROOF INSULATION AND ACCESSORIES

- A. Coordinate installation of roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written installation instructions. Install minimum of two layers of insulation under area of roofing to achieve required thickness.
- C. Install each layer of insulation with end joints staggered not less than **12 inches** in adjacent rows and offset not less than **12 inches** from previous layer.
 - 1. Trim insulation neatly to fit around penetrations and projections, and to fit tightly to intersecting sloping roof decks.
 - 2. Make joints between adjacent insulation boards not more than **1/4 inch** in width.
 - 3. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches**.
 - 4. Trim insulation, so that water flow is unrestricted.
 - 5. Fill gaps exceeding **1/4 inch** with insulation.
 - 6. Cut and fit insulation within **1/4 inch** of nailers, projections, and penetrations.
 - 7. Secure insulation in accordance with **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" for specified wind-uplift load capacity]** .
 - 8. Secure insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

3.5 INSTALLATION OF COVER BOARD

- A. Install cover board over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches** in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Adhere cover board to substrate in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.

3.6 INSTALLATION OF TPO ROOFING MEMBRANE SHEET

- A. Install roofing membrane over roof area for adhered application method in accordance with roofing system manufacturer's written installation instructions.
- B. Unroll roofing membrane and allow it to relax before installing.
- C. Start installation in presence of roofing system manufacturer's technical personnel .
- D. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- E. Adhered Application: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply to splice area of roofing membrane.
 - 1. In addition to adhering, mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roof area.
- F. Seams and End Laps: Clean seam areas, overlap membrane, and hot-air-weld side seams and end laps of roofing membrane and sheet flashings to ensure a watertight installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane and sheet flashings.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing membrane that do not comply with requirements.
- G. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing membrane in place with clamping ring.

3.7 INSTALLATION OF BASE AND SHEET FLASHINGS

- A. General: Install and adhere base and sheet flashing and preformed flashing accessories to substrates in accordance with roofing system manufacturer's written installation instructions.
- B. Apply bonding adhesive to substrate and underside of flashings at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners.
- D. Clean seam areas, overlap, and firmly roll flashings into the adhesive. Hot-air-weld side seams and end laps to ensure a watertight installation.
- E. Terminate and seal top of flashings and mechanically anchor to substrate through termination bars.

3.8 CLEANING

- A. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 PROTECTION

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

3.10 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:
 - 1. Owner: <Insert name of Owner> .
 - 2. Owner Address: <Insert address> .
 - 3. Building Name/Type: <Insert information> .
 - 4. Building Address: <Insert address> .
 - 5. Area of Work: <Insert information> .
 - 6. Warranty Period: Five years from date of Substantial Completion.
 - 7. Date of Substantial Completion: _____.
- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 - 1. Specifically excluded from this Warranty are damages to Work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding <Insert mph> ;
 - c. fire;

- d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When Work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.
 4. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.
 6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect Work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075423

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing embedded reglets.
2. Section 042000 "Unit Masonry" for installing embedded reglets and for masonry through-wall flashing with receiver for counterflashing.
3. Section 055000 "Metal Fabrications" for downspout guards and downspout boots.
4. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
5. Section <Insert Section number> " <Insert Section title> " for air barrier and compatibility with and transitions to underlayment for roof specialties.
6. Section <Insert Section number> " <Insert Section title> " for roof-edge drainage-system components provided by metal-roof-panel manufacturer.
7. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated, sheet metal flashing and trim.
8. Section 077129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint cover assemblies.
9. Section 077200 "Roof Accessories" for manufactured roof curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
10. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.
11. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.
12. Section 099113 "Exterior Painting" for field painting of roof specialties.
13. Section 099114 "Exterior Painting (MPI Standards)" for field painting of roof specialties.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference [at Project site][by web conference]<Insert location> .

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof specialties.
 - 1. Plans, expansion-joint locations, keyed details, and attachments to other work. Distinguish between factory pre manufactured- and field-assembled installation.
 - 2. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 4. Details of termination points and assemblies, including fixed points.
 - 5. Details of special conditions.
- C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- D. Samples for Verification:
 - 1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
 - 2. Include **[copings][roof-edge specialties][roof-edge drainage systems][reglets and counterflashings]** made from **12-inch** lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of roof specialty **[copings][and][roof-edge specialties]** that is **[ANSI/SPRI/FM 4435/ES-1 tested][and][FM Approvals approved]** .
- B. Product Test Reports: For **[copings][and][roof-edge specialties]** , for tests performed by a qualified testing agency.
- C. Research Reports: For **[copings][and][roof-edge specialties]** , from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>** showing compliance with ANSI/SPRI/FM 4435/ES-1.
- D. Qualification Statements: For manufacturer.
- E. Sample Warranties: For specified special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roof specialties.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products that are [FM Approvals listed for specified class][and][ANSI/SPRI/FM 4435/ES-1 tested to specified design pressure] .

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge as indicated on Drawings.
 - 2. Build mockup of typical roof edge as part of "Integrated Exterior Mockup" specified in [Section 014000 "Quality Requirements."]<Insert Section number and title.>
 - 3. Build mockup of typical roof edge, including [fascia][gutter][and][downspout]<Insert item> , approximately [10 ft.]<Insert dimension> long, including supporting construction, seams, attachments, [underlayment,] and accessories.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 COORDINATION

- A. Coordinate roof specialties with roofing system, exterior wall system, air barrier, flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, weathertight, secure, and noncorrosive installation.
 - 1. Performance Coordination: Coordinate with the Work of roofing and exterior wall Sections to ensure that roof specialties provided under the Work of this Section

meet or exceed specified roofing and exterior wall design performance requirements.

- B. Confirm and coordinate compatibility of materials and comply with warranty requirements of roofing system manufacturer.
- C. Coordinate roof specialties layout and seams with sizes and locations of joints and seams in adjacent materials.

1.11 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section **<Insert Section number>** " **<Insert Section title>** ."
- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finishes or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **[20][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain roof specialties from single manufacturer providing roofing-system warranty specified in Section **<Insert Section number>** " **<Insert Section title>** ."

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install **[copings][roof-edge specialties]** that are listed in FM Approvals' "Approval Guide" and approved for windstorm classification, **[Class 1-60][Class 1-75][Class 1-90][Class 1-105][Class 1-120]<Insert class>** . Identify materials with FM Approvals' markings.

- C. SPRI Wind Design Standard: Manufacture and install [copings][roof-edge specialties] tested in accordance with ANSI/SPRI/FM 4435/ES and capable of resisting the following design pressures:
1. Design Pressure: [As indicated on Drawings]<Insert design pressure> .
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: [120 deg F, ambient; 180 deg F, material surfaces]<Insert temperature change> .

2.3 REGLETS AND COUNTERFLASHINGS

A. Finishes:

1. Metallic-Coated Steel: [Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer]<Insert finish> .
 - a. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color> .
2. Aluminum: [Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer][Clear anodic][Color anodic]<Insert finish> .
 - a. Color: [Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color> .
3. Stainless Steel: [ASTM A480/A480M No. 2B (bright, cold rolled, unpolished)][ASTM A480/A480M No. 3 (coarse, polished directional satin)][ASTM A480/A480M No. 4 (bright, polished directional satin)]<Insert finish> .
4. Copper: [Non-patinated, mill][Pre-patinated verdigris]<Insert finish> .

2.4 SHEET METAL MATERIALS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- B. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, **G90** coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, **Class AZ50** coating

designation; structural quality. [**Mill phosphatized for field painting where indicated.**]

1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
 2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of **0.2 mil**.
 3. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight in color coat.
 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of **0.5 mil**.
- C. Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
1. Mill Finish: As manufactured.
 2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of **0.2 mil**.
 3. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
 4. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
 5. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight in color coat.
 6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of **0.5 mil**.
- D. Aluminum Extrusions and Tubes: **ASTM B221**, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise, mill finished.
- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
- F. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

2.5 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Roof specialty manufacturer's recommended fasteners, designed to meet performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Metallic-Coated Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
 - 4. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 5. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
- C. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- D. Elastomeric Sealant: ASTM C920, elastomeric **[polyurethane][silicone]** polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- G. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.
- H. Solder for Copper: ASTM B32, **[lead-free solder][Grade Sn50, 50 percent tin and 50 percent lead]**<Insert solder grade> .

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable.

Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ROOF SPECIALTIES, GENERAL

- A. Install roof specialties in accordance with manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer's written installation instructions.
 - 1. Coat concealed side of **[uncoated aluminum][and][stainless steel]** roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of **[12 ft.]<Insert dimension>** with no joints within **[18 inches]<Insert dimension>** of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between **40 and 70 deg F**,

set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

- D. **Fastener Sizes:** Use fasteners of sizes that penetrate [wood blocking or sheathing not less than **1-1/4 inches** for nails and not less than **3/4 inch** for wood screws][substrate not less than recommended in writing by fastener manufacturer to achieve maximum pull-out resistance]<Insert size requirement> .
- E. Seal concealed joints with butyl sealant as required by roof specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below **40 deg F**.
- G. **Soldered Joints:** Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of **1-1/2 inches**; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 CLEANING

- A. **Galvanized Surfaces:** Clean field welds, bolted connections, and abraded areas and repair galvanizing in accordance with ASTM A780/A780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with [Section 099113 "Exterior Painting."][Section 099114 "Exterior Painting (MPI Standards)."]
- C. Clean and neutralize flux materials. Clean off excess solder and sealants.
- D. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

3.4 PROTECTION

- A. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 077100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Latex joint sealants.

B. Related Requirements:

1. **[Section 083453.13 "Security Hollow Metal Doors and Frames"]****[and]****[Section 119812 "Detention Doors and Frames"]** for specialized security joint sealants.
2. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Include preparation requirements and installation instructions.
2. Indicate VOC content.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint Sealant Schedule: Include the following information:

1. Joint sealant application, joint location, and designation.
2. Joint sealant manufacturer and product name.
3. Joint sealant formulation.
4. Joint sealant color.
5. Joint sealant backing or joint filler.
6. Joint size (width and depth).
7. Tooled joint profile.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For specified special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Warranty Documentation:

1. Manufacturers' special warranties.
2. Installer's special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

1.6 MOCKUPS

- A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F .
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other

atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer for each sealant type .

2.2 JOINT SEALANTS, GENERAL

- A. Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application indicated, and as indicated within approved joint sealant schedule submittal based on joint sealant manufacturer's testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range .

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. General: No staining of substrates when tested in accordance with ASTM C1248.
- B. Silicone, Nonstaining Sealant: Neutral-curing; ASTM C920.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. Pecora Corporation
 - 2. Pecora 890 NST
 - 3. Type: S .
 - 4. Grade: NS .
 - 5. Class: 50 .
 - 6. Use: NT .

2.4 LATEX JOINT SEALANTS

- A. Acrylic Latex Sealant: ASTM C834.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. Pecora Corporation: AC-20
 - 2. Type: OP .

3. Grade: Minus 18 deg C .

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended in writing by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Porous Joint Substrate Surfaces: Clean by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.

3. Concrete Substrate Surfaces: Remove laitance and form-release agents from concrete.
 4. Nonporous Joint Substrate Surfaces: Clean with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer or as indicated by preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant and backing manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Joint Sealants: Install 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.
- D. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
 4. Provide flush joint profile at locations indicated on Drawings in accordance with

Figure 8B in ASTM C1193.

5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings in accordance with Figure 8C in ASTM C1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard exterior hollow metal doors and frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow metal doors.

1.2 COORDINATION

- A. Coordinate installing anchors for hollow metal frames, including sleeves, concrete inserts, and anchor bolts.

- B. Coordinate requirements for installing door hardware, including electrified door hardware, and access control and security systems.

1.3 DEFINITIONS

- A. Minimum Steel Sheet Thickness: Minimum thickness of base metal without coatings in accordance with [ANSI/SDI A250.8][NAAMM-HMMA 803] .

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.

1. Include construction details, material descriptions, core descriptions, and finishes.
2. Include information indicating compliance with performance requirements indicated.

- B. Shop Drawings:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and base-metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and base-metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of each wall opening condition.
 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 7. Details of frame anchors, joints, field splices, and connections.
 8. Details of accessories.
 9. Details of moldings, removable stops, and glazing.
- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for doors and frames with factory-applied color finishes.
- D. Samples for Verification: For factory applied color finishes, prepared on Samples of not less than **3 by 5 inches** .
- E. Product Schedule: For hollow metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings used on the Drawings and in schedules. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For tests performed by a qualified testing agency for the following:
1. Thermally rated door assemblies.
- B. Qualification Statements: For field testing and inspecting agency **[and][Fire-Rated Door Inspector][Egress Door Inspector]** .

1.7 CLOSEOUT SUBMITTALS

- A. Record Documents: For door assemblies, list of door numbers and applicable room name and number to which door provides access.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic, canvas, or other material that can entrap moisture.
1. Provide additional protection to prevent damage to factory-applied color finishes.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal doors and frames vertically under cover at Project site with head up. Place on minimum **4-inch-** high wood blocking. Provide minimum **1/4-inch** space between each stacked door to permit air circulation.

- D. Immediately remove and replace damaged or wet packaging or protective material.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain hollow metal doors and frames from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than **0.50 deg Btu/F x h x sq. ft.** when tested in accordance with ASTM C1363 or ASTM E1423.

2.3 STANDARD EXTERIOR HOLLOW METAL DOORS AND FRAMES

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

1. [Ceco Door; AADG, Inc.; ASSA ABLOY]
2. [Curries, AADG, Inc.; ASSA ABLOY Group]
3. [DCI Hollow Metal on Demand]
4. [DE LA FONTAINE]
5. [Deansteel Manufacturing Company, Inc.]
6. [Expi-Door Systems, Inc.]
7. [Hollow Metal Xpress]
8. [Mesker Door; Mesker Openings Group]
9. [MPI Group, LLC (The)]
10. [Pioneer Industries; AADG, Inc.; ASSA ABLOY]
11. [Premier Products, Inc]
12. [Republic Doors and Frames; an Allegion brand]
13. [Steelcraft; Allegion plc]
14. [Stiles Custom Metal, Inc]
15. <Insert manufacturer's name>

- B. Exterior Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Steel Sheet: Minimum **A60** metallic coating.
2. Doors: **1-3/4 inches** thick.
 - a. Faces: Steel sheet; minimum **0.042-inch** base-metal thickness.
 - b. Edge Construction: Model 1, Full Flush .
 - c. Edge Bevel: Provide manufacturer's standard beveled or square edges .
 - d. End Closures: Steel sheet; minimum **0.042-inch** base-metal thickness.
Flush top channel sealed against water penetration and flush bottom

- e. channel with weep-hole openings to permit moisture to escape.
- e. Cores: Vertical steel stiffeners with insulation .
- 3. Frames: Steel sheet; minimum **0.053-inch** base-metal thickness.
 - a. Construction: Full-profile welded .
- 4. Exposed Finish: Prime painted .

2.4 ACCESSORIES

- A. Door Louvers: SDI 111C; steel sheet matching door face material.
 - 1. Frames: Minimum **0.042-inch** base-metal thickness. Provide fixed frame moldings with hairline joints at corners on outside of exterior and on secure (key) side of interior doors.
 - 2. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
 - a. Blades: Minimum **0.026-inch** base-metal thickness.
- B. Frame Anchors: ANSI/SDI 250.4; steel sheet; minimum base-metal thickness required by door and frame standard indicated.
 - 1. Interior Locations: ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.
 - 2. Exterior-Wall Anchors: ASTM A653/653M, **A60** metallic coating.
 - 3. Jamb Anchors: Of minimum size and type required by door and frame standard indicated, and suitable for performance level indicated.
 - a. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each **24 inches** of frame height above **7 ft.**
 - b. Postinstalled Expansion Anchor: Minimum **3/8-inch-** diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
 - 4. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
 - 5. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips that allow **2-inch** height adjustment. Terminate bottom of frames at top of underlayment.

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.6 FABRICATION

- A. Hollow Metal Frames:
 - 1. Welded Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles, at each joint, fabricated from metal of same or greater thickness as frames.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- B. Hardware Preparation: Factory prepare hollow metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the door hardware required, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with ANSI/SDI A250.14 for preparing hollow metal doors and frames for hardware.

2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite

prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION OF STANDARD EXTERIOR HOLLOW METAL DOORS AND FRAMES

- A. Install in accordance with ANSI/SDI A250.8 and ANSI/SDI A250.11.
- B. Install hollow metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- C. Mineral-Fiber Insulation: Solidly pack mineral-fiber insulation inside frames.

3.4 FIELD QUALITY CONTROL

- A. Repair or remove and replace installations where testing and inspections indicate noncompliance with specified requirements.
- B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.5 ADJUSTING

- A. Remove and replace defective work, including frames that are warped, bowed, or otherwise defective.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged

areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

- C. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.

END OF SECTION 081113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hinges.
2. Bored locks.
3. Mortise locks.
4. Delayed-egress electromagnetic locks.
5. Lock cylinders.
6. Operating trim.
7. Surface closers.
8. Wall- and floor-mounted stops.
9. Door gasketing.
10. Thresholds.

1.2 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .
 1. Conference participants must include Installer's Architectural Hardware Consultant and Owner's security consultant .

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For electrified door hardware.
 - 1. Include diagrams for power, signal, and control wiring.
 - 2. Include details of interface of electrified door hardware and building safety and security systems.

- C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.
 - 1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

- D. Samples for Initial Selection: For each type of exposed finish.

- E. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of product data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - 2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
 - 3. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - e. Fastenings and other installation information.
 - f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - g. Mounting locations for door hardware.
 - h. List of related door devices specified in other Sections for each door and frame.

- F. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer .
- B. Field quality-control reports.
- C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final door hardware schedule.
- C. to Owner.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC) .

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lockup for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to Owner by registered mail or overnight package service.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures, including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
 - a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Means of Egress Doors: Latches do not require more than **15 lbf** to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1 .
 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than **5 lbf**.
 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: **5 lbf** applied perpendicular to door.
 - b. Sliding or Folding Doors: **5 lbf** applied parallel to door at latch.
 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than **1/2 inch** high.
 4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
 5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

- A. Hinges: ANSI/BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. [Allegion plc]
 - b. [Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
 - c. [Bommer Industries, Inc]
 - d. [Cal-Royal Products, Inc]
 - e. [Design Hardware; Mesker Openings Group; dormakaba]
 - f. [Don-Jo Mfg., Inc]
 - g. [Hager Companies]
 - h. [INOX; Unison Hardware, Inc]
 - i. [Lawrence Hardware Inc.]
 - j. [McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - k. [PAMEX Inc.]
 - l. [PBB, Inc]
 - m. [STANLEY; dormakaba USA, Inc.]
 - n. <Insert manufacturer's name>
 2. Refer to Hardware Schedule on drawings for Basis of Design

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
1. Bored Locks: Minimum **1/2-inch** latchbolt throw.
 2. Mortise Locks: Minimum **3/4-inch** latchbolt throw.
 3. Deadbolts: Minimum **1.25-inch** bolt throw.
- C. Lock Backset: **2-3/4 inches** unless otherwise indicated.
- D. Lock Trim:
1. Description: As indicated on Drawings .
 2. Levers: Cast .
 - a. <Insert model number and description> .
 3. Escutcheons (Roses): Cast .
 4. Dummy Trim: Match lever lock trim and escutcheons.

- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Extra-Long-Lip Strikes: For locks used on frames with stone veneer surround.
- F. Bored Locks: ANSI/BHMA A156.2, Grade 1 , Series 4000.
- G. Mortise Locks: ANSI/BHMA A156.13, Operational Grade 1 ; stamped steel case with steel or brass parts; Series 1000.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. [Accurate Lock & Hardware]
 - b. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
 - c. [Allegion plc]
 - d. [Arrow USA; an ASSA ABLOY Group company]
 - e. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - f. [Cal-Royal Products, Inc]
 - g. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
 - h. [Design Hardware; Mesker Openings Group; dormakaba]
 - i. [dormakaba USA Inc.]
 - j. [Hager Companies]
 - k. [INOX; Unison Hardware, Inc]
 - l. [Lawrence Hardware Inc.]
 - m. [Marks USA; Napco Security Technologies, Inc.]
 - n. [RR Brink Locking Systems, Inc.]
 - o. [SARGENT Manufacturing Company; ASSA ABLOY]
 - p. [STANLEY; dormakaba USA, Inc.]
 - q. [Yale Security Inc; ASSA ABLOY]
 - r. <Insert manufacturer's name>
 - 2. Refer to Hardware Schedule on drawings for Basis of Design

2.5 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. [Allegion plc]
 - b. [Arrow USA; an ASSA ABLOY Group company]
 - c. [ASSA, Inc.]
 - d. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - e. [Cal-Royal Products, Inc]

- f. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
- g. [Hager Companies]
- h. [Medeco Security Locks; an ASSA ABLOY Group company]
- i. [PAMEX Inc.]
- j. [PDQ Industries, Inc.]
- k. [SARGENT Manufacturing Company; ASSA ABLOY]
- l. [STANLEY; dormakaba USA, Inc.]
- m. [Yale Security Inc; ASSA ABLOY]
- n. <Insert manufacturer's name>

2. Refer to Hardware Schedule on drawings for Basis of Design

B. Standard Lock Cylinders: ANSI/BHMA A156.5, Grade 1 permanent cores; face finished to match lockset.

1. Core Type: Removable .

2.6 KEYING

A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. Master Key System: Change keys and a master key operate cylinders.

a. Provide three cylinder change keys and five master keys.

2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver .

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: Information to be furnished by Owner.

2.7 OPERATING TRIM

A. Operating Trim: ANSI/BHMA A156.6; stainless steel unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :

- a. [Allegion plc]
- b. [Burns Manufacturing Incorporated]
- c. [Don-Jo Mfg., Inc]
- d. [Forms+Surfaces]
- e. [Hager Companies]
- f. [Hiawatha, Inc; a division of the Activar Construction Products Group]

- g. [INOX; Unison Hardware, Inc]
- h. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
- i. [Standard Metal Hardware Manufacturing LTD]
- j. [Trimco]
- k. <Insert manufacturer's name>

- 2. Refer to Hardware Schedule on drawings for Basis of Design

2.8 SURFACE CLOSERS

- A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :

- a. [Allegion plc]
- b. [Arrow USA; an ASSA ABLOY Group company]
- c. [Cal-Royal Products, Inc]
- d. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
- e. [Design Hardware; Mesker Openings Group; dormakaba]
- f. [dormakaba USA Inc.]
- g. [Hager Companies]
- h. [INOX; Unison Hardware, Inc]
- i. [Norton Rixson; part of ASSA ABLOY Group]
- j. [PAMEX Inc.]
- k. [SARGENT Manufacturing Company; ASSA ABLOY]
- l. [STANLEY; dormakaba USA, Inc.]
- m. [Yale Security Inc; ASSA ABLOY]
- n. <Insert manufacturer's name>

- 2. Refer to Hardware Schedule on drawings for Basis of Design

2.9 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :

- a. [Allegion plc]
- b. [Architectural Builders Hardware Mfg., Inc]
- c. [ASI-American Specialties, Inc.]

- d. [Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
- e. [Burns Manufacturing Incorporated]
- f. [Cal-Royal Products, Inc]
- g. [Don-Jo Mfg., Inc]
- h. [Door Controls International]
- i. [Hager Companies]
- j. [Hiawatha, Inc; a division of the Activar Construction Products Group]
- k. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
- l. [Trimco]
- m. <Insert manufacturer's name>

- 2. Refer to Hardware Schedule on drawings for Basis of Design

2.10 DOOR GASKETING

- A. Door Gasketing: ANSI/BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
- B. Maximum Air Leakage: When tested in accordance with ASTM E283/E283M with tested pressure differential of **0.3 inch wg**, as follows:
 - 1. Gasketing on Single Doors: **0.3 cfm/sq. ft.** of door opening.

2.11 THRESHOLDS

- A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. [Hager Companies]
 - b. [Legacy Manufacturing]
 - c. [M-D Building Products, Inc]
 - d. [National Guard Products, Inc]
 - e. [Norton Rixson; part of ASSA ABLOY Group]
 - f. [Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - g. [Reese Enterprises, Inc]
 - h. [Sealeze]
 - i. [Zero International; Allegion plc]
 - j. <Insert manufacturer's name>
 - 2. Refer to Hardware Schedule on drawings for Basis of Design

2.12 FABRICATION

- A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18.
- B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended; however, aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 - 1. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - 2. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.13 FINISHES

- A. Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

3.3 INSTALLATION OF DOOR HARDWARE

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every **30 inches** of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every **30 inches** of door height greater than **90 inches**.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner .
- F. Key Control System:
- G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, in equipment room . Verify location with Architect.
 - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 1. Do not notch perimeter gasketing to install other surface-applied hardware.

- K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.

- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant is to examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

- B. Maintenance Service: Beginning at Substantial Completion, maintenance service is to include six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

END OF SECTION 087100

**SECTION 089543
FLOOD VENTS**

PART 1 – GENERAL

1.1 SUMMARY

- A. Work Results:
 - 1. Installation of Flood Vents: Factory assembled stainless steel flood vents.
- B. Principal Products:
 - 1. Engineered Stainless Steel Flood Vents.
- C. Section Includes:
 - 1. Engineered Stainless Steel Flood Vents.
 - 2. Trim and Sleeve Kits.
 - 3. Accessories.

1.2 REFERENCES

- A. International Building Code (IBC), latest edition as approved by the authorities having jurisdiction.
- B. International Code Council Evaluation Service (ICC-ES) Acceptance Criteria for Mechanically Operated Flood Vents (AC-364), latest edition.
- C. ASCE/SEI 24 “Flood Resistant Design and Construction”, latest edition.
- D. Code of Federal Regulations (CFR), Title 44.
- E. Federal Emergency Management Agency (FEMA) Regulations, latest.
- F. National Flood Insurance Program (NFIP) Regulations, latest.
- G. FEMA/NFIP Technical Bulletin 1 “Openings in Foundation Walls and Walls of Enclosures”, latest edition.
- H. FEMA/NFIP Technical Bulletin 2 “Flood Damage-Resistant Materials Requirements”, latest edition.
- I. International Energy Conservation Code (IECC), latest edition as approved by the authorities having jurisdiction.

1.3 ADMINISTRATIVE PROCEDURES

- A. Coordination Procedures: Coordinate flood vent locations with architectural finishes.

1.4 ACTION SUBMITTALS

- A. Product Data: Provide manufacturer’s information on each material and component of the vent.
- B. Manufacturer’s Certificates: Certify products meet or exceed specified requirements.

1.5 INFORMATIONAL SUBMITTAL

- A. Test and Evaluation Reports: Manufacturer test results showing flood protection coverage per product.
- B. Manufacturer’s instructions.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Manual.
- B. Warranty Documentation.

1.7 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Five (5) years of documented experience, minimum, in the manufacture of the products specified in this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's unopened packaging with labels undamaged, legible, and readable until ready for installation. Inspect materials for damages.
- B. Protect stored materials from moisture exposure.
- C. Store materials in a dry, cool, ventilated, and weathertight location.
- D. Outdoor Storage Requirements (if necessary): Store materials on an incline to avoid moisture accumulation and facilitate runoff. Cover materials with a tarp set up in a tent-like fashion and raised above the products to allow for air circulation and to avoid UV exposure. Keep all additional hardware in a dry, climate-controlled setting.

1.9 FIELD CONDITIONS

- A. Ambient Conditions: Perform work within manufacturer's recommended weather and temperature limitations.
- B. Existing Conditions: Verify field measurements before fabrication. Show field measurements on Shop Drawings.
 - a. Have flood vent manufacturer, installer, or qualified person(s) conduct site survey to document the conditions at the installation site to detail the type of materials, dimensions, configuration, potential interferences with the mounting surface, and any other contributing factors for proper installation.

1.10 WARRANTY

- A. Manufacturer Limited Warranty:
 - 1. Manufacturer's 15-year extended limited warranty with product registration.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Subject to requirements manufacturer's may include but are not limited to: Smart Vent Products, Inc., which is located at: 19 Mantua Road, Mount Royal, NJ, 08061; Telephone: 877-441-8368; Email: info@smartvent.com; Website: www.smartvent.com.
- B. Single Source Responsibilities: Obtain all flood vent assemblies from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Flood Vents are constructed of Marine Grade 316 Stainless Steel formed and smooth-welded with a rigid construction. Frames are designed for installation in masonry, concrete, or framed walls, stud walls, garage doors and metal panels. Vents have a pivoting door assembly that is fitted with two patented sealed floats that provide vermin protection

and immediately and automatically release the door upon contact with rising water to relieve unbalanced lateral forces on foundation walls. All flood vents are required to work bi-directionally, without human intervention.

- B. Engineering Code Practices: Engineer flood products to conform to the design requirements that are based on the latest adopted editions of ASCE 24, and the International Building Code (IBC).
- C. Design Criteria: Conform to the requirements for A and AE Zones as set forth by the National Flood Insurance Program (NFIP).
 - 1. Design flood vent model(s), quantity, and location to satisfy flood ventilation and placement requirements for building enclosure.
- D. Product Criteria:
 - 1. Certifications:
 - a. International Code Council - Evaluation Service Report (ESR-2074) including Florida Building and Residential Code Supplement, California Building and Residential Code Supplement.

2.3 PRODUCTS

- A. Insulated Series: Provide flood protection only. Insulated Core with perimeter weather-stripping.
 - 1. FLOOD VENT Products Model #1540-520: Flush or Solid Insulated Door.
 - a. Flood Coverage: 200 sq. ft.
 - b. Insulated Core R-Value: 8.34
 - c. Size: 16 inches W by 8 inches H by 3 inches D.
 - d. Rough Opening: 16-1/4 inches W by 8-1/4 inches H.
- B. Powder-Coat Finish with color as follows:
 - 1. Black
 - 2. White
 - 3. Gray
 - 4. Wheat
 - 5. Custom (Sherwin-Williams or PPG Industries): _____
- C. Trim and Sleeves Kits: Sleeves for use in 'un-filled' masonry and for, Fire Walls where 'air-space' is required on Exterior Walls and to finish off the inside of openings:
 - 1. For 16" W x 8" H vent models:
 - a. Adjustable Sleeve/Trim #1540-531-12: for 7 inches to 12.5 inches wall thickness.
- D. Accessories:
 - 1.
 - a. Installation Clips, four for each vent.
 - b. Security Clips, two for each vent.
 - c. Sealant: HurriBond™ (www.hurribond.com) or equivalent adhesive for masonry or concrete surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify vent locations are ready to receive work, and dimensions are as indicated on shop drawings or as instructed by manufacturers.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Review and coordinate setting drawings, templates, and related items that are to be embedded in concrete and masonry.
- C. Verify that no obstructions exist that will interfere with the proper operation of the vents.
- D. 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 in accordance with manufacturer's instructions.
- B. Install vents in at least two different walls spaced evenly around foundation perimeter and located a maximum of 12 inches higher than the interior or exterior grade, to the bottom of vent.
- C. Install vents plumb, level, square, true to line, and rigid.
- D. Attach vents securely in place using applicable manufactured approved adhesive, supplied or manufacturer approved fasteners, and installation clips.
- E. Separate incompatible materials to prevent galvanic corrosion.
- F. Install one single height flood vent for every 200 sq. ft. of enclosed space below floodplain.

3.4 FIELD QUALITY CONTROL

- A. Field Tests and Inspections: Installer to perform float activation test to check flood door alignment. This is done by inserting two business cards (or similar items) into the two water-entry slots on the front or back of the flood door. This will simulate a flood event by dislodging the internal floats. The flood door should be able to swing freely in either direction. Once checked, installer will manually put the flood door positioned back in sitting position to engage the internal floats to latch.

3.5 CLEANING AND STORAGE

- A. Inspect components for damages.
- B. Touch-up minor damages to components to the satisfaction of the Architect. Replace components that are beyond repair.
- C. Clean exposed surfaces.

3.6 PROTECTION

- A. Protect installed product and finished surfaces during normal and general operation.

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
- B. Related Requirements:

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Samples for Verification: Actual sample of finished products for the following:
 - 1. Trim Accessories: Actual sample of finished products for each profile of aluminum trim .
 - a. Size: Full size profile, [12 inches]<Insert dimension> long.
 - 2. Texture Finish: [Manufacturer's standard size]<Insert requirements> for each texture finish required and on same backing indicated for Work.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or

splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of gypsum board and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide panel products in maximum lengths and widths available that will minimize joints in each area and that correspond with support system specified or indicated on Drawings.

2.3 INTERIOR GYPSUM BOARD

- A. Lightweight Mold-Resistant Gypsum Board: ASTM C1396/C1396M; manufactured with moisture- and mold-resistant core and paper surfaces.

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :

- a. USG Corporation

- 2. Core: **5/8 inch**, Type X .
- 3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.
- 4. Long Edges: Tapered .

- B. Trim for Interior Gypsum Board: ASTM C1047.

- 1. Material: PVC .
- 2. Shapes:

- a. Cornerbead.
- b. Bullnose bead.
- c. LC-Bead: J-shaped; exposed long flange receives joint compound.
- d. L-Bead: L-shaped; exposed long flange receives joint compound.
- e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
- f. Curved-Edge Cornerbead: With notched or flexible flanges.
- g. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

- C. Joint Treatment Materials for Interior Gypsum Board: Comply with ASTM C475/C475M requirements.

1. Joint Tape: Paper.
2. Joint Compound: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - a. Mold-Resistant Joint Compound: Use mold-resistant formulations with mold-resistant gypsum board products.
 - b. Prefilling: At open joints , rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - c. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - d. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - e. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - f. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound .

2.4 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended in writing by manufacturer for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise specified or indicated on Drawings.
 1. Use screws complying with ASTM C954 for fastening panels to steel members from **0.033 to 0.112 inch** thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF GYPSUM BOARD, GENERAL

- A. Comply with ASTM C840 requirements.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than **1/16 inch** of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form expansion (control) joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than **8 sq. ft.** in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow **1/4- to 3/8-inch-** wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide **1/4- to 1/2-inch-** wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated on Drawings.
 - 2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- B. Trim for Interior Gypsum Board: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim in accordance with manufacturer's written instructions.
 - 1. LC-Bead: Install at exposed panel edges .
 - 2. Expansion (Control) Joint: Install control joints at locations indicated on Drawings

- C. Joint Treatment Materials for Interior Gypsum Board: Treat joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare panel surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
 - 1. Prefill open joints , rounded or beveled edges, and damaged surface areas.
 - 2. Apply joint tape over panel joints, except for trim products specifically indicated as not intended to receive tape.

- D. Finish interior gypsum board panels to comply with levels indicated below and in accordance with ASTM C840:
 - 1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.4 PROTECTION

- A. Protect adjacent surfaces from joint compound and promptly remove from floors and other non-gypsum board surfaces. Repair surfaces stained, marred, or otherwise damaged during gypsum board installation and finishing.

- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- C. Remove and replace panels that have gotten wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Sections:

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .
 - 1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
 - 2. Review details of integral cove bases.
 - 3. Review manufacturer's written instructions for installing resinous flooring systems.
 - 4. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
 - 1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.
- B. Samples for Initial Selection: For each type of exposed finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each resinous flooring component.
- B. Material Test Reports: For each resinous flooring system, by a qualified testing agency.
- C. Qualification Statements: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by

manufacturer.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

1.7 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Apply full-thickness mockups on **96-inch**- square floor area selected by Architect.
 - a. Include **96-inch** length of integral cove base with inside [**and outside**] corner.
2. Simulate finished lighting conditions for Architect's review of mockups.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.
- C. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

1.10 WARRANTY

A. Special Warranty for Resinous Flooring Products: Manufacturer agrees to repair or replace components of flooring installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of flooring due to unusual

- traffic, failure of substrate, vandalism, or abuse.
2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Flammability: Self-extinguishing in accordance with ASTM D635.

2.2 RESINOUS FLOORING

- A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. Sherwin-Williams High Performance Flooring: Hybri-Flex EC
2. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.
3. System Characteristics:
 - a. Color and Pattern: As selected by Architect from manufacturer's full range .
 - b. Wearing Surface: Textured for slip resistance .
 - c. Overall System Thickness: **3/16 inch** .
4. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:
 - a. Compressive Strength: **<Insert value>** minimum in accordance with ASTM C579.
 - b. Tensile Strength: **<Insert value>** minimum in accordance with ASTM C307.
 - c. Flexural Modulus of Elasticity: **<Insert value>** minimum in accordance with ASTM C580.
 - d. Water Absorption: **<Insert number>** percent maximum in accordance with ASTM C413.
 - e. Shrinkage: **<Insert number>** percent maximum in accordance with ASTM C531.
 - f. Indentation: **<Insert number>** percent maximum in accordance with MIL-D-3134J.
 - g. Impact Resistance: No chipping, cracking, or delamination and not more

- h. than **1/16-inch** permanent indentation in accordance with MIL-D-3134J.
 - h. Resistance to Elevated Temperature: No slip or flow of more than **1/16 inch** in accordance with MIL-D-3134J.
 - i. Abrasion Resistance: **<Insert value>** maximum weight loss in accordance with ASTM D4060.
 - j. Hardness: **<Insert value>** , Shore D in accordance with ASTM D2240.
 - k. Critical Radiant Flux: **[0.45 W/sq. cm][0.22 W/sq. cm]** or greater in accordance with NFPA 253.
5. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested in accordance with **[ASTM D1308 for 50 percent immersion][ASTM D543, Procedure A, for immersion][ASTM C267 for immersion]<Insert testing requirements>** in the following reagents for no fewer than seven days:
- a. **<Insert list of reagents that Owner has determined are likely to contact resinous flooring during in-service use>** .
6. Primer: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.
- a. Products:
 - 1) **<Insert, in separate subparagraphs, manufacturer's name; product name or designation>** .
 - b. Formulation Description: **[100 percent solids][High solids][Water based]<Insert requirements>** .
7. Waterproofing Membrane: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.
- a. Products:
 - 1) **<Insert, in separate subparagraphs, manufacturer's name; product name or designation>** .
 - b. Formulation Description: **[100 percent solids][High solids]<Insert requirements>** .
8. Reinforcing Membrane: Flexible resin formulation that is recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.
- a. Products:
 - 1) **<Insert, in separate subparagraphs, manufacturer's name; product name or designation>** .
 - b. Formulation Description: **[100 percent solids][High solids]<Insert**

requirements> .

- 1) Provide fiberglass scrim embedded in reinforcing membrane.
9. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended in writing by manufacturer for installation indicated.
- a. Products:
 - 1) <Insert, in separate subparagraphs, manufacturer's name; product name or designation> .
10. Body Coats:
- a. Products:
 - 1) <Insert, in separate subparagraphs, manufacturer's name; product name or designation> .
 - b. Resin: [Epoxy][Urethane][Epoxy novolac][Vinyl ester][Methyl methacrylate][Polyaspartic]<Insert resin> .
 - c. Formulation Description: [100 percent solids][High solids][Water based]<Insert requirements> .
 - d. Type: [Clear][Pigmented]<Insert description> .
 - e. Installation Method: [Self-leveling slurry with broadcast aggregates][Self-leveling slurry][Troweled or screeded] .
 - f. Number of Coats: [One][Two]<Insert number> .
 - g. Thickness of Coats: [8 mils][1/16 inch][1/8 inch]<Insert thickness> .
 - h. Aggregates: [Manufacturer's standard][Colored quartz (ceramic-coated silica)][Vinyl flakes][Granite][Natural silica]<Insert requirements> .
11. Grout Coat:
- a. Products:
 - 1) <Insert, in separate subparagraphs, manufacturer's name; product name or designation> .
 - b. Resin: [Epoxy][Urethane][Epoxy novolac][Vinyl ester][Methyl methacrylate][Polyaspartic]<Insert resin> .
 - c. Formulation Description: [100 percent solids][High solids][Water based]<Insert requirements> .
 - d. Type: [Clear][Pigmented]<Insert description> .
 - e. Thickness of Coat: [8 mils][1/16 inch][1/8 inch]<Insert thickness> .
12. Topcoats: Sealing or finish coats.
- a. Products:
 - 1) <Insert, in separate subparagraphs, manufacturer's name; product

name or designation> .

- b. Resin: [Epoxy][Urethane][Epoxy novolac][Vinyl ester][Methyl methacrylate][Polyaspartic]<Insert resin> .
- c. Formulation Description: [100 percent solids][High solids][Water based]<Insert requirements> .
- d. Type: [Clear][Pigmented]<Insert description> .
- e. Number of Coats: [One][Two]<Insert number> .
- f. Thickness of Coats: [8 mils][1/16 inch][1/8 inch]<Insert thickness> .
- g. Finish: [Matte][Gloss] .

2.3 INTEGRAL COVE BASE ACCESSORIES

- A. Installation Adhesive: As recommended in writing by accessory manufacturer.
 - 1. Adhesives: Comply with VOC emissions evaluation criteria.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resinous flooring systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare and clean substrates in accordance with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 - 1. Roughen concrete substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with requirements in SSPC-SP 13/NACE No. 6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.
 3. Moisture Testing: Perform tests so that each test area does not exceed **200 sq. ft.** , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of **[3 lb of water/1000 sq. ft.][5 lb of water/1000 sq. ft.]<Insert value>** in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum **[75]<Insert number>** percent relative humidity level measurement.
 4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrate alkalinity is not less than **[6]<Insert number>** or more than **[8]<Insert number>** pH unless otherwise recommended in writing by flooring manufacturer,
- C. Patching and Fill Material: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.
1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

3.3 INSTALLATION OF RESINOUS FLOORING

- A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.
1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
- B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.
- C. Reinforcing Membrane: Apply reinforcing membrane to **[substrate cracks][entire substrate surface]<Insert requirements>** .
- D. Integral Cove Base Accessories: Adhesively install precast accessories before applying flooring coats and in accordance with manufacturer's written instructions.
- E. Field-Formed Integral Cove Base: Apply cove base mix to wall surfaces before

applying flooring coats. Apply in accordance with manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: [4 inches]<Insert dimension> high.
- F. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness specified for flooring system.
1. Aggregates: Broadcast aggregates at rate recommended in writing by manufacturer. After resin is cured, remove excess aggregates to provide surface texture indicated.
- G. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness specified for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended in writing by manufacturer.
- H. Grout Coat: Apply grout coat to fill voids in surface of final body coat.
- I. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

3.4 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may, at any time and any number of times during resinous flooring installation, require material samples for testing for compliance with requirements.
1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
 3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reinstall flooring materials to comply with requirements.
- B. Core Sampling: At Owner's direction and at locations designated by Owner, take one core sample per **1000 sq. ft.** of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.5 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

Workshop Architecture		Springvale Park Pavilion
26004		East Ridge, Tennessee

SECTION 09 90 00
INTERIOR, EXTERIOR AND HIGH PERFORMANCE PAINTS AND COATINGS

1. GENERAL

1.1. SECTION INCLUDES

- A. Interior paint and coating commercial systems including surface preparation.
- B. Interior high-performance paint and coatings systems including surface preparation.
- C. Exterior high-performance paint and coatings systems including surface preparation.
- D. Exterior paint and coating systems including surface preparation.

1.2. RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 04 20 00 - Unit Masonry: Concrete Masonry Units (CMU) and brick.
- C. Section 05 12 16 - Fabricated Fireproofed Steel Columns.
- D. Section 05 50 00 - Metal Fabrications.
- E. Section 06 20 00 - Finish Carpentry.
- F. Section 06 40 00 - Architectural Woodwork.
- G. Section 08 11 13.16 - Custom Hollow Metal Doors and Frames.
- H. Section 09 21 16.23 - Gypsum Board Shaft Wall Assemblies.
- I. Section 23 05 00 - Common Work Results for HVAC.
- J. Section 26 05 00 - Common Work Results for Electrical.

1.3. REFERENCES

- A. Steel Structures Painting Council (SSPC):
 - 1. SSPC-SP 1 - Solvent Cleaning.
 - 2. SSPC-SP 2 - Hand Tool Cleaning.
 - 3. SSPC-SP 3 - Power Tool Cleaning.
 - 4. SSPC-SP5/NACE No. 1, White Metal Blast Cleaning.
 - 5. SSPC-SP6/NACE No. 3, Commercial Blast Cleaning.
 - 6. SSPC-SP7/NACE No. 4, Brush-Off Blast Cleaning.
 - 7. SSPC-SP10/NACE No. 2, Near-White Blast Cleaning.
 - 8. SSPC-SP11, Power Tool Cleaning to Bare Metal.
 - 9. SSPC-SP12/NACE No. 5, Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating.
 - 10. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete.
- B. Material Safety Data Sheets / Environmental Data Sheets: Per manufacturer's MSDS/EDS for specific VOCs (calculated per 40 CFR 59.406). VOCs may vary by base and sheen.

1.4. SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: For each paint system indicated, including.
 - 1. Product characteristics.
 - 2. Surface preparation instructions and recommendations.
 - 3. Primer requirements and finish specification.
 - 4. Storage and handling requirements and recommendations.
 - 5. Application methods.
 - 6. Cautions for storage, handling and installation.
- C. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's products, colors, and sheens available.
- D. Coating Maintenance Manual: Upon conclusion of project, the Contractor or paint manufacturer/supplier will furnish a coating maintenance manual, such as Sherwin-Williams, "Custodian Project Color and Product Information" report or equal. Manual will include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
- E. Only submit complying products based on project requirements (i.e. LEED). One must also comply with the regulations regarding VOCs (CARB, OTC, SCAQMD, LADCO). To ensure compliance with district regulations and other rules, businesses that perform coating activities should contact the local district in each area where the coating will be used.

1.5. QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, Architect will select from standard products, colors, and sheens available.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless indicated.
- D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish surfaces for verification of products, colors, and sheens.
 - 2. Finish area designated by Architect.
 - 3. Provide samples that designate primer and finish coats.
 - 4. Compatibility and Adhesion: Check after one week of drying and curing by testing in accordance with ASTM D3359; Adhesion by tape test. If the coating system is incompatible, additional surface preparation up to and including complete removal may be required.
 - 5. Do not proceed with remaining work until the Architect approves the mock-up.
 - 6. Subject to approval the mockup may be incorporated into the finished work.

1.6. DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging will bear the manufacturer's name, label, and the following list of information.
 - 1. Product name, and type (description).
 - 2. Application and use instructions.
 - 3. Surface preparation.
 - 4. VOC content.

5. Environmental handling.
 6. Batch date.
 7. Color number.
- B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.
- D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.7. PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8. EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and, in the quantities, described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
- B. Furnish Owner with an additional one percent of each material and color, but not less than 1 gal (3.8 l) or 1 case, as appropriate.

2.PRODUCTS

2.1. MANUFACTURERS

- A. Acceptable Manufacturers include but are not limited to: Sherwin-Williams
1 Sherwin Way
Cleveland, OH 44113
Toll Free Tel: 800-4-SHERWIN (474-3794)
Tel: 678-361-6108
Email: brian.w.quick@sherwin.com
Web: <https://www.sherwin-williams.com/architects-specifiers-designers>
<https://www.sherwin-williams.com/full-spectrum-possibilities>
<https://www.swspecs.com>.
- B. Requests for substitutions will be considered in accordance with the provisions of Section 01 60 00 - Product Requirements.

2.2. APPLICATIONS/SCOPE

- A. High Performance Interior Paint and Coating Systems:
1. Masonry: Concrete masonry units, including split-face, scored, and smooth block.
 2. Metal: Aluminum, galvanized steel.
 3. Metal: Structural steel, joists, trusses, beams, partitions, and similar items.
- B. High Performance Exterior Paint and Coating Systems:
1. Masonry: Concrete masonry units, cinder, or concrete block.
 2. Metal: Aluminum, galvanized steel.
 3. Metal: Miscellaneous iron, ornamental iron, ferrous metal.
- C. Exterior Paint and Coating Systems:
1. Wood: Non-vehicular floors, and platforms.
 2. Drywall: Gypsum board, and exterior drywall.

2.3. PAINT MATERIALS - GENERAL

- A. Paints and Coatings:
 - 1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
 - 2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color. Or follow manufacturer's product instructions for optimal color conformance.
- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use a primer categorized as "best" by the manufacturer.
- C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.
- D. Color: Refer to Finish Schedule for paint colors, and as selected.

2.4. HIGH PERFORMANCE INTERIOR PAINT AND COATING SYSTEMS

- A. Masonry CMU: Concrete.
 - 1. Urethane Systems; Waterbased:
 - a. Semi-Gloss Finish:
 - 1. 1st Coat: S-W Heavy Duty Block Filler, B42W46 (18.0-34.0 mils. wet, 10.0-18.0 mils. dry per coat).
 - 2. 2nd Coat: S-W Pro Industrial Waterbased Acrolon 100 Semi-Gloss, B65-520 Series.
 - 3. 3rd Coat: S-W Pro Industrial Waterbased Acrolon 100 Semi-Gloss, B65-520 Series (4.0-8.0 mils. wet, 1.7-3.4 mils. dry per coat)
- B. Drywall: Walls, Ceilings, and Gypsum Board.
 - 1. Urethane Systems; Waterbased:
 - a. Semi-Gloss Finish:
 - 1. 1st Coat: S-W ProBlock Premium All-Purpose WB Primer, B51-620 (4.0 mils. wet, 1.4 mils. dry per coat).
 - 2. 2nd Coat: S-W Pro-Industrial Waterbased Acrolon 100 Semi-Gloss, B65-520 Series.
 - 3. 3rd Coat: S-W Pro-Industrial Waterbased Acrolon 100 Semi-Gloss, B65-520 Series (4.0-8.0 mils. wet, 1.7-3.4 mils. dry per coat).

2.5. HIGH PERFORMANCE EXTERIOR PAINT AND COATING SYSTEMS

- A. Masonry; CMU: Concrete, Split Face.
 - 1. Urethane Systems; Waterbased:
 - a. Semi-Gloss Finish:
 - 1. 1st Coat: S-W Heavy Duty Block Filler, B42W46 (18.0-34.0 mils. wet, 10.0-18.0 mils. dry per coat).
 - 2. 2nd Coat: S-W Pro Industrial Waterbased Acrolon 100 Semi-Gloss, B65-520 Series.
 - 3. 3rd Coat: S-W Pro Industrial Waterbased Acrolon 100 Semi-Gloss, B65-520 Series (4.0-8.0 mils. wet, 1.7-3.4 mils. dry per coat).
- B. Non-Ferrous Metal: Galvanized and Aluminum.
 - 1. Urethane Systems; Waterbased:
 - a. Semi-Gloss Finish:
 - 1. 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series (5.0-10.0 mils. wet, 1.8-3.6 mils. dry per coat).

2. 2nd Coat: S-W Pro-Industrial Waterbased Acrolon 100 Semi-Gloss, B65-520 Series.
 3. 3rd Coat: S-W Pro-Industrial Waterbased Acrolon 100 Semi-Gloss, B65-520 Series (4.0-8.0 mils. wet, 1.7-3.4 mils. dry per coat).
- C. Metal - (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, Ferrous Metal).
1. Urethane System; Waterbased:
 - a. Semi-Gloss Finish:
 1. 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series. (5.0-10.0 mils. wet, 1.8-3.6 mils. dry per coat).
 2. 2nd Coat: S-W Pro Industrial Waterbased Acrolon 100 Semi-Gloss, B65-520 Series.
 3. 3rd Coat: S-W Pro Industrial Waterbased Acrolon 100 Semi-Gloss, B65-520 Series. (4.0-8.0 mils. wet, 1.7-3.4 mils. dry per coat).

2.6. EXTERIOR PAINT AND COATING SYSTEMS

- A. Wood: Decks, Exterior including pressure treated lumber, non-vehicular Floors, and Platforms.
1. Stain Systems:
 - a. Semi-Transparent Stain:
 1. 1st Coat: S-W SuperDeck Exterior Waterborne Semi-Transparent Stain, SD3T Series.
 2. 2nd Coat: S-W SuperDeck Exterior Waterborne Semi-Transparent Stain, SD3T Series (100 - 350 sq ft/gal).

3. EXECUTION

3.1. EXAMINATION

- A. Do not begin installation until the substrates have been properly prepared; notify Architect of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.
- C. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead based paints, notify Architect immediately if lead based paints are encountered.

3.2. SURFACE PREPARATION

- A. General: Surfaces will be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint, or other contamination to ensure good adhesion.
1. Prior to attempting to remove mildew, it is recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions are advised.
 2. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply solution and scrub the mildewed area. Allow solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/ water solution.
 3. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

4. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50 degrees F (10 degrees C), unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface, and material temperatures must be 50 degrees F (10 degrees F) or higher to use low temperature products.
- B. Aluminum: Remove all oil, grease, dirt, oxide, and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
 - C. Block (Cinder and Concrete): Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75 degrees F (24 degrees C). The pH of the surface should be between 6 and 9 unless the products are designed to be used in high pH environments. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.
 - D. Concrete, SSPC-SP13 or NACE 6: This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.
 - E. Cement Composition Siding/Panels: Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. The pH of the surface should be between 6 and 9 unless the products are designed to be used in high pH environments.
 - F. Drywall - Exterior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth, and all dust removed prior to painting. Exterior surfaces must be spackled with exterior grade compounds.
 - G. Drywall - Interior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth, and all dust removed prior to painting.
 - H. Galvanized Metal: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply to a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.
 - I. Steel: Structural, Plate, And Similar Items: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.
 1. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
 2. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale,

loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Beforehand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.

3. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
 4. White Metal Blast Cleaning, SSPC-SP5 or NACE 1: A White Metal Blast Cleaned surface, when viewed without magnification, will be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease will be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
 5. Commercial Blast Cleaning, SSPC-SP6 or NACE 3: A Commercial Blast Cleaned surface, when viewed without magnification, will be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining will be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease will be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
 6. Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4: A Brush-Off Blast Cleaned surface, when viewed without magnification, will be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease will be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.
 7. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, will be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.
 8. Near-White Blast Cleaning, SSPC-SP10 or NACE 2: A Near White Blast Cleaned surface, when viewed without magnification, will be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining will be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease will be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
 9. High- and Ultra-High Pressure Water Jetting for Steel and Other Hard Materials: SSPC-SP12 or NACE 5: This standard provides requirements for the use of high- and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream.
 10. Water Blasting, SSPC-SP12/NACE No. 5: Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.
- J. Wood: Must be clean and dry. Prime and paint as soon as possible. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.

3.3. INSTALLATION

- A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin

coatings according to manufacturer's recommendations.

- B. Do not apply it to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content. Wait until wood is fully dry after rain or morning fog or dew.
- C. Apply coatings using methods recommended by manufacturer.
- D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.
- E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.
- F. Regardless of the number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.
- G. Inspection: The coated surface must be inspected and approved by the Architect just prior to the application of each coat.

3.4. PROTECTION

- A. Protect finished coatings from damage until completion of project.
- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION

SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
- B. Related Requirements:
 - 1. Section 101423 "Panel Signage" for panel signs and field-applied vinyl-character signs.

1.2 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings: For room-identification signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements , including raised characters and Braille , and layout for each sign at least half size .
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For Installer and manufacturer .
- B. Sample Warranty: For specified special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For room-identification signs.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer .

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" .

2.2 SIGN MATERIALS

- A. Aluminum Sheet and Plate: **ASTM B209**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: **ASTM B221**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

- D. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings and suitable for exterior applications .
- E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
 - 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
 - b. Fastener Heads: Use oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
 - 4. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
 - b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies in accordance with requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed

fasteners where possible; use exposed fasteners that match sign finish.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 ADJUSTING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

3.2 CLEANING

- A. Remove temporary protective coverings and strippable films as signs are installed.
- B. On completion of installation, clean exposed surfaces of signs in accordance with manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423.16

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Childcare accessories.

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
- B. Samples: For each exposed product and for each finish specified, full size.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, visible silver spoilage defects.
 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

- A. Owner-Furnished Materials: Soap dispensers, paper towel dispensers, toilet paper dispensers .

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design accessories and fasteners to comply with the following requirements:
1. Grab Bars: Installed units are able to resist **250 lbf** minimum concentrated load applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Grab Bars:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. Bobrick Washroom Equipment, Inc
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, **0.05 inch** thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area .
4. OD: **1-1/2 inches** .

5. Configuration and Length: As indicated on Drawings .

C. Sanitary-Napkin Disposal Unit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. Bobrick Washroom Equipment, Inc
2. Mounting: Surface mounted .
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset .
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .

D. Mirror Unit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. Bobrick Washroom Equipment, Inc
2. Frame: Stainless steel, fixed tilt .
 - a. Corners: Manufacturer's standard .
3. Size: As indicated on Drawings .
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant .

2.4 CHILDCARE ACCESSORIES

- A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.

B. Diaper-Changing Station:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. Koala Kare Products; Bobrick Washroom Equipment, Inc.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Structural Performance: Engineered to support minimum of **250 lb** static load when opened.
3. Mounting: Surface mounted, with unit projecting not more than **4 inches** from wall when closed .

4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin), exterior shell with rounded plastic corners; HDPE interior in manufacturer's standard color .

2.5 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, **0.031-inch**- minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), **0.036-inch**- minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, with **G60** hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer in writing or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION OF TOILET, BATH, AND LAUNDRY ACCESSORIES

- A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer in writing. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

3.3 CLEANING

A. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinet.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Initial Selection: For each type of exposed finish required.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 FIRE-PROTECTION CABINETS

- A. Fire-Protection Cabinet:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. Potter Roemer LLC; a Division of Morris Group International: Fire Extinguisher Cabinet. Alta Type. Recessed Cabinet. Configurable Cabinet and Door. Specify options and Material. ADA. Model 7000 Series.
2. Fire-Protection Cabinet Type: Suitable for fire extinguisher .
3. Cabinet Construction: Nonrated .
4. Cabinet Material: Stainless steel sheet .
5. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
6. Cabinet Trim Material: Stainless steel sheet .
7. Door Material: Stainless steel sheet .
8. Door Style: Flush opaque panel, frameless, with no exposed hinges .
9. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - a. Provide projecting lever handle with cam-action latch .
 - b. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
10. Accessories:
 - a. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - b. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle .
 - c. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. .
 - 1) Identify fire extinguisher in fire-protection cabinet with the words " FIRE EXTINGUISHER ."
 - a) Location: Applied to cabinet door .

- b) Application Process: Etched .
- c) Lettering Color: White .
- d) Orientation: Vertical .

11. Materials:

- a. Aluminum: **ASTM B221** for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
 - 1) Finish: Clear anodic .
- b. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.
 - 1) Finish: ASTM A480/A480M No. 4 directional satin finish, .
- c. Copper Alloy, Brass: ASTM B36/B36M alloy as standard with manufacturer .
 - 1) Finish: Satin .
- d. Copper Alloy, Bronze: ASTM B36/B36M alloy as standard with manufacturer .
 - 1) Finish: Satin polish .

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Miter corners and grind smooth.
 - 3. Provide factory-drilled mounting holes.
 - 4. Prepare doors and frames to receive locks.
 - 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum **1/2 inch** thick.
 - 2. Fabricate door frames of one-piece construction with edges flanged.
 - 3. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM AMP 500 for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION OF FIRE-PROTECTION CABINETS

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Fire-Protection Cabinet Mounting Height: **42 inches** above finished floor to top of fire extinguisher.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.4 ADJUSTING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection

cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

3.5 CLEANING

- A. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- B. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- C. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers .
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets .
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. Potter Roemer LLC; a Division of Morris Group International: Fire Extinguisher, Portable. Type ABC Multi Purpose Dry Chemical. Model 3000 Series.
 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 3. Valves: Manufacturer's standard .
 4. Handles and Levers: Manufacturer's standard .
 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B .

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
 1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
 1. Mounting Height: Top of fire extinguisher to be at **42 inches** above finished floor.

END OF SECTION 104416

SECTION 26 00 00

ELECTRICAL GENERAL PROVISIONS

PART I – GENERAL:

- 1.1 RELATED DOCUMENTS: The General Conditions and Supplemental General Conditions are part of this division. Contractor shall and hereby agrees that he will read carefully all paragraphs and be bound by their conditions.
- 1.2 WORK DESCRIPTION:
- A. Provide all labor, equipment, material, (tools, services), etc. required to complete installation specified herein and/or shown or scheduled on drawings.
 - B. This section supplements all sections of this Division and shall apply to all phases of work hereinafter specified, shown on the drawings or required to provide a complete installation of electrical systems.
 - C. The specifications and drawings for electrical work are complementary and are for the complete interpretation of the work.
 - D. Unless noted or modified by specific notation to the contrary, the modification and/or description of any electrical item in the documents carries with it the instruction to furnish, install and connect same. It shall be understood that the intent governs the work, regardless of whether or not this instruction is explicitly stated.
 - E. No exclusion from, or limitation in the drawings or specifications, for the electrical work shall be the reason for omitting the appurtenances or accessories necessary to complete any required system or item of equipment.
- 1.3 SPECIAL CONDITIONS, ELECTRICAL:
- A. By the act of submitting a bid, this Contractor agrees that all of the "Contract Documents" in each of the Divisions of the complete specifications have been reviewed and studied, and all requirements and coordination resulting there from are included in his proposal. The Contractor further acknowledges that he has visited the site to become familiar with existing conditions.
 - B. In Division 26, the word "Contractor" means the Electrical Contractor. The word "provide" means furnish, install and connect.
 - C. Do not scale drawings having 1/4" or smaller scale. Because of small scale, it is not possible to indicate all offsets, fittings and accessories; provide such as are required for complete installation.
 - D. The right is reserved to move any element as much as ten (10) feet at no increase in cost provided Contractor is notified before work in question is started (prior to rough-in.)
 - E. All conductors, regardless of service, shall be installed in raceways unless specifically noted otherwise.

- F. The Contract Drawings are shown in part diagrammatic, intended to convey the scope of work, indicating the general arrangement of equipment, conduit and outlets. Follow the drawings in laying out the work and verify places for the installation of the materials and equipment. Wherever a question exists as to the exact intended location of the outlets or equipment, obtain instructions from the Engineer before proceeding with the work.
- G. The Contractor is to fill out and furnish to the utility company all required forms and load information.

1.4 RELATED WORK SPECIFIED ELSEWHERE:

- A. Foundations and pads required for equipment furnished under this division of the specifications are specified in Division 03.
- B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting, is specified in Division 09.
- C. Flashing of conduits into roofing and outside walls.
- D. Heating, ventilating, and air-conditioning equipment.
- E. Plumbing Equipment.
- F. Kitchen Equipment.
- G. Fire Protection Equipment.

1.5 CODES AND STANDARDS:

- A. The intent is that the complete installation shall comply with applicable laws and ordinances, utility company regulations, and applicable requirements of the latest editions of the following:
 - 1. NFC - National Fire Codes (NFPA)
 - 2. NEC - National Electrical Code
 - 3. UL - Underwriters Laboratories
 - 4. NESC - National Electrical Safety Code
 - 5. NEMA - National Electrical Manufacturers Association
 - 6. OSHA - Occupational Safety and Health Act.
 - 7. IBC - International Building Code.
- B. Where the contract documents exceed minimum requirements, the contract documents take precedence.
- C. Comply with all requirements for permits, licenses, fees and codes. Permits, licenses, fees, inspections and arrangements required for the work under this contract shall be obtained prior to commencement of the work unless otherwise specified.
- D. Comply with the requirements of the applicable utility companies serving this work. Make all arrangements with the utility companies for proper coordination of the work. Pay all charges required by the utility.

1.6 COORDINATION OF WORK:

- A. Plan all work so that it proceeds with a minimum of interference with other trades. Inform all

parties concerned, of the openings required for equipment or conduit in the building construction for electrical work and provide all special frames, sleeves, inserts, supports, anchor bolts, etc. as required. Coordinate the electrical work with the mechanical installation.

- B. Work lines and established heights shall be in strict accordance with architectural drawings and specifications insofar as these drawings and specifications extend. Verify all dimensions shown and establish all elevations and detailed dimensions not shown.
- C. Lay out and coordinate all work well enough in advance to avoid conflicts or interferences with other work in progress, so that in case of interference, the electrical layout may be altered to suit the conditions, prior to the installation of any work and without additional cost to the Owner.
- D. Lines, which must pitch, shall have right-of-way over lines whose elevations can be changed.
- E. Coordinate all outlets, fixtures, etc. with floor, wall and ceiling patterns (reflected ceiling drawings).

1.7 EXECUTION OF THE WORK:

- A. Install equipment and materials in a neat and workmanlike manner and align, level and adjust for satisfactory operation. Install equipment so that all parts are easily accessible for inspection, operation, maintenance and repair.

1.8 DATA AND SHOP DRAWINGS:

- A. Prior to installation, submit certified prints and/or descriptive brochures for major pieces of equipment, fixtures, materials, etc.
- B. Submittals shall show: manufacturer's catalog number, finishes, optional features and modifications.
- C. When work in accordance with manufacturer's recommendation is specified, a copy of recommendations will be kept in job office.

PART 2 – PRODUCTS:

2.1 REFERENCE TO DRAWINGS:

- A. Reference shall be made to drawing schedules and details for: manufacturer, model, catalog number, size, capacity, performance, installation, etc. of equipment, fixtures and materials. Equipment of manufacturer's other than those named will be acceptable provided, in the opinion of the Engineer, it is of equal substance, function, performance and appearance.

2.2 CHOICE OF MATERIALS AND EQUIPMENT:

- A. In submitting substitutions, bidders should note the following minimum considerations:
 1. Capacities shown are absolute minima and must be equaled.
 2. Physical size limitations for space allotted.
 3. Structural Properties
 4. Noise Level
 5. Interchangeability.
 6. Compatibility with other materials, assemblies and equipment.
 7. Similar items shall be same manufacturer and style, etc. except where specifically exempted.

8. Equipment as manufactured by Eaton and/or Cutler Hammer such as (but not limited to) transformers, panels, circuit breakers, disconnects, switches, variable frequency drives, transfer switches, switchgear, relays, receptacles, meters, control centers, etc. are unacceptable due to poor performance and will be rejected.

B. All material and equipment, for which a UL Standard, or NEMA Standard is established, shall be so approved and labeled or stamped.

C. Adhesives are not acceptable as a mounting, supporting, or assembling technique.

D. Contractor shall pay any costs added to total contract as a result of a substitution.

2.3 ELECTRICAL EQUIPMENT:

A. NEMA Standards shall be taken as minimum requirements for electrical equipment.

B. Equipment shall operate properly under a 10% plus or minus voltage variation.

PART 3 – EXECUTION:

3.1 EXISTING SERVICES:

A. No services shall be interrupted without written permission of Owner. Notify owner, in writing, 72 hours in advance of requested interruption.

B. Protect active circuits, which are to remain: relocate them as directed. If existing circuits are not indicated, request instructions.

C. Inactive circuits or those, which are to be discontinued:

1. Disconnect at panel or at appropriate junction box.
2. Remove existing conductors
3. Remove exposed conduits and boxes including those in removable ceiling spaces.
4. Cap conduits 1" behind or below finished building surfaces.
5. Remove all surface raceways, conductors, etc.

3.2 INSPECTION OF SITE:

A. The drawings are prepared from the best information available and reflect the conditions commensurate with this information. However, the contractor shall visit the site prior to submitting a proposal and shall verify the locations, sizes, depths, characteristics, etc., of all existing utilities; and familiarize himself with working conditions, hazards, existing grades, soil conditions, obstructions, etc. If it becomes evident that existing site conditions will impair the proper operation of the utilities, or the construction process, the architect shall be notified in writing.

B. All proposals shall take these existing conditions and any revisions required into effect, and the lack of specific site information on the drawings shall not relieve the contractor of his responsibility.

END OF SECTION

SECTION 26 01 00

MECHANICAL AND ELECTRICAL COORDINATION

PART 1 – GENERAL:

1.1 RELATED DOCUMENTS:

- A. Refer to Section 26 00 00 – Electrical General Provisison.

1.2 SUMMARY:

- A. This Section describes the coordination between the Mechanical and Electrical portions of the work.

1.3 WORK INCLUDED:

- A. Responsibility - Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. This schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

<u>ITEM</u>	<u>FURNISHED UNDER DIVISION</u>	<u>INSTALLED UNDER DIVISION</u>	<u>WIRED AND CONNECTED UNDER DIVISION</u>
1. Equipment Motors	23	23	26
2. Magnetic Motor Starters:			
a. Automatically controlled, with or without HOA switches	23	26	Notes 1, 3
b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment	23	23	Notes 1, 2
c. Manually controlled	23	26	Notes 1, 3
d. Manually controlled and furnished as part of factory wired equipment	23	23	Notes 1, 3
e. Furnished in Motor Control Centers	26	26	Notes 1, 3
3. Line voltage thermostats, time clocks etc., not connected to control panel systems.	23	26	26

<u>ITEM</u>	<u>FURNISHED UNDER DIVISION</u>	<u>INSTALLED UNDER DIVISION</u>	<u>WIRED AND CONNECTED UNDER DIVISION</u>
4. Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached to ducts, pipes, etc.	23	23	23
5. Temperature control panels and time switches mounted on temperature control panels.	23	23	23
6. Motorized valves, motorized dampers solenoid valves, EP and PE switches, etc.	23	23	23
7. Alarm bells furnished with equipment installed by Division 23.	23	23	23
8. Wiring to obtain power for control circuits, including circuit breaker.	26	26	26
9. Low voltage controls, thermostats valves, dampers, etc.	23	23	26
10. Fire protection system (sprinkler) controls.	23	23	23
11. Fire and smoke detectors installed on mechanical units and in ductwork.	26	23	Note 2
12. All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment.	23	23	23
13. Pushbutton stations, pilot lights	23	23	23
14. Heat Tape	23	23	26
15. Disconnect switches, manual operating switches furnished as a part of the equipment.	23	23	Note 1
16. Disconnect switches, manual operating switches furnished separate from equipment.	26	26	26
17. Multi-speed switches	23	23	26
18. Thermal overloads	23	23	23

<u>ITEM</u>	<u>FURNISHED UNDER DIVISION</u>	<u>INSTALLED UNDER DIVISION</u>	<u>WIRED AND CONNECTED UNDER DIVISION</u>
19. Control relays, transformers	23	23	23
20. Tamper switches for fire protection (sprinkler) system.	23	23	26
21. Flow switches for fire protection (sprinkler) system.	23	23	26
22. Alarm bells or horns for fire protection (sprinkler) system.	23	23	26
23. Underground fuel tank leak detection and monitoring system.	23	23	23

NOTES

- (1) Power wiring as defined in Section 260513 of the specifications shall be under Division 26; control wiring as defined in Section 260513 of the specifications shall be under Division 23.
 - (2) Wiring from alarm contacts to alarm system by Division 26; wiring from auxiliary contacts to air handling system controls by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for supply duct and return air duct for all air handling systems 2000 CFM or greater. Refer to other Division specifications and drawings for more specific requirements.
 - (3) For requirements for Magnetic Motor Starters, refer to Division 23, Section 230501 – General Requirements for Mechanical Work.
 - (4) Disconnect switches, operating switches, starters and other similar items, which are factory-mounted as a part of a complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.
- B. Connections - Make all connections to controls, which are directly attached to ducts, piping and mechanical equipment with flexible connections.
- C. Precedence
1. In general, piping systems, which require a stated grade for proper operation, shall have precedence over systems.
 2. Precedence for pipe, conduit and duct systems shall be as follows:
 - a. Building lines
 - b. Structural members
 - c. Soil and drain piping
 - d. Vent piping
 - e. Condensate piping
 - f. Supply ductwork
 - g. Exhaust ductwork
 - h. Automatic fire protection sprinkler piping
 - i. Domestic hot and cold water piping
 - j. Electrical conduit
 3. Lighting fixtures shall have precedence over air grilles and diffusers.

D. Final Inspection And Report

At the completion of the work, there shall be a meeting of the mechanical, electrical and temperature control contractors, representatives of mechanical and electrical equipment manufacturers whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies, which they represent, shall be filed with the Owner and Architect/Engineer.

END OF SECTION

SECTION 26 01 20

GUARANTEE AND WARRANTY

PART 1 – GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, material, etc. required to complete installation specified herein and/or shown or scheduled on drawings.

PART 2 – PRODUCTS:

2.1 TEST PERIOD:

- A. Each piece of equipment shall meet performance specifications after one (1) year actual operation.

PART 3 – EXECUTION:

- 3.1 The Contractor shall replace or make good any defect due to faulty workmanship or material, which shall develop within one year from date of acceptance. This guaranty shall cover both materials and labor. The Contractor is responsible to replace work found not in conformance with the contract at any time during the life of the installation. Replacement of non-conforming work is not subject to the one (1) year warranty limitations.
- 3.2 For first year after final acceptance, Contractor shall provide, at no cost to Owner, any required maintenance and service necessary to assure the proper operation of the system.
- 3.3 Date of acceptance shall be that date on which the contract has been satisfactorily completed in accord with contract documents and verified by the Engineer. If a whole or partial system, or equipment, is put into use for benefit of any party, other than Contractor, and with prior written permission of Owner, this agreed date shall become the "date of acceptance".
- 3.4 CERTIFICATION: Prior to completion and final acceptance of the installation, furnish to the Engineer certification that the electrical systems have been tested and that the installation and performance of those systems conform to the requirements of the contract documents.

END OF SECTION

SECTION 26 05 00

BASIC MATERIALS & METHODS

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, material, etc. required to complete installation specified herein and/or shown on scheduled on the drawings.

PART 2 – PRODUCTS:

2.1 CONCRETE:

- A. Where required for conduit encasement, equipment, bases, manhole construction, etc., provide 3,000 psi concrete as specified in Division 3.

PART 3 – EXECUTION:

3.1 TEMPORARY LIGHT AND POWER:

- A. As soon as practicable, install temporary wiring and lighting. See NEC Article 305.
- B. Provide:
 - 1. One pigtail lamp holder with wire guard for each 600 sq. ft. of floor space or fraction thereof equipped with a 100-watt lamp and with replacement made immediately upon burnout or theft.
 - 2. A 30-amp, single-phase, disconnect switch for each 4,000 sq. ft. of floor area.
 - 3. If a floor is less than 4,000 sq. ft., one 30-amp switch per floor.
- C. Temporary wire shall consist of plastic, non-metallic sheathed cable having ground wire to which all the receptacle ground poles shall be connected.
- D. Power consumed shall be paid for by General Contractor.

3.2 EXCAVATION, SHORING, AND BACKFILL:

- A. Provide any excavation required for this Division that is necessary for general construction. Unless specifically noted, no extras shall be paid if rock or excavation difficulties are encountered.
- B. Provide separate a trench for each utility, see drawing detail.
- C. Provide:
 - 1. Bracing, shoring, etc. to protect sides of excavation,
 - 2. Staging and suitable ladders.
- D. Remove all timber before backfilling. Backfill simultaneously on both sides of equipment, raceways, etc.

- E. Compact backfill under slab, building structure, and paving to a dry density equal to that required by general contract.
- F. Restore existing pavement, curbs, sidewalks, sodding, etc. removed or damaged in connection with work.
- G. Sides and floor of excavated trench may be used as formwork for the concrete encasement provided that the excavation is clean, neat, free of debris and is of the proper size.

3.3 CUTTING AND PATCHING:

- A. Provide all cutting, patching, etc. incident to this work.
- B. Do not cut into any major structural element without approval of Engineer.
- C. Patching shall be of quality equal to, and of appearance matching, existing construction.

3.4 FLASHING:

- A. Where raceways, etc. pass through walls or roof, flash per drawing detail. Where no detail is shown, use National Roofing Contractors Association details.
- B. Locate raceways, etc. through roof to clear parapets, etc. by at least 18".
- C. Flashing shall provide watertight seal with 8" depth of water on roof.
- D. Where conduits pass through floor structures, other than lowest floor, which floors contain a waterproofing membrane, provide a watertight floor sleeve for each pipe.
- E. Where conduit or buss way pass through concrete floors, provide a 3" x 8" concrete curb with sheet metal cap flashing, fill space between conduits, etc. and sleeve with rope packing and non-flammable sealant.

3.5 MOISTURE-DAMP PROTECTION:

- A. Whenever any electrical component such as: panel, raceways, etc. will be in contact with surfaces which may become damp or wet, mount using spacers to hold electrical work 1/4" away from damp surfaces.

3.6 SLEEVES-FIRE PROTECTION:

- A. Where conduits, buss ways, etc. pass through floors or walls of fireproof construction, fill space between conduit, etc. and sleeves with 3M fire stopping or approved equal. The sealing process shall maintain the rating of the floor or wall that is penetrated.

3.7 FIRE STOPPING REQUIREMENTS:

- A. Penetrations through rated walls and floors shall be sealed with a material capable of preventing the passage of flames and hot gasses when subjected to the requirements of the Test Standard specific for Fire Stops ASTM-E-814.

3.8 FIRE RATED WALL DEVICE SEPARATION:

- A. Electrical devices and junction boxes on opposite sides of a wall must be separated by a horizontal distance of 24" in any vertical distance floor to ceiling.

END OF SECTION

SECTION 26 05 13

CONDUCTORS AND CONNECTORS

PART 1 – GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation, as specified herein and/or shown or scheduled on drawings.
- B. All conductor sizes are based on copper ampacities.

PART 2 – PRODUCTS:

2.1 MATERIALS:

- A. Conductors - Shall be 98% copper unless noted otherwise. Conductor sizes No. 10-12 AWG shall be solid wire, sizes No. 8 AWG and larger shall be stranded.
- B. Conductors, 110-600 volts
 - 1. In raceway - Type THHN/THWN, or other types when noted.
 - 2. Direct burial outside building - Type UF and USE for service entrance.
 - 3. Flexible cords - Type SO.
- C. Lighting fixtures wiring shall be
 - 1. Fluorescent, #18 AWG
 - 2. Incandescent #16 AWG.
 - 3. Larger per NEC 402 or as noted.
 - 4. Conductors shall be stranded.
- D. Conductors for isolated power shall be Type XHHW with a dielectric constant of 3.5 or less. Color code as follows:
 - #1 - Orange
 - #2 - Brown
 - Grounding Conductor - Green with Yellow Stripe.
- E. Where required to "fish" in steel partitions, block walls which are dry and similar locations, metal-clad cable, Type MC having Type THW conductors can be used where the wire size is No. 8 or smaller. Note particularly NEC Art. 330 requirements.
- F. All conductors are to be identified, branch circuits and feeders by color coding as follows:

	<u>277/480V</u>	<u>120/208V</u>
PHASE A	BROWN	BLACK
PHASE B	PURPLE	RED
PHASE C	YELLOW	BLUE
NEUTRAL	WHITE W/YELLOW STRIPE	WHITE
GROUND	GREEN	GREEN W/YELLOW STRIPE

Contractor shall verify with local authority any wire color requirements. Local requirements shall dictate over colors specified. If no local requirements exist, these colors shall be used.

The color-coding on #8 and smaller conductors shall be continuous in length. No taping, painting or other means of coding will be acceptable. The color-coding on #6 and larger conductors shall be in the form of colored tape visible at each point of access or view.

- G. For #10 and smaller branch circuit and fixture conductor splices, use "live spring", pressure cable connectors listed for 600 volt (1000 volt when enclosed in fixture or sign).
- H. For terminal connections on copper, No. 8 or larger, or where multiple connections are made to one terminal, use solderless lugs, mechanical type as necessary.

PART 3 – EXECUTION:

3.1 CONDUCTOR SIZE:

- A. Branch Circuit conductors shall be at least No. 12 AWG except
 1. On home runs over 70' in developed length, minimum wire size shall be No. 10 AWG or larger as noted.
 2. Control circuits carrying 8 amps or less, may be #14 AWG.

3.2 INSTALLATION:

- A. All control and circuit wiring in cabinets, boxes, gutters, etc. shall be neatly tied and held using nylon cable ties and mounting brackets.
- B. Where "high-press" terminals are used, provide increased cabinet gutter space as required.
- C. Conductors 600 volt and below shall not be bent to a radius less than 10 times the diameter of the cable.
- D. After installation, conductors shall not have dents, scars, cuts, pressure indentations, abraded areas, etc.
- E. Talc is the only permitted wire-pulling lubricant to be used with isolated branch circuit conductors.
- F. Branch circuits from isolated power systems shall be run by the most direct route keeping the overall circuit length to a minimum.

3.3 PROTECTION OF BURIED CONDUCTORS:

- A. When conduits, or cables, are directly buried without concrete encasement, install permanently colored polyethylene, 0.004" film, marking tape, 6" wide above conduits or cables, and at 6" below finished grade. Tape shall incorporate wording similar to "CAUTION: BURIED ELECTRICAL LINES".

3.4 CABLE SUPPORT:

- A. Inside all manholes, all cables are to have racks with insulator supports. Supports are to be within 6" of each side of a splice and 3' centers.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 – GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown on drawings.
- B. Ground circuits to limit excessive voltage from lightning, line surges, or unintentional contact with higher voltage and to limit the voltage to ground during normal operation.
- C. Ground conductive materials enclosing electric conductors or equipment or forming part of such equipment, to prevent voltage above ground on these enclosures.

PART 2 – PRODUCTS:

- 2.1 All grounding conductors shall be copper.
- 2.2 All grounding clamps, connectors, etc. shall be heavy-duty type.

PART 3 – EXECUTION:

3.1 GROUNDING SYSTEM:

- A. The following items shall be grounded
 1. Electric service and secondary of all transformers, except isolating type.
 2. Conduits and other conductor enclosures.
 3. Neutral conductor
 4. Panel Boards
 5. Grounding connection of convenience outlets, etc.
 6. Building steel

Note particularly NEC Art. 250 concerning grounding of all exposed non-current carrying metal parts of motors, lamps, appliances, fixtures, cabinets, cases and conduits.

- B. Ground conductors are required in all conduits.
- C. The cold water pipe shall be the primary electrode, using a grounding clamp. In addition, drive five 3/4" diameter, 10' long copper weld rods as a second grounding and connect to same ground point as water pipe ground. The ground conductor shall be No. 4/0 AWG bare copper, medium drawn, stranded or as required to conform to National Electrical Code.
- D. Make an approved ground connection to the main panel housing and connect to the neutral. Extend the ground bus conductor to this point.
- E. Use grounding clips and bonding jumpers to ground conduit where RGS or IMC conduit are used; ground devices with a grounding conductor.

- F. For transformer grounding, install a line looped to and connecting the secondary of all transformers.
- G. Ground the secondary neutral of each dry type transformer and each individual panel board enclosure with NEC sized ground wire.
- H. Building structure shall be grounded as noted and/or as shown on drawings.
- I. Provide one No. 6 TW copper wire in 1/2" conduit from the main telephone board and fire alarm control panel to the street side of the domestic water service (street side of main shut-off valve).

END OF SECTION

SECTION 26 05 33

RACEWAYS, FITTINGS AND SUPPORTS

PART 1 – GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, material, etc. required to complete installation specified herein and/or shown or scheduled on drawings.
- B. Conduit size shall be 3/4" minimum; provide larger conduit where noted or required by N.E.C. Exception: For switch legs with not more than 6-#12 conductors or 4-#10 conductors.

PART 2 – PRODUCTS:

2.1 CONDUIT:

Note: Non-metallic corrugated conduit (sometimes known as "blue pipe" or "smurf pipe") is not allowed on this project. All conduit shall be galvanized rigid steel, EMT, or PVC as noted below.

- A. For outside buried lines, use:
 - 1. PVC, Type EB, encased in concrete, or as noted on the drawings, or
 - 2. Rigid Galvanized Steel (RGS) conduit with bituminous coating, as noted on the drawings.
 - 3. All stub-ups and their associated elbows are to be RGS conduit with bituminous coating; do not rise above slab with PVC.
- B. Use RGS conduit in the following locations:
 - 1. Secondary Service Entrance
 - 2. Exposed Locations, below 6'-0"
 - 3. In or under concrete Floors
 - 4. Where conduit penetrates a fire-rated floor ceiling structure, and for all work below ground level.
 - 5. Panel board Feeders installed in concrete.
- C. Use Electrical metallic tubing (EMT) conduit in the following:
 - 1. Panel board feeders installed overhead
 - 2. Branch circuits installed overhead
 - 3. Branch circuits installed exposed above 6'-0"
- D. Galvanized single strip flexible steel conduit shall be used to make connections to motors or other vibrating equipment, and it may be used between conduit and lighting fixtures in ceiling.
- E. Flexible conduit connections shall not exceed 24" long for motors and 72" long for lighting fixtures. Flexible conduit may be used where required for connections in metal partitions or steel studs, where permitted by code. Maximum length shall be 24".
- F. Flexible watertight conduit shall be used for equipment connections exposed to possibility of water or other liquids. Conduit shall be PVC covered.
- G. Conduit fittings shall have same protective coating as conduit; rigid steel conduit fittings shall be

threaded.

- H. Couplings, connectors and fittings for EMT shall be case hardened steel, rain-tight, designed specifically for use with EMT. Cast fittings (other than steel) will not be permitted. Split couplings shall be used where necessary to add conduit to inaccessible locations. All connectors shall be of the insulated throat type. Indented type fittings are not acceptable.
- I. Conduit connections to cabinets, boxes, etc. shall have grounding wedges, bushing, double locknuts. Install insulating bushings on all conduits.
- J. Plastic conduit: Schedule 40 PVC, 90 degree C., UL Listed conforming to NEMA Standards shall have a tensile strength of 7,000 psi at 73.4 degrees F., a flexural strength of 11,000 psi and a compressive strength of 8,600 psi. Conduit, fittings and cement shall be produced by same manufacturer who shall have 5 years experience manufacturing these products. Use beneath the slab only.

2.2 BOXES:

- A. Concealed boxes inside buildings, above grade: pressed steel, hot dipped galvanized at least 1-1/2" deep. Use gang boxes and plates where more than one device occurs at the same location. Outlets intended to support lighting fixtures shall be 4" octagonal X 2-1/8" deep, and where required, equipped with 3/8" fixture stud through bottom of box. Sectional switch boxes are not acceptable. Thru wall boxes are not acceptable.
- B. Boxes in exposed masonry: square, or rectangular, masonry module.
- C. Exposed units inside building: cast aluminum.
- D. Boxes, above grade, exposed to weather or dampness: cast aluminum with threaded hubs and watertight gasketed covers.
- E. Boxes flush with or below grade: Malleable iron with neoprene gasketed covers with self-retaining stainless steel screws.
- F. Provide blank covers, galvanized steel, for all outlet boxes left for future use.

2.3 WIREWAYS:

- A. Provide surface metal wire ways only where shown.
- B. Use junction boxes at conduit connections with suitable covers, elbows, special fittings, etc. as required or shown.
- C. Wire ways shall be surface-mounted, cold rolled galvanized steel with a base thickness of 0.05" and a cover thickness of 0.05". Outside surfaces of base and cover shall be ASA-61 gray. Where combination wire ways for low and high potential distribution are noted, compartments shall be divided by metallic dividers.
- D. Provide all necessary fittings including couplings, device plates, flat elbows, connectors, internal and external elbows, combination single receptacle and telephone outlet covers, combination duplex receptacle and telephone outlet covers, etc. as required for a complete installation.

PART 3 – EXECUTION:

3.1 CONDUIT:

- A. Conceal and run shortest practical path unless noted. Maximum run between junction pull boxes shall not exceed 100'. The conduit shall follow the routing described on the drawings as closely as possible. The routing and layout, however, is diagrammatic and where changes are necessary as a result of structural conditions, apparatus, or other causes, the routing shall be changed without additional cost to the owner. All conduit risers and offsets are not indicated on the drawings, but are intended to be installed as required.
- B. Provide conduit expansion joints at building structural expansion joints.
- C. In equipment rooms: conduits may be exposed, run parallel to building, cast aluminum boxes shall be used.
- D. Locate conduits at least 6" from any surface, which may be above 140°F.
- E. In general, conduits below floors shall be installed in floor slab and above the waterproofing with a minimum of 1-1/2" concrete above conduit. Where conduits are too large for encasement in normal slab, trench around conduit to provide a minimum concrete encasement of 2". During construction, close conduit stub-ups, provide closure which:
 - 1. Protect threads,
 - 2. Keep dirt out,
 - 3. Prevent entrance of water.
- F. Where groups of conduits terminate together or pass through floors, provide template to hold conduits in proper relation to each other and to building.
- G. Those conduits, which are to be left for future use, shall be tested for clean bore using a ball mandrel followed by 12 AWG copper wire, which shall be left in place.
- H. Circuits under 600 volts below grade outside of building shall have 24" of fill cover; above 600 volt, shall have 36" fill cover, measured from top of conduit.
- I. Conduit system shall be electrically and mechanically continuous from distribution center to final point of use.

3.2 BOXES:

- A. Boxes shall be flush with wall and/or ceiling and cover shall be accessible; use extension rings where needed. Boxes shall have no openings except those through which conduit passes. Boxes shall be secured to building structure.
- B. Prior to beginning work, coordinate the location of boxes in the block module with the Engineer's representative.

3.3 SUPPORTS:

- A. Outlets, junction, pull boxes, etc. when overhead, shall be independently supported and shall not depend upon conduit for support. Where a conduit run is not supported by slabs, walls, etc., use galvanized pipe straps, trapeze hangers, beam clamps, channel and fittings, etc.

Support within 3' of each outlet box, junction box, cabinet or fitting. Support at least every 10', except per NEC for straight run.

- B. Anchors requiring explosive charges shall be used only after prior approval by Engineer. Phillips "Red Head" shields may be used for loads under 300 lbs.

3.4 PLASTIC CONDUIT (PVC):

- A. PVC conduits Schedule 40 heavy wall when used in lieu of RGS or EMT, for uses permitted by Section 2.01 I above shall be installed per NEC. Contractor must obtain approval of Engineer and the authority having jurisdiction prior to using plastic conduit in lieu of metallic conduit. Use PVC beneath slab only; do not rise up into building envelope with PVC. In addition to NEC Paragraph 347-3, note the prohibited uses in Paragraph 517-11.
- B. Provide a grounding conductor per NEC in all plastic conduits.
- C. All joints shall be solvent welded per manufacturer's recommendations.
- D. Nylon pull cords shall be used instead of metal fish wires to pull in conductors.

END OF SECTION

SECTION 26 05 73

OVER-CURRENT PROTECTIVE DEVICES

PART 1 – GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on drawings.

PART 2 – PRODUCTS:

- 2.1 DISCONNECT MEANS: Non-fused safety switch, motor switch, or "Twist-Loc" receptacle.
- 2.2 SAFETY SWITCHES: NEMA Type HD; heavy duty; fusible except when used as disconnect only; enclosure with dual cover interlock; NEMA Type I indoors; NEMA Type 3R outdoors. Provide electrical interlock to break control circuits which would otherwise remain "hot"; actuate from switch mechanism.
- 2.3 FUSES: Motor circuit fuses to be dual element type, Class K5. All other fuses, unless noted to be NEMA Class H, general purpose, non-renewable type. All fuse clips shall be provided with fuses. All fuse clips for fuses rated above 10,000 AIC shall be rejection type. Furnish Owner one extra set of fuses of each size.
- 2.4 CIRCUIT BREAKERS: Quick-make and quick-break, thermal-magnetic type having trip free, automatic release by means of thermal elements in each phase. Breakers shall be permanent trip type, fully rated, and ambient temperature compensated. Marking showing ampacity shall be visible from front of unit. Breakers scheduled are sized for motors having no LR-KVA Code letter. Where installed motors have Code letter indicating LR-KVA, provide circuit protection per NEC Table 430-152.
- 2.5 GROUND FAULT PROTECTION, SERVICE ENTRANCE AND/OR MAIN FEEDERS: A ground sensor encircling all phase conductors including neutral in a 4-wire system connected to a solid state ground relay which initiates tripping of the main circuit interrupting device. Ground protection shall be adjustable from 200 to 3000 primary amperes and time-current characteristic shall provide 6-cycle operation at about ten-time settings. Relay output shall operate from 120V AC source.

PART 3 - EXECUTION

- 3.1 OVER-CURRENT PROTECTION: Thermal over-load trips, fuses, etc. shall be sized for the wire or motor being protected regardless of maximum size possible to install in unit.
- 3.2 TWIST-LOCK RECEPTACLE: Unless noted, on circuits serving 1/8 HP portable equipment, the disconnect means shall be a "twist-lock" receptacle.

END OF SECTION

SECTION 26 09 00

COMPLETION ITEMS

PART 1 – GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation specified herein and/or shown on scheduled drawings.

1.2 WIRING ELECTRICALLY OPERATED EQUIPMENT:

- A. Provide all conduit, conductors, wiring, etc. required to connect all electrically operated equipment installed, whether provided by this Division, other Divisions, or by Owner. Complete all circuits and leave in satisfactory operating condition. Install, support and connect starters, control devices, etc.
- B. For equipment furnished by other Divisions of this Contract, or by Owner, the control equipment shall be furnished by the other divisions or owners except that this Division furnishes the disconnect means and all components of life safety systems such as duct smoke detectors which are to be included with the building fire alarm system.
- C. Install disconnect means immediately ahead of, and in sight of, each piece of electrically operated equipment.
- D. All motors 1/2 HP and larger and all fixed appliances, or equipment, rated at 1.0 KW or larger shall be on individual circuits, except where several items are built into one piece of factory-assembled equipment.

PART 2 – PRODUCTS:

2.1 RECORD AND AS-BUILT DOCUMENTS:

- A. Maintain at job site a set of contract documents kept current by indicating thereon, all changes, substitutions, etc. between work as specified and as installed.
- B. Furnish Owner with one (1) complete set of reproducible drawings and one complete, clean sets of specifications showing installed locations, size, etc. of all work and material as taken from record documents.
- C. For each piece of equipment, provide three (3) sets of:
 - 1. Manufacturer's printed catalog pages, operating and maintenance instructions, wiring and connections diagrams, etc.
 - 2. A list giving names and addresses of nearest supply house carrying spare parts for all equipment furnished and name of installation subcontractor with address and phone number.
- D. Bind this information into 8-1/2" x 11" booklet. One complete set shall be assembled in a loose-leaf ring or post hard-backed binder.

PART 3 – EXECUTION:

3.1 EQUIPMENT OPERATION:

- A. Operate all motors for at least one hour. During this time, check for proper lubrication, rotation and control operation. At the end of this hour's run, check for motor temperature.
- B. This Division is responsible for:
 - 1. Proper rotation,
 - 2. Observing that lubrication has been properly performed,
 - 3. Motors operate within nameplate limits,
 - 4. Overload heater elements are properly sized,
 - 5. Reporting observed discrepancies to the Engineer.
- C. On equipment furnished by other sections, if lubrication is not correct, or if motors do not operate within proper limits, this Division is responsible for notifying the General Contractor as to the deficiencies and for leaving the piece of equipment involved in a locked "OFF" condition.

3.2 SYSTEM BALANCE:

- A. Balance all circuits so that feeders, when fully loaded, shall be no more than 10% out of balance, phase-to-phase.

3.3 CIRCUIT CONTINUITY:

- A. Complete installation shall be free of short circuits, grounds and open circuits. Tests shall be made as required to prove that all parts of installation meet specified performances. Note Paragraph 110-7 of N.E.C. "Megger" tests shall be performed to assure proper insulation values and system integrity.
- B. Following the installation of all high voltage cables, prior to their final connections to switches, transformers, lightning arrestors, etc., D-C high potential tests shall be performed. All tests voltages and procedures are to meet cable and connector manufacturer's approval as well as the Utility supplying service. Following these tests, all final connections are to be made to switches, transformers, lightning arrestors, etc. and all circuits are to then be tested with a megohmmeter.
- C. All tests are to be properly recorded and submitted to the Engineer for record purposes.

3.4 OPERATING INSTRUCTIONS:

- A. When systems are completely adjusted, furnish personnel for one full day to instruct Owner's operators. Schedule instruction sessions with the Owner through the Engineer.

3.5 CLEANING:

- A. Fixtures, panels, equipment, etc. shall be free from any foreign matter and be thoroughly cleaned per manufacturer's printed instructions.

3.6 PAINTING:

- A. All equipment shall present a clean, painted appearance; touch-up or repair as required.

- B. Paint all ferrous metal, which is not otherwise protected against corrosion. Paint exposed pipe threads with Bitumastic No. 50.
- 3.7 IDENTIFICATION:
- A. Identify feeders by stenciling a legend on conduit in all exposed locations at 50' intervals. Letter height shall be 1/2 of conduit diameter, or 2", whichever is smaller.
 - B. Identify all major items of equipment including controls, panels, and associated starters, switches, junction boxes, relays, etc. by 2-1/2" x 3/4" embossed nameplates, with wording approved by Engineer. Secure with screws or brad, adhesives alone are not acceptable.
 - C. Nameplates after installation shall be easily visible from the floor and shall bear notations corresponding to those shown on record drawings.
 - D. Identify location of outside underground conduits by:
 - 1. 4" x 4" x 12" concrete stakes, flush with finish grade, located above lines at ends and/or corners.
 - 2. 2" x 2" brass plates imbedded in building walls above conduits.

END OF SECTION

SECTION 26 12 00

UNDERGROUND SECONDARY ELECTRICAL SERVICE

PART 1 – GENERAL:

1.1 SCOPE:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on drawings.

1.2 CHARACTERISTICS:

- A. Service will be underground and will be available from pad-mounted transformer(s) furnished and installed by Power Company.
- B. Secondary Service Voltage will be:
480/277V - Three Phase, Four Wire, Wye.

1.3 METERING:

- A. Metering will be on the secondary of the transformers and will be located on the
1. Transformer (confirm with utility).
- B. Meter Base will be supplied and installed by the contractor, co-ordinate details with utility. The meter will be provided by the power company.
- C. If current transformer metering is required, an I-1/4" RGS conduit shall be furnished and installed by the contractor.
- D. Metering current transformers and metering conductors will be installed by the power company.

1.4 SECONDARY SERVICE CONDUCTORS AND CONDUITS:

- A. Secondary service conductors and conduit shall be furnished and installed by the contractor.
- B. Secondary conduits shall be run from the building main disconnect underground to the transformer, and shall terminate as directed by the power company.

PART 2 – PRODUCTS:

- 2.1 Products required for the service entrance are specified under the Basic Materials Sections of these specifications.

PART 3 – EXECUTION:

- 3.1 Contractor shall coordinate the service entrance with the power company and shall be guided by their rules and regulations. Any substantial deviations shall be reported to the Engineer immediately for directions.

- 3.2 The Electrical Contractor shall provide the power company with the load requirements and voltage characteristics so that the proper transformer(s) will be installed. Also, verify that fault current characteristics for service entrance equipment specified in Section 16400 meets local conditions.
- 3.3 Grounding shall be in accordance with ART. 250 of The National Electrical Code.

END OF SECTION

SECTION 26 12 19

PAD MOUNTED TRANSFORMER ELECTRIC SERVICE

PART 1 – GENERAL:

1.1 WORK DESCRIPTION:

- A. Service shall be 480/277 volt, 3 phase, 4 wire, wye connected system.
- B. Service shall be grounded in accordance with latest edition of National Electric Code, Article No. 250, and any special requirements as required by municipal, state, or federal authorities having jurisdiction. See Grounding Section 26 05 26 of these specifications.
- C. Metering will be provided by Power Company on transformer housing.
- D. Transformer will be provided by Power Company.
- E. Transformer shall be mounted on a reinforced concrete pad as sized and detailed on drawings.
- F. Primary conduits will be provided by Electrical Contractor as shown on drawings, including pull rope, excavation, backfill, and a 4" concrete envelope. Conduit risers shall be as directed by Power Company. Spare conduits shown shall be capped off 36" above grade with plumber's pipe cap.
- G. Primary conductors will be provided by Power Company.
- H. Secondary conduits, wire, excavation, and backfill to be provided by Electrical Contractor as shown on drawings from transformer to main distribution point.
- I. Electrical Contractor to provide secondary lugs on transformer and shall coordinate with Power Company as to proper drilling and lugs required.

PART 2 – PRODUCTS:

2.1 BASIC MATERIALS:

- A. Specific products to be as called for in the Basic Materials Section of these specifications.

PART 3 – EXECUTION:

3.1 COORDINATION:

- A. Electrical Contractor shall coordinate with Power Company to determine final exact location of transformer pad, exact size required, and conduit stub-up points for primary and secondary entrances.
- B. Electrical Contractor shall be responsible for furnishing the breakdown listing of the loads as shown on the drawings to the local utility, and determining that fault current requirements for the service entrance equipment specified in Section 26 20 00 meets local conditions.

END OF SECTION

SECTION 26 20 00

PANEL BOARDS, WIRING DEVICES, PLATES & LV SWITCHING

PART 1- GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on drawings.

PART 2 - PRODUCTS:

2.1 PANEL BOARDS:

- A. Circuit Breakers - Quick-make, quick-break, thermal-magnetic, trip indicating, with common trip on all multi-pole breakers. Branch circuit breakers, feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker in order to give "flash protection" for frayed stranded wire cords. Connections to the buss shall be of the Bolt-on Type. Where Noted Provide:
 1. Key Operation
 2. Built-In Ground Fault Circuit Interrupter on breakers
 3. Shunt Trip Breakers.
 4. Lock on Clips

All panel-mounted circuit breakers used to switch lighting circuits shall be UL listed SWD (switching duty) rated at applied voltage. All breakers used to serve package type air conditioning equipment shall be UL listed "HACR".

Verify with local utility that service entrance equipment meets fault current requirements of local conditions. Request instructions, prior to bidding, if discrepancies exist, or provide suitably rated equipment to match conditions.

- B. Ground Fault Circuit Interrupter - Shall be circuit interrupting; shall operate manually for normal switching functions and automatically under overload, short circuit, and .005 ampere line-to-ground fault conditions; shall provide circuit and self-protection; shall be of insulated cast construction; shall be interchangeable with other panel breakers, and shall not protrude into wiring space. Mechanism shall be trip-free against any abnormal over-current short-circuit or ground fault condition. The trip unit shall provide inverse time delay under overload conditions and instantaneous magnetic tripping for short-circuit protection. Additionally, unit shall sense line-to-ground faults, and open breaker contacts. The device shall be suitable for use on a system capable of delivering a maximum of 10,000 (symmetrical) RMS amperes fault current at 120 volts, or as noted.
- C. Bus bar connections to the branch circuit breakers shall be "phase sequence" type. Three-phase, four-wire bussing shall be such that any three adjacent single-pole breakers are individually connected to each of the three different phases.
- D. Terminals shall be UL listed as suitable for the type of conductor specified.
- E. All lighting and distribution panel boards 600 amps or less shall have provisions for a sub-feed breaker equal to the size of the mains ratings.

- F. Enclose panel board bus assembly in dead-front type, galvanized steel cabinet, in accord with NEMA Standards No. PB1 and UL Standards No. 67.
- G. Fronts shall include doors and have flush, corrosion proof steel, cylinder locks with catches and spring-loaded door pulls. Fronts shall have adjustable indicating trim clamps, which are concealed when the doors are closed. Doors shall be mounted by concealed hinges. Fronts shall consist of a door, which covers the dead front and also a hinge where the entire cover can be swung open revealing the wiring gutter without removing the panel trim. Where the panel trims are flush mounted, a door in door front shall be used. The first door covers the dead front and the second door reveals the wiring gutter. Fronts that have to be removed to gain access to the full wiring gutter will not be accepted. Fronts shall not be removable with door in locked position. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish. Minimum panel board width to be 20" for panel boards 250A and below, maximum width of 24" for 400A and 600A panel boards.
- H. Distribution power panel board fronts shall have a hinged gutter cover where all that is necessary to gain access to the wiring gutter is to remove two screws and the entire length of the gutter cover will open and expose the wiring gutter. Any gutter covers that have to be totally removed to expose the wiring will not be accepted. Hinged gutter covers to be a minimum of 9" wide, NO EXCEPTIONS.
- I. Provide 2-handle lock-off devices per panel to be installed where directed.
- J. Furnish 5 keys to panel board locks, all locks keyed alike.
- K. Where two or more panels are located at one point supply common trim.
- L. Directory cards shall be filled in on typewriter. Indicate circuit's use such as "Lighting-Office 105". Verify proper room identification.
- M. Ground fault protection, service entrance and/or main feeders: a ground sensor encircling all phase conductors including neutral in a 4-wire system connected to a solid state ground relay which initiates tripping of the main circuit interrupting device. Ground protection shall be adjustable from 200 to 1,200 primary amperes and time-current characteristic shall provide 6-cycle operation at about ten times setting. Relay output shall operate from 120V AC source.

2.2 INTEGRATED SURGE PROTECTIVE DEVICES:

- A. References
 1. ANSI/IEEE C62.41 - IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits
 2. ANSI/IEEE C62.45-IEEE Guide for Surge Suppressor Testing
 3. FIPS Pub 94 (1983) - Guide on Electrical Power for ADP Installation
 4. National Electric Code - Article 280-1, 2, 4, 12, 21, 25
 5. National Fire Protection Association - NFPA-20, NFPA-70, NFPA-75, NFPA-78.
 6. NEMA LS-1 - Low Voltage Surge Protective Devices
 7. UL 1283 - Electromagnetic Interference Filters
 8. UL 1449 - Transient Voltage Surge Suppressor
- B. Panel Boards
 1. Integral Surge Suppressor-supplied with every panelboard and load center.
 - a. SPD shall be Listed and Component Recognized in accordance with UL 1449 and UL 1283.

- b. SPD shall be installed by and shipped from the electrical distribution equipment manufacturer's factory.
- c. SPD shall provide surge current diversion paths between each phase conductor and the neutral conductor, between each phase conductor and the ground and between the neutral conductor and ground.

2.3 WIRING DEVICE:

- A. Devices shall be specification grade and meet requirements of NEMA WDI "Heavy Duty". Acceptable manufacturers are: Hubbell, Pass & Seymour, and Leviton.
- B. Switches shall meet 50,000 close-open cycles of operation, and shall be rated for 120/277 volt, AC service. Switches shall be "T" rated.
- C. Receptacles shall have grounding terminal and shall be "self-grounding" except when "isolated ground" is noted.
- D. Devices shall be color as selected by architect.
- E. Plates shall be same manufacturer as devices and shall be 0.04 inch, stainless steel, satin finish, or Lexan plate as desired by Architect.

PART 3 – EXECUTION:

3.1 WIRING:

- A. Convenience outlets shall not be wired on same circuit with other type outlets unless specifically shown. Leave at least 8" of slack in conductors at every outlet box. In duplex receptacles mounted vertically, install with grounding pole above phase poles.
- B. Where a switch carries more than 1,440 watts on 120 volt circuit or 3300 watts on 277 volt circuit, provide 20 amp size switch, or larger as required.
- C. Provide 20 amp receptacles unless noted otherwise.
- D. Receptacles servicing equipment through exposed "pig-tails" shall be "twist-lock" type.
- E. Where more than one switch is at one location, gang-mount under common plate. Provide separating partitions for switches servicing 277-volt lighting circuits.
- F. Connect to live side of circuit, control only the outlet shown, lever in "down" position when "OFF".
- G. Secure switches firmly on boxes without depending on plates to draw them up tightly. Where several conductors must be held together, use nylon cable ties.
- H. Use shallow outlet boxes only where space conditions require it, and only after Engineer's approval.
- I. Unless otherwise noted, outlets shall be height above floor as follows: Switches up 48", receptacles up 18".
- J. Where ceiling outlets are "aligned", hold the fixture accurately to line.

- K. Switches shall be on strike side of door, and 4" from door trim unless otherwise noted.
- L. Where several outlets are shown close together to serve a particular piece of furniture or equipment, group closely as directed.
- M. Devices shall not be mounted back back. A minimum, of two feet (2') shall separate devices on opposite sides of any wall.

3.2 BRANCH CIRCUITS:

- A. Multi-wire, 120-volt circuits on a common neutral and in one conduit can be used without change in wire size up to #3 on 120-208V, 3 Phase wye service and 2 circuits on 120-240V, 3 phase, and delta service. Where it will be of advantage, provided the wire is increased one size and two neutrals are used, 6 circuits on 120-208V, 3 phase, wye are acceptable in one conduit.

3.3 WIRING IN AIR HANDLING SPACES:

- A. In connection with wiring in ducts, plenum and other air handling spaces, note the requirements in the National Electrical Code.

END OF SECTION

SECTION 26 50 00

BUILDING LIGHTING AND LAMPS

PART 1 – GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide labor, material, equipment and services necessary to provide all interior lighting fixtures, necessary hangers and lamps. Fixtures include all interior fixtures plus all exterior fixtures mounted to exterior wall or to structures connected directly to building.
- B. Fluorescent fixtures to be designed in such a manner that all electrical components may be replaced without disturbing fixture in or on ceiling.
- C. Ballasts shall have overall power factor of more than 90%. Ballasts noise shall be inaudible in a room ambient of 35 DB.

PART 2 – PRODUCTS:

- 2.1 Provide lighting fixtures indicated by type on lighting fixture schedule on Drawing.
 - A. Light fixtures, accessories, controls, etc. as manufactured by Cooper Industries or Eaton are not acceptable due to poor performance and will be rejected.
- 2.2 Recessed fluorescent fixtures shown with acrylic lenses to be furnished with 0.125 minimum thickness acrylic lenses.
- 2.3 Fluorescent ballasts to be electronic energy saving, high-power factor and bear ETL and CBN labels for Class "P" protection and shall be rated for 110/125-volt operation unless noted otherwise.
- 2.4 Provide one ballast per fixture unless otherwise noted on plans for multi-level switching.
- 2.5 Provide all fluorescent, high intensity discharge and incandescent lamps as indicated below.
- 2.6 Fluorescent Lamps:
 - A. Fluorescent lamps to be 32 watt T8 or 28 watt T5, unless noted otherwise.
- 2.7 Led Luminaires:
 - A. Definitions:
 - 1. Driver - the power supply used to power LED luminaires, modules, or arrays.
 - 2. L70, L70, or L70% - The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LED's original light output. This test is being developed by the IES and is currently described by TM-21-11.
 - 3. LED's - Broadly defined as complete luminaire with light emitting diode (LED) packages, modules, light bars or arrays, complete with driver.
 - 4. LED luminaire failure - Negligible light output from more than 10 percent of the LED's constitutes luminaire failure.

- B. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:
1. Minimum Light Output.
 2. Zonal Lumen Requirements.
 3. Minimum Luminaire Efficacy.
 4. Minimum CRI.
 5. L70 Lumen Maintenance.
 6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
- C. Additional Requirements:
1. Color Temperature of 3000K-4100K for interior luminaires as listed in the Luminaire Schedule on the plans. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
 2. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
 3. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
 4. Luminaire shall be mercury-free, lead-free, and RoHS compliant.
 5. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
 6. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
 7. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
 8. Driver shall have a rated life of 50,000 hours, minimum.
 9. Lumen output shall not depreciate more than 20% after 10,000 hours of use.
 10. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
 11. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.
 12. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
 13. LED driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
 14. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
 15. Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
 16. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
 17. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
 18. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
 19. All luminaires shall be provided with knockouts for conduit connections.
 20. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).

22. Provide all of the following data on submittals:

- a. Delivered lumens
- b. Input watts
- c. Efficacy
- d. Color rendering index.

D. LED Luminaires used for Emergency Egress Lighting:

1. The failure of one LED shall not affect the operation of the remaining LEDs.

E. Emergency LED Luminaire Compatibility with Inverters:

1. Emergency Inverters shall be sine-wave type, or have written confirmation from the luminaire manufacturer that the luminaire will function with a square-wave inverter.

F. Dimming:

1. LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC) or Pulse Width Modulation (PWM) operation.
2. LED luminaires shall dim to (20%, 15%, 10%, 5%, or 0.1%) as specified in the Luminaire Schedule on the plans without visible flicker or "popcorn effect". "Popcorn effect" is defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire.

2.8 MISCELLANEOUS LAMPS:

- A. Incandescent lamps to be rated at 130-volts, inside frosted, unless specifically called for otherwise by manufacturer or listed otherwise in fixture schedule.

2.9 EXIT LIGHTS:

- A. Exit lights shall have LED lamps nickel cadmium battery, charger, and 120/277V electronic circuitry. Directional arrows per drawings.

2.10 FLUORESCENT EMERGENCY BATTERIES

- A. Emergency illumination shall be provided by using a standard fluorescent fixture equipped with fluorescent emergency ballast. Supply and install for each designated fixture, a fluorescent emergency ballast consisting of a special high temperature nickel cadmium battery, charger, and electronic circuitry contained in one (1) compact steel case.
- B. A test switch, installation hardware and a charging indicator light, to monitor the charger and battery, shall be provided.
- C. The battery unit shall be installed within the fixture ballast channel or outside the channel requiring an external mounting kit. Every emergency ballast shall be capable of fully automatic operation of one (1) 2' through 8' lamp, or two (2) 2' through 4' lamps in the emergency mode at reduced illumination. Emergency illumination shall be a minimum of 650 lumens for ninety (90) minutes.

PART 3 – EXECUTION:

- 3.1 Recessed fixtures in dropped ceiling areas to be connected using Greenfield and No. 14 AF wire. Greenfield to be connected to fixture and cover of outlet box. Each piece of Greenfield to have installed in it a separate insulated green grounding conductor not smaller than No. 14 AWG for grounding continuity between fixture and conduit system. Grounding conductor to be mechanically connected in a permanent and effective manner to fixture and conduit system and

to be electrically continuous. No conduit shall enter a recessed fixture directly as this would prevent removal of fixture without disturbing balance of circuit.

- 3.2 Joints in fixture wiring to be made using wire nuts, pre-insulated Scotch locks, Ideal No. 30-410 crimps and No. 30-415 wrap caps, or other approved mechanical means of connection.
- 3.3 Adjustable type to be adjusted by the Contractor to illuminate intended area to satisfaction of Owner.
- 3.4 Any adjustable outside area lights or lights mounted on building to be adjusted at night by the Contractor to satisfaction of Owner.
- 3.5 Surface or recessed fixtures in or on plastered or dry wall ceiling to be supported from pieces of support channel spanning across main support channels and shall not depend on ceilings for support. Fixtures in plastered ceilings to have plaster frames.
- 3.6 Coordinate with ceiling tradesman and Contractor in order that proper fixtures are furnished to match ceiling suspension system being installed.
- 3.7 Coordinate fixture locations to clear diffusers, ductwork, piping, etc.
- 3.8 Maintain integrity of parabolic lensed fixtures by leaving the protective wrapping or seal on until final inspection.
- 3.9 Maintain integrity of enclosures on all enclosed and gasketed fixtures. Minimize number of enclosure penetrations and make such penetrations water and dust tight with appropriate gasketing and fittings.
- 3.10 Submit for approval prior to purchasing fixtures complete fixture lists of fixtures proposed to be used. Include cuts of both specified fixture and proposed equivalent features if fixtures other than those specified are submitted.
- 3.11 If requested by Architect, submit a sample fixture, which will be returned after inspection by Architect. Architect reserves right to accept any fixture as approved equivalent.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING AND LAMPS

PART 1 – GENERAL:

- 1.1 Provide labor, materials, equipment and services necessary for installation of all exterior lighting fixtures, lamps, poles, pole bases etc. for area lighting.
- 1.2 Refer to details and arrangements shown on drawings.
- 1.3 Provide anchor bolts, conduit stub-ups to pole bases, concrete bases, etc. as required for poles and luminaries and types of arrangements indicated.
- 1.4 Provide exterior lighting fixtures and poles indicated by type on lighting fixture schedule on drawings.
- 1.5 Fixture manufacturer to furnish sufficient amount of paint (matching fixtures being furnished) for adequate field painting of prime painted poles being furnished.

PART 2 – PRODUCTS:

- 2.1 Fixtures, poles, etc. to be suitable for exterior use, shall be UL listed, and to be of standard design.

PART 3 – EXECUTION:

- 3.1 Install parking luminaries and poles on concrete bases. Provide all anchor bolts and bolt hole circle templates. Adjust luminaries to correct tilt and lamp all fixtures.
- 3.2 Adjust or rotate [roadway and flood lighting at night to maximize light utilization in intended areas.
- 3.3 Effectively ground all luminaries to poles and all poles to equipment grounding conductor and to separate 3/4" diameter x 8' copper weld ground rod driven at base of each pole.
- 3.4 Submit for approval prior to purchasing fixtures complete shop drawings and brochures including photometrics for each type of exterior lighting system specified. Shop drawings and brochures to be specific and to include all pertinent data and accessories. If substitute fixtures are proposed include cuts of both specified fixture and proposed equipment fixtures if requested by Engineer. Submit a sample fixture, which will be returned after inspection by Engineer. Engineer reserves right to accept any fixture as an approved equivalent.

END OF SECTION

SECTION 27 53 00

CONTACTORS, PHOTO ELECTRIC CONTROLS AND TIME CLOCKS

PART 1 – GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc, required to complete installation as specified herein and/or scheduled on drawings.

PART 2 – PRODUCTS:

2.1 CONTACTORS:

- A. All contactors shall:
 - 1. Be UL listed in accordance with UL-508
 - 2. Be suitable for continuous duty with all types of loads
 - 3. Be industrial duty and rated 600 volts even though they may be used for commercial duty and/or at a lower voltage
 - 4. Have 120-volt coils unless noted otherwise.
- B. Contactors shall have totally enclosed silver alloy double break power contacts capable of making and breaking any load within the rating of the contactor without the assistance of auxiliary arcing contacts are not acceptable. All contacts must be removable without disturbing line or load wiring.
- C. Electrically held lighting contactors - Contactor coils shall be continuously rated and encapsulated as a further protection against burnout.
- D. Mechanically held lighting contactors - Contactor latch coils shall be energized only during the instant of operation, but shall be continuously rated and encapsulated as a further protection against burnout.
- E. Provide adapter-mounting bracket with locking type socket.
- F. Unit design shall provide a delay of 15 seconds or longer to prevent false starts. Temperature operating range: -50 degrees to +60 degrees C.

2.2 TIME CLOCK:

- A. Units shall be astronomical type with multiple pre-sets automatic DST adjustment, and have the following:
 - 1. NEMA-I enclosure
 - 2. Synchronous
 - 3. Contact capacity: 55 amps at 277 volts inrush, 12 amps at 277 volts nominal
 - 4. Dial with removable trippers and day omitting device.
- B. Provide 24-hour, 3-1/4" dial, or 7-day, 6-1/2 dial per schedule.

- C. Unit shall have either a sustained SPDT circuit or a 2-second momentary circuit closure per schedule. The momentary timing circuit shall be solid-state type independent of timing motor circuit.

PART 3 – EXECUTION:

3.1 INSTALLATION

- A. Contactors shall be connected to and controlled by building Energy Management System.
- B. Controls shall have electrical or mechanical adjustment to provide operation within range of illumination specified.

END OF SECTION

SECTION 23 01 01

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, material, etc. required to complete installation specified herein and/or shown or scheduled on the drawings.
- B. Equipment and materials used in the work shall be in accordance with the contract documents, of the best quality and grade for the use intended, shall be new and unused and shall be the manufacturer's latest standard or current model for which replacement parts are readily available.
- C. All apparatus and equipment shall be installed and connected in accordance with the best engineering practices and in accordance with the manufacturer's recommendations. All auxiliary piping, water seals, valves, electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.

1.2 SPECIAL CONDITIONS, MECHANICAL:

- A. By the act of submitting a bid, this Contractor agrees that all of the "Contract Documents" and each of the Divisions of the complete specifications have been reviewed and studied, and all requirements and coordination resulting there from are included.
- B. In this section, the word "Contractor" means the Mechanical Contractor. The word "provide" means furnish, install and connect.
- C. Do not scale drawings having 1/4" or smaller scale. Because of small scale, it is not possible to indicate all offsets, fittings, and accessories; provide such as are required for complete installation.
- D. The right is reserved to move any element as much as ten (10) feet at no increase in cost provided Contractor is notified before work in question is installed.
- E. Contractor shall be responsible for determining and verifying the characteristics of electrical current available to operate the mechanical equipment prior to ordering such equipment.
- F. Contractor shall be responsible for reviewing all drawings (Architectural, Mechanical, Electrical, Structural etc.). If any discrepancies are discovered between drawings, the contractor shall notify the Architect/Engineer prior to bidding so that an addendum may be issued for clarification.

1.3 CODES AND STANDARDS:

- A. The intent is that the complete installation shall comply with applicable laws and ordinances, utility company regulations, and applicable requirements of the following:
 - 1. International: Building Code, Gas Code, Mechanical Code, and Plumbing Code.
 - 2. NFPA: National Fire Protection Association.
 - 3. National Plumbing Code

4. AGA: American Gas Association.
5. FM: Association of Factory Mutual Fire Insurance Company.
6. ASME: American Society of Mechanical Engineers.
7. ASTM: American Society of Testing Materials.
8. NSF: National Sanitary Foundation.
9. PDI: Plumbing Drainage Institute.
10. UL: Underwriters Laboratories.
11. NEC: National Electrical Code.
12. NEMA: National Electrical Manufacturer's Association.
13. SMACNA: Sheet Metal and Air Conditioning Contractors National Association.
14. ARI: American Refrigeration Institute.
15. PFMA: Power Fan Manufacturer's Association.
16. MSS: Manufacturer's Standard Society of Valve and Fittings Ind.
17. ANSI: American National Standard Institute.
18. API: American Petroleum Institute.
19. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers.
20. Tennessee Energy Code.
21. TOSHA: Tennessee Occupational Safety & Health Act.

1.4 COORDINATION OF WORK:

- A. Furnish and locate required anchor bolts, sleeves, inserts, supports, etc.
- B. Lines which pitch shall have right-of-way over lines whose elevations can be changed. Offsets, transitions and changes in direction in pipe and ducts shall be made as required to maintain proper headroom, pitch, etc.
- C. Coordinate all ducts, outlets, fixtures, etc. with floor, wall and ceiling patterns.
- D. The mechanical work shall be installed as neatly as possible in the locations shown but shall be subject to such deviations, modifications and relocations as may be necessary to conform to the requirements of the architectural drawings and as necessary to avoid interferences with the structural work and the work of other trades, and interferences between the various trades. This shall be done at no cost to the Owner. No ductwork, piping or equipment shall be installed which would require ceilings to be lower than required by drawings, unless approval is obtained from the Architect.
- E. If necessary to coordinate and expedite the work, the Contractor shall prepare "interference drawings" and submit them to the Architect for approval. Such drawings shall show the work of the various trades involved, illustrate proposed details of construction and arrangement of equipment and apparatus, and clearly indicate any deviations from contract requirements.
- F. Minor changes in arrangement may be made to suit unforeseen conditions, but no major deviation shall be made without written approval from the Architect. If any deviations are deemed necessary, submit all details of proposed changes and all reasons therefore, in writing, to the Architect for approval prior to making installation of such work.
- G. Contractor shall coordinate requirements for utility connections with municipal utility departments and utility companies. Installation of service taps, extensions, valves and metering provisions shall comply with criteria of appropriate authority, and any cost associated therewith shall be included in the bid amount.

1.5 DATA AND SHOP DRAWINGS:

- A. Prior to ordering, submit certified prints and/or descriptive data for major pieces of equipment, fixtures, valves, insulation, controls, etc. Stamp, sign and certify to be correct and in compliance with the Contract Documents, each drawing submitted for review. Drawing submitted without signed certification will be returned without review.
- B. Any deviation in submittal from contract documents of materials, capacities, space requirements in items furnished, etc. shall be listed in a letter accompanying submittal stating deviation and reason requested for consideration of acceptance.
- C. Submittals shall include one paper copy and one electronic copy, clearly marked, and in order as indicated on drawings. Items submitted partially and in an unorganized manner shall be returned without review.
- D. Submittal shall show: manufacturer's catalog number, performance data with indicated operating points, finishes, optional features and modifications. Each sheet of printed submittal data shall be clearly marked (using arrows, underlining, or circling) to show the particular size, type, model number, ratings and options actually being proposed.
- E. When work in accordance with manufacturer's recommendation is specified, a copy of recommendations shall be kept in the job office.
- F. Furnish the number of copies required by the General and Special conditions of the contract but in no case less than six (6) copies.
- G. Shop drawings shall show sizes and details of required concrete and steel machine foundation, location of anchor bolts, physical dimension of equipment, equipment weight or other pertinent data required for equipment support or installation.
- H. Approved shop drawings do not mean that drawings have been checked in detail; said approval does not in any way relieve the contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings or specifications.

PART 2 - PRODUCTS:

2.1 REFERENCE TO DRAWINGS:

- A. Reference shall be made to drawing schedules and details for: manufacturer, model, catalog number, size, capacity, performance, installation, etc. of equipment and material. Equipment of manufacturers other than those named, will be acceptable provided, in the opinion of the Engineer, it is of equal substance, function, performance and appearance.

2.2 CHOICE OF MATERIALS AND EQUIPMENT:

- A. In submitting substitutions, bidders should note the following minimum considerations: (1) capacities shown are absolute minimum and must be equaled, (2) physical size limitation for space allotted, (3) static and dynamic weight limitation (4) structural properties, (5) noise level, (6) vibration generation, (7) interchangeability, (8) accessibility for maintenance and replacement, (9) compatibility with other materials, assemblies, and (10) similar items shall be same manufacturer and style wherever possible.

- B. All material and equipment, for which a UL Standard, an AGA approval, or an ASME requirement is established, shall be so approved and labeled or stamped. Label or stamp shall be conspicuous and not covered, painted or otherwise obscured from visual inspection.
- C. Adhesives are not acceptable as a mounting, supporting, or assembling technique.
- D. Contractor shall pay any costs added to total contract as a result of any substitutions.
- E. Equipment, etc. shall not be purchased without Engineer's written approval.

PART 3 - EXECUTION:

3.1 EXISTING SERVICES:

- A. No service shall be interrupted without permission of the Owner. Owner must receive written request a minimum of 72 hours in advance of any anticipated shutdown.
- B. When encountered in work, protect existing active: sewer, water, gas, electric, other utility services, structures; when required for proper execution of work, relocate them as directed. If existing active services are not indicated, request Engineer for instructions.
- C. When encountered in work, whether or not indicated, cap or plug to otherwise discontinue existing inactive: sewer, water, gas, electric, other utility services, structures which interfere with work execution. Notify Engineer in writing of action taken. If removal is required, request instructions.

3.2 DRAWINGS:

- A. Drawings are diagrammatic. Contractor shall install the work in such manner that the equipment, piping, vents, conduit, panels, ductwork, etc. will fit in space provided, maintain headroom, and if in finished areas, be as neatly installed and "out-of-the-way" as physically possible. All equipment, piping, ductwork, conduits, etc., shall be installed to provide needed maintenance and passage space.

3.3 FEES:

- A. The contractor shall pay for fees and inspections as may be required for water and sanitary sewers, gas service, sprinkler systems, and all other systems requiring inspections by agencies having jurisdiction.

3.4 INSPECTION OF SITE:

- A. The drawings are prepared from the best information available and reflect the conditions commensurate with this information. However, the Contractor shall visit the site prior to submitting a proposal and shall verify the locations, sizes, depth, pressures, etc., of all existing utilities; and familiarize himself with working conditions, hazards, existing grades, soil conditions, obstructions, etc. If it becomes evident that existing site conditions will impair the proper operation of the utilities, or the construction process, the Architect shall be notified in writing.
- B. All proposals shall take these existing conditions and any revisions required into account, and the lack of specific site information on the drawings shall not relieve the Contractor of his responsibility.

END OF SECTION

SECTION 23 01 02

HVAC AND ELECTRICAL COORDINATION

PART 1 - GENERAL:

1.1 RELATED DOCUMENTS:

- A. Refer to Section 23 01 01 – General Requirements for Mechanical Work.

1.2 SUMMARY:

- A. This Section describes the coordination between the Mechanical, Fire Protection, Plumbing, and Electrical portions of the work.
- B. This Section is included under the Division 21 and 26 portions of the specifications.

1.3 WORK INCLUDED:

- A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. This schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

<u>ITEM</u>	<u>FURNISHED UNDER DIVISION</u>	<u>INSTALLED UNDER DIVISION</u>	<u>WIRED AND CONNECTED UNDER DIVISION</u>
1. Equipment Motors	23	23	26
2. Magnetic Motor Starters:			
a. Automatically controlled, with or without HOA switches	23	26	Notes 1,3
b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment	23	23	Notes 1,2
c. Manually controlled	23	26	Notes 1,3
d. Manually controlled and furnished as part of factory wired equipment	23	23	Notes 1,3
e. Furnished in Motor Control Centers	26	26	Notes 1,3
3. Line voltage thermostats, time clocks etc., not connected to control panel systems.	23	26	26

<u>ITEM</u>	<u>FURNISHED UNDER DIVISION</u>	<u>INSTALLED UNDER DIVISION</u>	<u>WIRED AND CONNECTED UNDER DIVISION</u>
4. Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached to ducts, pipes, etc.	23	23	23
5. Temperature control panels and time switches mounted on temperature control panels.	23	23	23
6. Motorized valves, motorized dampers solenoid valves, EP and switches, etc.	23	23	23
7. Alarm bells furnished with equipment installed by Division 23.	23	23	23
8. Wiring to obtain power for control circuits, including circuit breaker.	26	26	26
9. Low voltage controls, thermostats valves, dampers, etc.	23	23	23
10. Fire protection system (sprinkler) controls.	21	21	26
11. Fire and smoke detectors installed on mechanical units and in ductwork.	26	23	Note 2
12. All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment.	23	23	23
13. Pushbutton stations, pilot lights	23	23	23
14. Heat Tape	23	23	26
15. Disconnect switches, manual operating switches furnished as a part of the equipment.	23	23	Note 1
16. Disconnect switches, manual operating switches furnished separate from equipment.	26	26	26
17. Multi-speed switches	23	23	26
18. Thermal overloads	23	23	26

<u>ITEM</u>	<u>FURNISHED UNDER DIVISION</u>	<u>INSTALLED UNDER DIVISION</u>	<u>WIRED AND CONNECTED UNDER DIVISION</u>
19. Control relays, transformers	23	23	26
20. Tamper switches for fire protection (sprinkler) system.	21	21	26
21. Flow switches for fire protection (sprinkler) system.	21	21	26
22. Alarm bells or horns for fire protection (sprinkler) system.	21	21	26
23. Underground fuel tank leak detection and monitoring system.	22	22	26

NOTES:

- (1) Power wiring as defined in Section 26 05 13 of the specifications shall be under Division 26; control wiring as defined in Section 26 05 13 of the specifications shall be under Division 23.
 - (2) Wiring from alarm contacts to alarm system by Division 26; wiring from auxiliary contacts to air handling system controls by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for supply duct and return air duct for all air handling systems 2000 CFM or greater. Refer to other Division specifications and drawings for more specific requirements.
 - (3) For requirements for Magnetic Motor Starters, refer to Division 23, Section 23 01 01 – General Requirements for Mechanical Work.
 - (4) Disconnect switches, operating switches, starters and other similar items, which are factory-mounted, as a part of a complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.
- B. Connections: Make all connections to controls, which are directly attached to ducts, piping and mechanical equipment with flexible connections.
- C. Precedence:
1. In general, piping systems, which require a stated grade for proper operation, shall have precedence over systems.
 2. Precedence for pipe, conduit and duct systems shall be as follows:
 - a. Building lines
 - b. Structural members
 - c. Soil and drain piping
 - d. Vent piping
 - e. Refrigerant piping
 - f. Condensate piping
 - g. Supply ductwork
 - h. Exhaust ductwork
 - i. Automatic fire protection sprinkler piping
 - j. Domestic hot and cold water piping

- k. Natural gas piping
- l. Electrical conduit

3. Lighting fixtures shall have precedence over air grilles and diffusers.

D. Final Inspection and Report:

At the completion of the work, there shall be a meeting of the mechanical, electrical and temperature control contractors, representatives of mechanical and electrical equipment manufacturers whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies, which they represent, shall be filed with the Owner and Architect/Engineer.

END OF SECTION

SECTION 23 01 03

COMPLETION ITEMS

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

1.2 CONNECTION TO EQUIPMENT:

- A. Work shall include all labor, material, equipment, etc. required including, but not limited to, the following: (1) provide steam supply and return, chilled water supply and return, heating hot water supply and return, refrigerant piping, domestic hot and cold water supply, drain, vent, gas, etc., and (2) connections to all equipment specified in this or other sections requiring such services.
- B. Indicated locations and sizes of equipment connections are approximate; exact locations and sizes of piping, valves, etc. shall conform to approved shop drawings. Connection sizes shall not be smaller than scheduled size or equipment outlet size, whichever is larger.
- C. Equipment furnished by other sections shall be properly equipped structurally and mechanically with all accessories, including plumbing, piping, drains, traps, tailpieces, supply fittings, ductwork, gas lines, etc., internal to and part of the equipment installed by the equipment manufacturer or supplier, ready to receive single connections for each of the various mechanical items, except that this Division shall furnish shut-off valves and unions or flanges.
- D. Where existing equipment is removed, disconnect and cap lines, behind or below finished building surfaces.
- E. Verify all connections and rough-in locations with the Architect and/or the equipment supplier or contractor prior to the start of their work.

1.3 ADJUSTING AND TESTING:

- A. Before testing, protect from damage any control and indicating devices, etc. not designed to stand test pressures. Test all elements before covering or "closing in".
- B. Provide labor, material, instruments, fuel, electricity, water and other costs in connection with all tests. Installed instruments may be used for tests if calibrated and approved for the purpose.
- C. Conduct pressure, temperature, ampere, voltage, performance and operating tests for each system, equipment, unit motor, etc. as directed by and in presence of Engineer. Submit tabulation showing: (1) nameplate amperes and voltages, (2) actual full-load amperes and voltage for each phase of every motor, (3) overload element number and rating, (4) CFM for each air intake and outlet including O.A. and exhaust with actual reading obtained, (5) each fan RPM, (6) static pressures entering and leaving each fan, (7) water pressures in and out of each pump and, (8) water flow at each pump. See Section 23 05 93 for additional test and balance requirements.

- D. Test all piping, except refrigeration, air and oil, hydrostatically to 1.5 times maximum working pressure, but in no case less than 125 PSIG, for at least 4 hours. Subject welded joints to hammer test while under pressure. Caulking or peening repairs not permitted.
- E. Obtain certificates of approval, acceptance and compliance with regulations from agencies having jurisdiction.

PART 2 - PRODUCTS:

2.1 RECORD AND AS-BUILT DOCUMENTS:

- A. Maintain at job site a set of contract record documents kept current by indicating thereon all changes, substitutions, etc. between work as specified and as installed.
- B. Furnish Engineer one (1) complete set of electronic drawing files showing installed location, size, etc. of all work and material in .pdf and .dwg format.
- C. Show on record documents actual air quantities, water flow rates, valve or damper positions after balancing, etc.; also show, by actual dimension, location of all underground work.
- D. For each piece of equipment, provide the owner three (3) sets of: (1) manufacturer's printed catalog pages, operating and maintenance instructions, wiring and connection diagram, etc., (2) temperature-humidity and motor interlock control and wiring diagrams showing operation instructions for, and normal position of, each motor and controller, control valve, thermostat, etc., and (3) lubrication chart. Bind this information into 8-1/2" x 11" booklets. All three (3) sets shall be assembled in hardback binders.

PART 3 - EXECUTION:

3.1 OPERATING INSTRUCTIONS:

- A. Furnish to the Architect written operating and maintenance instructions for each system and each piece of equipment. Include in equipment data binder specified above: (1) instructions to start and stop each piece of equipment, (2) itemized maintenance schedule, (3) submittals.
- B. When systems are completely adjusted, furnish personnel for five (5) full days to instruct Owner's operators. When Owner operates on a 24-hour basis, each shift shall be properly trained.

3.2 CLEANING AND FLUSHING:

- A. Fixtures, Equipment, Etc.
 - 1. Fixtures, piping, ducts, equipment, etc. shall be cleaned per manufacturer's printed instructions and Engineer's instructions.
 - 2. No air unit shall be operated without a construction set of specified type filters being installed.
- B. Before final building interior finish is applied:
 - 1. Interior of air handling equipment shall be thoroughly cleaned.
 - 2. Drain pans shall be cleaned and then flushed with water after which, run all fans with air terminals out, put filters in place for 24 hours.

C. Clean-Up of Piping:

1. Piping shall be: (1) flushed with clean water, (2) "blown out" with steam or compressed air, or (3) "swabbed out" as required, except where specified otherwise. All temporary connections required for flushing shall be provided and subsequently removed by the Contractor.
2. Care shall be exercised by contractor to prevent any other foreign matter from entering pipe or components of system during construction. Plug pipe ends or cover with burlap, or other material to keep out foreign materials. Before erection, each piece of pipe, fitting or valve shall be visually examined and all dirt or other foreign matter removed.
3. Connect all equipment with fine mesh strainer in place and spools to bypass coil in fan coil units to prevent foreign matter from entering coils. With system filled, trapped air vented, check system to determine that no leaks exist. Any leaks in piping shall be repaired before proceeding. Pipe shall be opened at lowest points and highest points for initial flush and blow down, making sure makeup water fill valves are set to make up water at same rate of drainage. Check pressure gauge at pump suction and manually adjust makeup to hold same steady positive pressure before and after opening drain. Flushing shall continue until water is clean after opening drain points. In no case shall flushing period be less than two (2) hours. Provide temporary hoses on pipes as necessary to thoroughly flush all parts of system. Drain system.

D. System Start-up Cleaning and Flush:

1. Fill system at city water makeup connection, with all air vents open. After filling with air vented, vents shall be closed.
2. Start pump with pressure reducing valve set for test pressure or for maximum for pump casing whichever is smaller. Vents shall be checked in sequence to bleed off any trapped air until there is circulation through all components of system. Open control valves in sequence for complete system circulation.
3. All vents shall be opened and pipe opened at valves and low points to completely drain system.
4. After system is drained it shall be refilled for operation under closed conditions. Contractor shall add a chemical cleanup solution to the system, the pump started, trapped air vents, drains closed, and control valves opened. Solution shall circulate for approximately 24 hours. Mechanical Engineer shall be given notice of this cleaning operation and will be present to observe the cleaning operation. If the engineer deems it necessary, the cleaning operation shall be repeated.
5. After system cleanout is completed, drain system and install flow control devices, coarse mesh strainers and connections to all coils. The fine mesh strainers at the pumps shall be removed and coarse mesh strainers installed. Refill system and make ready for operation and operating water treatment.

3.3 PAINING:

- A. All equipment shall present a clean, painted appearance; touch-up, or repair, as required.
- B. All gas piping above ground, in or out of building, concealed or exposed, shall be painted yellow.
- C. Paint all equipment and other ferrous metal, which is not otherwise protected against corrosion. Paint exposed pipe threads with Bitumastic #50. Clean thoroughly all surfaces before painting.
- D. Where ductwork can be seen through grilles, louvers, etc. paint the visible areas with flat black paint.

3.4 LUBRICATION:

- A. During construction, all bearings and shafts shall be kept thoroughly greased and protected. All rotating equipment (fans, pumps, etc.) shall be turned by hand or by "bumping" the starter at least once a week during construction.
- B. After equipment has been operated seven (7) days and before final acceptance, all bearings shall be inspected and filled to operating level.

3.5 TESTING AND BALANCING AIR DISTRIBUTION & HYDRONIC SYSTEMS:

- A. See Section 23 05 93.

3.6 QUIETNESS OF OPERATION:

- A. Pumps, fans, motors and other apparatus shall be selected and installed for reasonably quiet operation. Any objectionable noise, which develops, shall be corrected before the work will be accepted. Equipment, which produces objectionable noise, shall be adjusted or insulated so as to eliminate the noise, or shall be removed and replaced by satisfactory equipment. Provide spring or rubber machine mounting isolators and flexible piping and duct connections where necessary to prevent transmission of vibration to building structure or to piping and duct system. Refer to Section 20 05 16 for requirements and type.

END OF SECTION

SECTION 23 01 04

HVAC GUARANTEE AND WARRANTY

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

- 1.2 TEST PERIOD: Each piece of equipment shall meet performance specifications after one (1) year's actual operation.

PART 2 - PRODUCTS:

Not used.

PART 3 - EXECUTION:

- 3.1 The Contractor shall replace, or make good, any defect due to faulty workmanship or material, which shall develop within one (1) year from date of acceptance at no cost of Owner. This guarantee shall cover both material and labor and shall include: (1) refrigerant and oil replacement, (2) any adjustments or service required, and (3) any necessary adjustments in system control set points when required, but no filter maintenance. The Contractor is responsible to replace work found not in conformance with the contract at any time during the life of the installation. Replacement of non-conforming work is not subject to the one-year warranty limitation.
- 3.2 Date of Acceptance shall be certified by the Engineer as that date on which the contract has been satisfactorily completed in accord with Contract Documents. If a whole or partial system, or equipment is put into use for benefit of any party, other than contractor and with prior written permission of the Owner, this agreed date shall become the "Date of Acceptance" for that piece of equipment or system.
- 3.3 CERTIFICATE: Prior to completion and final acceptance of the facility, furnish to the Engineer certification that the mechanical systems have been tested and that the installation and performance of those systems conform to the Contract Documents.
- 3.4 See other sections for additional warranty requirements.

END OF SECTION

SECTION 23 01 05

BASIC MATERIALS AND METHODS

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

PART 2 - PRODUCTS:

2.1 ELECTRICAL EQUIPMENT:

- A. Motor controllers, protective devices, etc. for control and protection of equipment shall be furnished with the equipment, but installed and electrically connected to power source under Division 26.
- B. NEMA Standards shall be taken as a minimum requirement for electrical equipment.
- C. Equipment shall operate properly under a 10% plus or minus voltage variation, and a 5% plus or minus frequency variation.
- D. Unless noted otherwise, motors shall be squirrel-cage induction type with ball bearings. Motors 1/2 HP and smaller shall be 120 volts, single phase with permanently lubricated bearings; 3/4 HP and larger shall be 3 phase, general purpose, Design "B" or "C", drip proof type. Verify characteristics of available current at the building before equipment is ordered.
- E. Motor shall be in accordance with IEE, UL and NEMA Standards, non-radio interfering type, rated for continuous, full-load duty and capable of withstanding momentary overloads of 50%. Select motors so actual loads does not exceed nameplate rating, and does not use motor "service factor". "Open" motors shall be rated 40 degrees C.; "totally enclosed" type shall be 50-degrees C. rated. Motors over 5 HP shall be "NEMA premium efficiency" type and so labeled, and in compliance with NEMA MG-1 Standards. Service factor for motors shall be 1.15.
- F. Provide both overload and under-voltage protection in all phases.
- G. Except where interlock or automatic control is required, single speed motors, 1/2 HP and smaller have manual switch with pilot light and thermal overload protection.
- H. For manual operation of 3/4 HP and larger motors, furnish magnetic starter with:
 - 1. Maintained contact PB and pilot light or momentary contact pushbutton station and pilot light.
 - 2. Trip free, thermal overload relays.
 - 3. Capable of accepting electrical interlocks.
- I. Where interlock or automatic operation is specified, regardless of HP, provide magnetic starter complete with RUN/OFF/AUTO" switch so connected that in "RUN" or "AUTO" all safety controls shall stop the motor.

- J. All magnetic starters shall have control circuits individually fused from line side of starter, or load side of breaker. All starters on service 200 volts and above shall have 120 volt, built-in control circuit transformer fused on line and load side.
- K. Provide dual element fused disconnect for all hermetic motors above 3/4 HP.
- L. Heating Equipment: 1.8 KW and smaller, 120 volts; 1.81 KW through 4.7 KW, single phase; 4.8 KW and larger, 3 phase, voltage as noted or unless noted otherwise.
- M. Contactors shall be UL listed for 100,000 cycles of operation.
- N. Normal operation pilot lights shall be green; emergency condition signal lights shall be red.

2.2 EQUIPMENT ACCESSORIES:

- A. Provide removable guards to enclose all rotating or moving elements. Construct of galvanized steel to withstand 250 lbs. static load. Provide tachometer access to shaft ends.
- B. Design V-belt drives for overload per belt manufacturer's recommendations, but in no case less than 150% of motor horsepower.
- C. Note that fixed speed drives are specified. If final tests, under operating conditions, indicate the need for a different speed drive to accomplish the required load at the least power requirements, the Contractor shall provide the required drive changes at no extra cost.
- D. On direct-coupled drive equipment, dowel motor and driven equipment to a common base using 2 dowels each.

2.3 ACCESS PANELS:

- A. Provide access panels, or doors, at concealed dampers, valves, shock absorbers, vents, traps, trap primers, inspection points, etc. and where noted. Panels shall be galvanized steel, 16 gauge frame, 14 gauge door with mounting accessories, spring hinges, screwdriver operated lock, and prime coat paint. Milcor "A" for acoustic tile, "M" for exposed masonry, "K" for plaster finishes, stainless steel for ceramic, or glazed structural tile. Where ceiling is "lift out" construction, ceiling access panels are not required. Panels shall be 18" x 18" or larger, as required for service intended.
- B. Access doors giving access to "live" electrical gear shall have switch to cut off power when opened.
- C. Access panels in fire rated construction shall have a UL label, Class B rating.

2.4 ROOF MOUNTED EQUIPMENT: All roof-mounted equipment shall be furnished with a roof curb designed for flashing to roof and so designed to meet roof slope and make equipment level. Roof curbs shall be designed for Seismic Zone 2 and have an "R" rating from the state of California.

2.5 CONCRETE: Where required for thrust blocks, pipe system encasement, equipment bases, etc. for Division 23, provide 3,000-PSI concrete.

PART 3 - EXECUTION:

3.1 ELECTRICAL WORK:

- A. All electrical work shall be provided under "Electrical Division", except: that associated with Division 15, (1) that associated with interlock circuits, (2) control circuits, (3) temperature-humidity controls. For these excepted items, this division shall provide conduit, wiring, connections, etc. as required for a complete control installation.
- B. The work under this Division shall be of the same type and quality as specified under "Electrical Division".

3.2 EXCAVATION, SHORING AND BACKFILL:

- A. Provide any excavation required for this Division below that is needed for general construction. Unless specifically noted, no extra shall be paid if rock or excavation difficulties are encountered.
- B. Provide separate trench for each utility.
- C. Provide: (1) bracing, shoring, etc. to protect sides of excavation, (2) staging, suitable ladders, barricades, etc. Comply with local regulations, or absence thereof with Division of the Manual of Accident Prevention provided for in Construction of the AGC.
- D. When trench excavation is required to cross traffic areas, one-half of the traveled portion of the pavement must remain open to traffic at all times, unless a plan approved by the City Traffic Engineer permits otherwise.
- E. Existing pavements, bases, curbs and gutters and sidewalks shall be cut and brought to a straight, vertical edge by mechanically sawing. Expansion joints removed shall be replaced.
- F. Maximum trench width is as shown on plans or 1.5 feet + O.D. of pipe or cable.
- G. Minimum trench width shall be sufficient to permit thorough compaction of the bedding material under and around the pipe or cable.
- H. All soft or otherwise unsuitable material shall be removed from the trench bottom and replaced with compacted crushed stone or other approved material.
- I. Bedding materials shall be the superior of class shown on approved plans or clean washed stone of 3/4-inch maximum particle size. Bedding shall provide a minimum of 6-inches cover above the pipe or cable unless otherwise shown on approved plans. Stone shall be brought up evenly on both sides of the pipe in 6-inch layers and tamped, rodded, or vibrated as required to provide a firm base and bedding around the pipe or cable.
- J. Remove all timber before backfilling. Backfill simultaneously on both sides of tanks, piping, etc. Backfill material shall be approved clay or chert, free of debris, rock larger than 1"Ø or other harmful material.
- K. All backfilling shall be compacted to 90% under sidewalks, or grass areas, and to 95% when under paved areas, structures, building slabs, and steps. etc. These percentages refer to "Percent of Maximum Density" per ASTM #D-1557. If more stringent, compact backfill to a dry

density equal to that required by G.C.

- L. Backfill material for utility cuts in City of Chattanooga Streets and extending 18 inches beyond edge of pavement or back of curb shall be mineral aggregate, class "A", grading "D", (previously "33P", or "pugmix") in accordance with TDOT specification. This backfill material shall be placed and compacted in 6-inch layers by means of a mechanical tamp to a density not less than 83 percent of the solid volume density as determined from the bulk specific gravity and the dry weight of the aggregate. Material that is too dry for adequate compaction shall receive a prior admix of sufficient water to secure optimum moisture content.
- M. Pavement shall be replaced in kind as shown on the city's standard drawings. The patch shall be finished so as to not leave a bump or dip in the finish grade.
- N. If permanent pavement repairs cannot be made within (2) days, then temporary replacement shall be made with 2-inches cold mix or hot bituminous seal coat. Permanent repair MUST be made within 10 workdays from date of pavement cut.
- O. Whenever trench openings are within state highways, the permit holder shall comply with all requirements and provisions of the Standard Method of the Tennessee Department of Transportation for opening trenches through highways and replacing pavements. All such work shall be subject to inspection and approval by the Tennessee Department of Transportation and/or the City of Chattanooga.
- P. Restore existing pavement, curbs, sidewalks, sodding, etc. removed or damaged in connection with work.
- Q. For insulated piping below grade, provide a bed of 6" sand minimum. After the insulation finish has cured, backfill with sand around the installation and over the insulation to a minimum of 6".

3.3 CUTTING AND PATCHING:

- A. Provide all cutting, patching, etc. incident to this work.
- B. Do not cut into any structural element without written approval of Engineer.
- C. Patching shall be: (1) of quality equal to, and of appearance matching existing construction, and (2) shall restore all services and construction which remains in use to its condition prior to this contract, unless otherwise noted.

3.4 PIPING THRU RATED WALLS AND FLOORS:

- A. Insulation on pipe passing thru fire rated walls must stop at pipe sleeve. Space between metal pipe and sleeve shall be protected with 3M Fire Barrier Penetration Sealing System or approved substitute. Installation shall be in accordance with the manufacturers recommendations for the hourly fire rating of the partition. The system shall be U.L. listed. Maintain vapor barrier on insulated chilled water and refrigerant suction piping.
- B. PVC pipe passing through rated walls or floors shall have 3M UL modified fire protection system.
- C. Refer to details on drawing for pipe and duct penetration thru rated walls and floors.

3.5 FLASHING:

- A. Where pipes, ducts, etc. pass through roof, flash per drawing details. Where no detail is shown, use National Roofing Contractors Association Details.
- B. Locate pipes, ducts, etc. through roof to clear parapets, etc. by at least 18".
- C. Provide flashing or caulking as required at each opening through outside walls or roof. Flashing through roof of same materials and methods as under "Moisture Protection Division"; through walls shall be aluminum unless noted otherwise.
- D. Make roof drains and floor drains in upper floors, watertight with 4 lbs. per square foot sheet lead or polypropylene sheeting extending at least 12" from drain rim into membrane waterproofing and clamped to drain.
- E. Flashing shall provide watertight seal with 8" depth of water on roof.
- F. Where ducts pass through concrete floors, provide a 3" x 3" concrete curb with sheet metal cap flashing, when through roofs, provide a 3" x 12" high-insulated curb or pre-fabricated insulated roof curb.
- G. Where pipes pass through floor structures, other than slabs on grade, which floors contain a waterproofing membrane, provide a watertight floor sleeve for each pipe.
- H. Provide necessary curbs to receive flashing. See SMACNA Plate #65 and/or drawing details.
- I. Sheet lead shall be FS #QQ-L-201A.

3.6 PROTECTION:

- A. Work shall be protected at all times. Pipes openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered if necessary, to protect against dirt, water, chemical or mechanical damage or defacement.

3.7 TEMPORARY WORK:

- A. Provide 3/4" water service with hose faucet 18" above grade located per instructions. Provide freeze protection. Upon completion of project: (1) close branch cock, (2) cap at point 18" below grade, (3) mark with concrete post.
- B. Water and electricity consumed during construction shall be paid for by General Contractor.

END OF SECTION

SECTION 23 05 29

HANGER & SUPPORTS FOR HVAC PIPING & EQUIPMENT

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.
- B. Support (1) from wood using coach screws on open construction and hanger flanges on sheeting, (2) from concrete using inserts, (3) from steel using beam clamps, rivets or bolts, (4) from concrete blocks using toggle or through bolts. Fasten supports to building in following order of preference: (1) steel framing, (2) concrete, (3) wood framing, (4) masonry, (5) wood sheathing. Do not support from roof deck without approval. All hangers, rods, and inserts shall be Underwriters Laboratories approved for the service intended and shall meet MSS #SP-58-2009 & 69-2009, and 2008 SMACNA guidelines for Seismic restraints of mechanical systems.
- C. Adhesives are not acceptable as mounting or supporting devices.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Mechanical General Provisions, See Section 23 01 01.
- B. Basic Materials and Methods, Section 23 01 05.

PART 2 - PRODUCTS:

2.1 HANGERS:

- A. Use adjustable swivel ring band type for pipe 2-1/2" and smaller, except C.I. For pipe 3" and larger and for cast iron pipe, unless otherwise noted, use adjustable steel, clevis type.
- B. At each hanger on insulated pipe provide: (1) pipe covering protection saddles on hot lines and (2) insulation shields on cold lines.
- C. Shields/saddles to be 16 gauge, minimum 120° saddles arc with the following minimum saddle lengths:

<u>PIPE SIZE</u>	<u>MINIMUM SADDLE LENGTH</u>
1	12"
2	12"
3	12"
4	12"
6	18"
8 & Greater	20"

- D. Hanger surface material shall be such that there will be no possibility of electrolytic corrosion between hanger and pipe.

- E. Anchors requiring explosive charges **shall not be used**. Phillips "Red-head" shields can be used for loads under 300 lbs.

2.2 BASES:

- A. On motor-driven equipment, where motor is not directly mounted on driven equipment, provide a structural steel base, reinforced to prevent flexure, which shall support both the equipment and the motor.
- B. Provide bolts, inserts, pipe stands, brackets and accessories to distribute loads over building structure.

2.3 SLIDE BEARINGS:

- A. Slide bearings shall consist of 2 elements each made of 3/32" thick, 100% virgin tetrafluorethylene polymer and reinforcing aggregates pre-bonded to a steel backing. Principal aggregates material shall be ground glass fibers. Bonding material shall be heat-cured, high temperature epoxy capable of -320° F. to + 500° F temperatures. The coefficient of static friction of material to itself shall not exceed 0.902".

PART 3 - EXECUTION:

3.1 HORIZONTAL PIPING SUPPORT SCHEDULE:

<u>PIPE SIZE</u>	<u>ROD DIA.</u>	<u>STEEL PIPING MAX. SPACE</u>	<u>COPPER PIPING MAX. SPACE</u>	<u>PVC PIPING MAX. SPACE</u>
Up to 1/2"	1/4"	6'	4'	3-1/2'
3/4" to 1"	3/8"	7'	5'	4'
1-1/4"	3/8"	7'	7'	5'
1-1/2"	3/8"	8'	8'	5'
2"	3/8"	10'	8'	5'
2-1/2"	1/2"	11'	9'	6'
3"	1/2"	12'	10'	6'
4"	5/8"	14'	11'	6-1/2'
6"	3/4"	17'	--	7-1/2'
8"	7/8"	19'	--	8'
10"	7/8"	20'	--	8-1/2'
12"	1"	22'	--	9-1/2'
16"	1-1/8"	26'	--	--
18"	1-1/4"	28'	--	--
20"	1-1/4"	30'	--	--
24"	1-1/2"	32'	--	--

3.2 METHOD:

- A. Support horizontal cast iron pipe with hanger, or pier, located close to the hub; use one support for each pipe length, or every other joint, whichever is closer.
- B. Provide hanger within 18" of each elbow, also provide hanger within 18" of connection to each piece of equipment.
- C. Support vertical pipe at base and at each floor. In addition, 1" or smaller copper pipe shall be supported at 5-foot intervals.
- D. Support hubless cast iron at every length near fitting. Where maintenance requirements may impose torque, as at a cleanout, support on both sides of torque point.
- E. When supporting PVC pipe, provide 18 ga. 12" long shield at each hanger.
- F. Pipes passing thru walls shall not bear on building construction.
- G. Hangers shall be sized to fit outside diameter of insulation and shield/saddle. Provide shields at each hanger. On 2½" and larger pipe, provide an "insert" 18" longer than the shield/saddle specified above; use Foamglass or calcium silicate or polyurethane foam with a jacket (same as insulation) on the "run" of the pipe. Hanger shall not bear on insulation.
- H. All floor-mounted equipment shall be mounted on a reinforced concrete base covering the complete floor area of equipment. This concrete base shall be 4" high and shall extend 6" beyond the equipment on all sides. The concrete base shall be doweled into the building concrete slab. Provide all necessary anchor bolts and templates. Provide 1/4" thick layer of non-shrinking grout between floor-mounted machinery and concrete pad. Where equipment mounts on structural steel, provide shims. Chamfer each edge a minimum of 3/4" x 3/4".
- I. Any piece of equipment installed in a finished ceiling, or wall area, shall be supported independently of the building finish. Ceiling-mounted items shall be supported directly from the building structure.
- J. Suspended equipment shall be supported from building structure by adjustable rods.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION OF HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

PART 2 - PRODUCTS:

Not used.

PART 3 - EXECUTION:

3.1 IDENTIFICATION:

- A. Identify all pipe by providing colored pipe markers, identifying the piping using flow arrows and colored bands: (1) in all accessible locations at 20 ft. intervals, (2) at each valve, (3) at each branch takeoff point, and (4) where a pipe leaves or enters a wall or floor so that lines may be traced from start to finish. Pipe labels and bands shall be snap on or strap on "setmark" as manufactured by Seton Name Plate Corporation, New Haven, Connecticut 06519, or approved equivalent meeting this level of quality. Identification colors, legend, letter sizes shall conform to ANSI and/or OSHA specifications.
- B. Identify all major items of equipment, including control panels and associated starters, switches, relays, etc. by 2-1/2" x 3/4" metal nameplates. Secure with screws or brads, adhesives alone are not acceptable. Nameplates after installation shall be easily visible and shall bear notations corresponding to those shown on record drawings.
- C. Identify location of outside underground piping by: 4"x4"x18" concrete stakes, flush with finish grade, located above lines at ends and/or corners, and by 2"x2" brass plates imbedded in building walls above pipes. On stakes provide plate secured to post indicating size and type of line below, along with depth of pipe below grade.
- D. Contractor shall mark the location of each duct smoke detector and all fire dampers. The mark shall consist of red marking tape acceptable to the Architect location on the ceiling grid at the location of each device.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL:

1.1 RELATED DOCUMENTS:

- A. All division 23 specification sections, drawings, and general provisions of the contract apply to work of this section, as do other documents referred to in this section.

1.2 SCOPE OF WORK:

- A. The mechanical contractor will contract with an independent testing, adjusting, and balancing (TAB) agency to test, adjust, and balance the HVAC systems.
- B. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results.
- C. The items requiring testing, adjusting, and balancing include the following:

AIR SYSTEMS:

Supply Fan AHU
Return Fans
Relief Fans
Exhaust Fans
Zone Branch & Main Ducts
VAV Systems
Diffusers, Registers & Grilles
Coils (Air Temperatures & Air Pressure Drops)
Air Flow Stations

HYDRONIC SYSTEMS:

Pumps
System Mains & Branches
Chillers
Cooling Towers
Boilers
Heat Exchangers
Coils
Circuit Setters

1.3 DEFINITIONS, REFERENCES, STANDARDS:

- A. All work shall be in accordance with the latest edition of the AABC National Standards, NEBB or SMACNA Standards for field measurement. If these contract documents set forth more stringent requirements than the AABC National Standards, these contract documents shall prevail.

1.4 QUALIFICATIONS:

- A. Agency Qualifications: The TAB Agency shall be a current member of the Associated Air Balance Council (AABC), National Environmental Balancing Bureau, or certified by Environmental Consultants as a Senior TAB Technician.
- B. Instrumentation, Total System Balance, Test and Balance technicians shall be full time employees of the selected balancing agency. Senior technicians shall have a minimum of five (5) years field experience and related formal training. The ratio of senior technicians to apprentice/associate technician shall not be less than one to one.

1.5 SUBMITTALS:

- A. Qualifications: The TAB agency shall submit a company resume listing personnel and project experience in air and hydronic system balancing and a copy of the agency's test and balance engineer (TBE) certificate.
- B. Procedures and Agenda: The TAB agency shall submit the TAB procedures and agenda proposed to be used.
- C. Sample Forms: The TAB agency shall submit sample forms, which shall include the minimum data required by the AABC National Standards.

1.6 TAB PREPARATION AND COORDINATION:

- A. The TAB agency shall review the project documents and contractor submittals for their affect on the TAB process and overall performance of the HVAC system within thirty (30) days after contract award to the mechanical contractor. The TAB agency shall submit recommendations for enhancements or changes to the engineer in writing.
- B. Shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work shall be provided to the TAB agency by the mechanical contractor no later than 30 days prior to the start of TAB work.
- C. System installation and equipment startup shall be complete prior to the TAB agency's being notified to begin.
- D. The building control system shall be complete and operational. The Building Control System contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution.
- E. All test points, balancing devices, identification tags, etc. shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.
- F. Qualified installation or startup personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.

1.7 REPORTS:

- A. Final TAB Report - The TAB agency shall submit the final TAB report for review by the engineer. All outlets, devices, HVAC equipment, etc., shall be identified, along with a numbering

system corresponding to report unit identification. The TAB agency shall submit an AABC "National Project Performance Guaranty" assuring that the project systems were tested, adjusted and balanced in accordance with the project specifications.

B. Upon approval, submit three (3) copies of the final report to the engineer.

C. General:

State method of measurement in report for each measurement.

Report should include pump curves, fan curves, balance valve schedule with settings and flow charts, balance damper schedule with settings and flow charts, VAV box flow charts, AHU flow charts, all heat exchanger performance charts and actual delta P, equipment pressure drop from manufacturers data on **installed** equipment at design flow.

1.8 DEFICIENCIES:

A. Any deficiencies in the installation or performance of a system or component observed by the TAB agency shall be brought to the attention of the appropriate mechanical contractor and the engineer.

B. The work necessary to correct items on the deficiency listing shall be performed and verified by the mechanical contractor before the TAB agency returns to retest. Unresolved deficiencies shall be noted in the final report.

C. All deficiencies shall be submitted to the engineer under separate cover letter entitled, "System Deficiencies."

PART 2 - INSTRUMENTATION

2.1 All instruments used for measurements must have been calibrated within a period of six (6) months prior to use. Calibration and maintenance of all instruments shall be in accordance with the requirements of AABC National Standards. All final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration, and who performed calibration.

PART 3 - EXECUTION:

3.1 GENERAL:

A. The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be + or - 10% except for NC levels where there is to be zero (0) tolerance unless otherwise stated.

B. Equipment settings, including manual damper quadrant positions, manual valve indicators, and similar controls and devices shall be marked to show final settings.

C. All information necessary to complete a proper TAB project and report shall be per AABC standards unless otherwise noted. The descriptions for work required, as listed in this section, are a guide to the minimum information needed.

D. Test all heating, cooling and ventilating equipment. When installation is complete, all equipment shall be tested for proper operation and functioning in accordance with the contract documents.

1. All equipment, motors, fans, etc., shall run at their required speed and be free from excessive vibration and noise. No bearings, journals, or any part of the motors shall heat to a temperature in excess of 40°C. above the temperature of the surrounding air.

3.2 AIR SYSTEMS:

- A. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set in the full open position. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards:
 1. For supply fans:
 - a. Fan speeds - Test and adjust fan RPM to achieve maximum or design CFM.
 - b. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
 - c. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main supply and return ducts, as applicable to obtain total CFM.
 - d. Outside Air - Test and adjust the outside air on applicable equipment using a Pitot-tube traverse. If a traverse is not practical use the mixed-air temperature method if the inside and outside temperature difference is at least 20 degrees Fahrenheit or use the difference between Pitot- tube traverses of the supply and return air ducts.
 - e. Static Pressure - Test and record system static profile of each supply fan.
 2. For exhaust, return, and relief fans:
 - a. Fan speeds - Test and adjust fan RPM to achieve maximum or design CFM.
 - b. Current and Voltage – Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
 - c. Pitot-Tube Traverse – Perform a Pitot-tube traverse of the main return ducts to obtain total CFM.
 - d. Static Pressure – Test and record system static profile of each return fan.
 3. For zone, branch and main ducts:
 - a. Adjust ducts to within design CFM requirements. As applicable, at least one zone-balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
 4. For diffusers, registers and grilles:
 - a. Tolerances - Test, adjust, and balance each diffuser, grille, and register to within 10% of design requirements. Minimize drafts.
 - b. Identification - Identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.
 5. For VAV Systems:
 - a. Set volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.
 - b. Identification – Identify the type, location, and size of each terminal box. This information shall be recorded on terminal box data sheets.
 6. For Coils:
 - a. Air Temperature – Once air flows are set to acceptable limits, take wet bulb and dry bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side

- of each heating coil.
- b. Air Pressure Drop – Test and record air pressure drop across each coil (cooling coil when wet).
- c. Records on coil data sheets.

3.3 HYDRONIC SYSTEMS:

- A. The TAB agency shall, as applicable, confirm that all hydronic equipment, piping and coils have been filled and purged; that strainers have been cleaned; and that all balancing valves (except bypass valves) are set full open. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards:
 - 1. For pumps:
 - a. Test and adjust chilled water, hot water and condenser water pumps to achieve maximum or design GPM. Check pumps for proper operation. Pumps shall be free of vibration and cavitation. Record appropriate gauge readings for final TDH and Block-Off/Dead head calculations.
 - b. Current and Voltage – Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.
 - 2. For system mains and branches:
 - a. Adjust water flow in pipes to achieve maximum or design GPM.
 - 3. For chillers:
 - a. Verify that chillers have been started by others and are in operation. Test and adjust chiller water flows to achieve maximum or design GPM.
 - b. Current and Voltage – Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure compressor motor is not in or above the service factor.
 - c. Test and record temperature profiles of chillers.
 - 4. For cooling towers:
 - a. Verify that cooling towers have been filled and started by others and are in operation.
 - b. Test and adjust water flows to balance tower cells and flows between towers.
 - c. Test and record temperature profiles for water and air side operation.
 - 5. For boilers:
 - a. Verify that boilers have been filled and started by others, and are in operation.
 - b. Current and Voltage – As applicable, test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
 - 6. For heat exchangers:
 - a. Verify that heat exchangers have been filled and started by others and are in operation.
 - b. Test and adjust water flow through heat exchangers.
 - c. Test and record temperature and pressure profiles of water or steam heat exchangers.
 - 7. For coils:
 - a. Tolerances: Test, adjust and balance all chilled-water and hot-water coils within 10% of design requirements.
 - b. Verification: Verify the type, location, final pressure drop and GPM of each coil. This information shall be recorded on coil data sheets.

3.4 SOUND TESTING:

- A. The TAB agency shall conduct sound testing in the following areas per AABC National Standards and to the criteria listed, using sound meet with octave band analyzer:

TEST AREA	NUMBER OF NC LEVEL	
	LOCATIONS	ACCEPTABLE
General Office	1	30-35
Executive Offices	1	25-30

Computer/Equipment Rooms	1	40-45
Hospitals	1	30-40
Churches	1	25-30
Libraries	1	35-40
Schools/Classrooms	1	25-30
Auditoriums	All	20-29
Projection Rooms	1	25-30
Theater Public Access	All	25-33

3.5 VIBRATION TESTING:

- A. The TAB agency shall conduct vibration testing on the following equipment per AABC National Standards. Test deflection in mils and velocity in inches per second shall be measured and the result compared to requirements in equipment specification sections.

Equipment:

Fans over ½ horsepower
Pumps over 3.0 horsepower
Compressors

3.6 INDOOR AIR QUALITY VERIFICATION:

- A. The TAB agency shall take measurements at design outside air. It shall measure temperature and humidity uniformity throughout the space, check filter installation for proper fit, seal and operation, and verify condensate drain operation. The TAB agency shall note any water damage or obvious contamination sources from inside or outside.
- B. The Tab agency shall conduct the following air sampling tests for every 2,500 square feet of space.
1. Carbon Dioxide
 2. Carbon Monoxide
 3. Ozone
 4. Nitrogen Oxides
 5. Formaldehyde
- C. The TAB agency shall prepare a report showing the results, location, time and date of each test. A summary of the HVAC operating conditions, and a listing of any discrepancies shall be provided.
- D. All IAQ readings are applicable only to the date and time noted in 3.06C.

3.7 ADDITIONAL TAB REQUIREMENTS:

- A. Job Site Inspections:

During construction, the TAB agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems. Inspections shall be conducted a minimum of two times.

(Typically, these are performed when 60% of the total system is installed and again when 90% of the total system is installed, prior to insulation of the duct and piping). The TAB agency shall submit a written report of each inspection to the engineer.

- B. Duct Leakage Testing:

The mechanical contractor shall isolate and seal sections of ductwork for testing. The test

pressures shall be at the full operating pressure of the fan system unless otherwise specified in the appropriate duct classification section. The testing shall be done in sections. All testing shall be based on one test per section only unless otherwise noted.

C. Verification of HVAC Controls:

The TAB agency shall be assisted by the building control systems contractor in verifying the operation and calibration of all HVAC and temperature control systems. The following tests shall be conducted:

1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water resets, fire and freeze stats, and other safety devices.
2. Verify that all controlling instruments are calibrated and set for design operating conditions.

D. Temperature Testing:

To verify system control and operation, a series of three temperature tests shall be taken at approximately two-hour intervals in each separately controlled zone. The resulting temperatures shall not vary more than two degrees Fahrenheit from the thermostat or control set point during the tests. Outside temperature and humidity shall also be recorded during the testing periods.

E. TAB Report Verification:

At the time of final inspection, the TAB agency may be required to recheck, in the presence of the owner's representative, specific or random selections of data recorded in the certified report. Points and areas for recheck shall be selected by the owner's representative. Measurements and test procedures shall be the same as approved for the initial work for the certified report. Selections for recheck, specific plus random, will not exceed 10% of the total number tabulated in the report.

F. Fume Hood Testing:

The TAB agency shall test and adjust fume hood total airflow by duct Pitot-tube traverse. If a Pitot-tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Test and record face velocities under design operating conditions using a maximum of a one square foot grid pattern across the entire open face. The TAB agency shall set sash height on hoods to obtain face velocities within 20% of 100 feet per minute unless specified otherwise. It shall test and adjust VAV controllers to obtain design exhaust airflows and make-up air flows to maintain design hood pressures and face velocities, and design room pressurization. The TAB agency shall test for turbulence and proper air flow patterns at the face and inside the hoods using a hand-held smoke puffer or other approved smoke-emitting device.

- G. The TAB agency shall test and adjust kitchen hood total air flow by duct Pilot-tube traverse if applicable under local code. All sealing of test holes in the exhaust duct to be by the mechanical contractor per local code requirements. The TAB agency shall test and record face velocities in accordance with design requirements. It shall test and adjust makeup air flow (if included) to meet design face velocities and pressurization and to minimize turbulence.

H. Building/Zone Pressurization:

The TAB agency shall test and adjust building/zone pressurization by setting the design flows to meet the required flow direction and pressure differential. For positive pressure areas, it shall set the supply air to design flow and gradually reduce the exhaust air rate to obtain the required flow or pressure difference. For negative pressure areas, it shall set the supply air to design flow, and

gradually increase the exhaust air rate to obtain the required flow or pressure difference.

I. Stairwell Pressurization:

The TAB agency shall test and adjust stairwell pressurization system to provide design air flow into the stairwell and set reliefs to maintain required pressurization. When required by the local authority, it shall check door pull force on all exit doors to specified requirements.

J. Fire and Smoke Testing:

The TAB agency shall test fire/smoke dampers to assure operation. It shall verify that an access door has been installed for each fire and smoke damper. For fire dampers, the TAB agency shall open the access door, disconnect the fusible link, and allow the damper to close. Operation should be smooth and the damper must close completely. The TAB agency shall then reset the damper. For the smoke damper, the TAB agency shall open the access door, activate the damper, and observe operation. The damper must close quickly and completely. The TAB agency shall then reset the damper and observe its complete opening.

K. Smoke Evacuation:

The TAB agency shall test smoke evacuation by activating the system either manually, or at the direction of the owner and local authority by the introduction of test smoke. As determined by design and test requirements, it shall observe and record system performance by time of smoke removal, pressurization readings, or duct Pilot-tube traverse.

L. Life Safety Controls:

The TAB agency shall test and record life safety control operation on the HVAC equipment. It shall verify the installation of required smoke detectors in air handling equipment (AHE), and shall verify operation of the smoke detector by activating the smoke detector and observing air handler shutdown. With the controls and alarm contractors, the TAB agency shall verify the operation of interconnected systems such as the AHE smoke detector's activation of the fire alarm system and the alarm system's activation of the life safety control sequences.

3.8 EXTENDED WARRANTY:

- A. Test and Balancing Agency shall include an extended warranty of 90 days, after completion of test and balance work, during which time the Engineer at his discretion may request a recheck on resetting of any outlet, supply air fan, exhaust fan, pumps, etc. as listed in test report.
- B. The Agency shall provide technicians to assist the Engineer in making any test he may require during the period of time.

END OF SECTION

SECTION 23 07 16

HVAC EQUIPMENT INSULATION

PART 1 - GENERAL:

1.1 WORK INCLUDED:

- A. Work required under this section consists of insulation for equipment as hereinafter specified.
- B. Certain equipment and/or systems to be factory insulated by manufacturer. Factory insulation materials to be as specified in applicable sections of the specifications.
- C. Thermal resistance "R" values used herein are expressed in units of "Hour degrees F sq. ft/BTU per inch of thickness" on a flat surface at a mean temperature of 75 degrees F, unless specifically noted.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Mechanical General Provisions, Section 23 01 01.
- B. Basic Materials and Methods, Section 23 01 05
- C. HVAC Pumps, Section 23 21 23.
- D. Refrigeration, Section 23 23 23.
- E. HVAC Fans, Section 23 24 00.
- F. Centrifugal Water Chillers, Section 23 64 16.
- G. Steam to Steam Heat Exchange, Section 23 57 13.
- H. Heat Exchangers - Shell and Tube, Section 23 57 16.
- I. Liquid to Liquid Exchanger, Section 23 57 19.
- J. Variable Air Volume Units, Section 23 36 16.
- K. Instrumentation & Control Devices for HVAC, Section 23 09 13.

1.3 CERTIFICATION:

- A. Insulation for equipment coverings, to be certified by manufacturer as having fire hazard classification rating, when tested in accordance with ASTM E 84, NFPA 225 and UL 723, not exceeding the following. "Insulation" to consist of insulating material, fittings, jacket, tapes, mastic, attachments and adhesive, either as a "system" or as an individual component when used separately.
 - 1. Equipment insulation flame spread less than 25, fuel contribution less than 50, and smoke development less than 200. Piping system located inside ceiling plenums or equipment rooms utilized for return air plenums to have maximum smoke development of 50.

2. Flexible tubular elastomeric piping insulation (Rubatex or Armaflex) - flame spread of 25 and smoke development of 200.
- B. Equipment for above grade exposed to weather outside building, insulation to be certified as being self-extinguishing for 1" thickness in less than 53 seconds when tested in accordance with ASTM D1692.

1.4 MATERIALS FOR PIPE AND EQUIPMENT:

- A. Provide factory pre-molded, segment type insulation for pipe, pipefittings, and valves, unless hereinbefore exempted. Fitting insulation to be of same thickness and material as adjoining pipe insulation.

PART 2 - PRODUCTS:

2.1 GLASS FIBER:

- A. Provide factory-formed, factory-jacketed "system" type conforming strictly to fire-resistive qualities hereinbefore specified in ""Certification" paragraph. Jacket to be ASJ-SSL factory applied reinforced with vapor barrier. System" density to be not less than 4 pounds per cubic foot. Product must be guaranteed by manufacturer to have continuous operational temperature limit of not less than 500 degrees F and a minimum "R" value of 4.00. All service jacket to be fiberglass reinforced white Kraft paper with aluminum foil. Provide insulation for following services:
1. Heat recovery-piping systems - 1-1/2" thick.
 2. Chilled water pump, casings - 1" thick.

2.2 CALCIUM SILICATE:

- A. Provide noncombustible hydrous calcium silicate, minimum density of 12 pounds per cubic foot meeting MIL-Spec #MIL-I-2781D. Product must be guaranteed by manufacturer to have continuous operational temperature limit of not less than 1500 degrees F and a minimum "R" value of 2.63. Straight pipe insulation to be factory formed; large pipe, vessel, duct and irregular surface insulation to be field lagging type. Insulation jacket to be 0.016" embossed aluminum. Use only on lines not exposed to moisture or weather. Provide insulation for the following services:
1. Emergency generator exhaust system and muffler - 4" thick.
 2. Flash tank and deaerator - 2" thick
 3. Heat exchanger - 3" thick

2.3 FLEXIBLE HIGH TEMPERATURE BLANKET:

- A. Provide noncombustible highly vibration-resistant glass fiber mat type, maximum density of 11 pounds per cubic foot meeting Fed. #I-558A and rated for continuous operating temperature of minimum 1200 degrees F., and having a minimum "R" value of 2.78 at 400 degrees F mean temperature completely enclosed in non combustible woven glass cloth removable and replaceable envelope. Provide insulation for the following:
1. Cooking hood exhaust duct - 1-1/2" thick.
 2. Emergency generator flexible connections and exhaust pipe inside building - 2-1/2" thick.
 3. Boiler breeching - 3" thick.
 4. Metal stack to HEIGHT shown - 3" thick.

2.4 FIBERGLASS BOARD FOR EQUIPMENT:

- A. Provide 3.0 pounds per cubic foot density unfaced fiberglass board with a FSK finish. Provide this insulation for the following:

1. Hot water air separator - 2" thick
2. Hot water expansion tank - 2" thick
3. Hot water pumps including flanges - 2" thick
4. Flash tank and deaerator - 2" thick
5. Cascade heater - 2-1/2" thick
6. Heat exchanger - 2-1/2" thick
7. Condensate receiver pumps - 2" thick

2.5 FIBERGLASS BOARD TYPE FOR DUCTS:

- A. Provide minimum 6 pound per cubic foot density semi-rigid, factory-reinforced foil faced Kraft vapor barrier glass fiberboard "system" type insulation with FSK jacket, having a minimum "R" value of 4.34. Insulation to conform strictly to fire-resistive qualities hereinbefore specified in "Certification" paragraph. Provide insulation for following:
1. Apparatus casing - 1-1/2" thick

2.6 FLEXIBLE SHEET ELASTOMERIC:

- A. Provide closed-cell flexible sheet type, having a minimum "R" 3.57.
1. Exterior surfaces of water chillers - 1" thick.
 2. Exterior surfaces of chilled water pumps - 3/4" thick.
 3. CW expansion tanks, air separator including flanges - 3/4" thick.

2.7 MATERIAL FOR NOISE INSULATION:

- A. Provide a dampening compound to reduce movement and noise generated by vibration of sheet metal. Compound to be noncombustible, have a smooth finish, be receptive to painting, and have a vibration decay rate of not less than 35 decibels per second.
1. Provide at locations as described under execution.

2.8 MATERIALS FOR FITTINGS, VALVES AND SPECIAL COVERINGS:

- A. Provide coverings and finishes for specific items hereinafter specified.
1. Provide factory pre-molded glass fiber fitting covers, matching basic insulation, equivalent to those manufactured by Hamfab, for all insulated pipe fittings (elbows, tees, etc.) and finished with glass fabric and vapor barrier mastic. Glass fiber blanket inserts with PVC covers are not acceptable for pipe fitting insulation. Shop or site segment mitered fittings are acceptable for fittings 8" and larger."
 2. For pipe fittings, valves, strainers, air separators and other irregular surfaces, in systems operating below 70 degrees F., when inside building or in equipment rooms, insulate with glass fiber of same thickness as adjoining pipe and cover insulation with white colored woven glass fabric imbedded in vapor barrier coating Foster 30-36 or equal.
 3. Cover chilled water pumps with custom made (field measurable) removable and reusable insulation covers as manufactured by Berry Soft Pack Fabricators, consisting of an outer layer of fiberglass cloth, 1/2" thick glass fiber, and an inner layer of fiberglass cloth.
 4. For flexible tubular elastomeric pipe and fitting insulation when exposed-to-view outside of building, cover with 1/16" applications for factory-mixed fibrated cutback vapor barrier asphalt, having one wrapping of woven glass fabric embedded in first coat. Finish to match surrounding surfaces using non-bleed color coat.
 5. For kitchen range exhaust duct insulation, when concealed from normal view within building and in equipment rooms, finish with woven wire mesh wrap and one 1/2" thick coat of insulating cement, troweled smooth.
 6. Where "pins and washers" are specified use welded copper plated, spotter pins, grooved for holding "stop-clips".

PART 3 - EXECUTION:

3.1 GENERAL:

- A. All surfaces to be cleaned of grease, dirt, dust, scale and dry when covering is applied. Covering to be dry when installed and before and during application of any finish, unless such finish requires specifically a wetted surface for application.
- B. All adhesive, cements and mastics to be compatible with materials applied and shall not attack materials in either wet or dry state.
- C. Install all insulation products in strict accordance with manufacturer's instructions using professional insulators who have adequate experience and ability.
- D. Exposed to view insulation shall have a well-tailored appearance.
- E. All items requiring service such as strainers, balancing valves, etc. provide removable insulation caps of insulation equal in thickness to pipe covering.
- F. See General Provisions for sleeves and insulation requirements.
- G. Adhere flexible elastomeric sheet insulation to sheet metal ducts or equipment by compression fit method and full coverage of air-drying contact adhesive. Seal butt joints with same adhesive. Apply same insulation and adhesive on standing metal seams for full height coverage as on duct or equipment surface.

3.2 INSTALLATION OF PIPE AND EQUIPMENT COVERING:

- A. Apply foamed cellular glass insulation to equipment, pipe and fittings with all joints tightly fitted to eliminate voids. Seal all joints using equivalent of Foster No. 95-44 mastic. Do not fill voids with joint sealer.
- B. Apply flexible tubular elastomeric insulation to pipe and fittings with all joints tightly fitted and sealed with adhesive and tape. Longitudinally split insulation will not be acceptable unless specifically approved in writing by Engineer. Fittings, valves etc. shall be insulated by mitering or nesting, sizes together to properly insulate the joint. Insulation shall not be slipped and bent around elbows, but shall be mitered. At tees and valves insulation shall be slit and slipped around the pipes. Insulation exposed to weather shall be finished with 2 coats of weatherproof finish.
- C. Fabricate and install readily removable insulation caps to facilitate service and maintenance accessibility to all valves, strainers, etc. in systems operating below 70 degrees F., such as refrigerant suction lines, chilled and dual chilled/hot water system. Material for caps to be either cellular glass or rigid cellular plastic and of same thickness as adjoining pipe covering.
- D. All valves, including body bonnet, flanges, gearboxes strainer, fittings, etc. shall be insulated with same type and thickness of insulation as adjoining piping.

3.3 INSTALLATION OF EQUIPMENT COVERING:

- A. Apply calcium silicate covering to ducts and breeching in 2" thick layers with blocks tightly butted, joints broken. Secure with 16-gauge copper wire and/or stainless steel bands. Finish

with a coat of insulating cement as hereinbefore specified. Apply same insulation and thickness

to all duct or breeching hangers at least 12" up or to supporting structure. Double insulate duct or breeching when passing through floor or roof slab.

- B. Cooking hood exhaust duct insulation shall be secured with stainless steel wire and then covered with 22 ga. sheet metal jacket.

3.4 EQUIPMENT INSTALLATION:

- A. On heated equipment, insulation shall be as follows: (1) cut or miter insulation to fit, (2) band in place with 3/4" x 0.015" galvanized steel bands on 12" centers, on irregular surfaces secure insulation on welded fasteners. Point up all joints with insulating cement. All voids between irregular surfaces and insulation shall be packed with light density glass fiber impaled over welded pins on 12 centers and secured in place with speed washers.
- B. Exterior surfaces of chilled equipment shall have sheet insulation fitted and adhered in place using rubber-based adhesive. Surface shall be finished using adhesive as required to thoroughly seal all joints.
- C. Insulation noted to receive plaster finish shall be finished with 2-1/4" thick coats of cement plaster, reinforced with 12" poultry wire netting. The final coat shall be mixed with Portland cement, and troweled to a neat uniform finish. Corner beads shall be used on all edges. Finish shall be neatly beveled at all access doors, flexible connections, and where the insulation terminates.
- D. Boiler Breeching Insulation: Boiler breeching insulation shall be held in place with 3/4" metal bands on 12" centers. Lace metal edges together with #16 galvanized annealed wire. Note that the 3/4" metal rib goes against the hot surface. Finish the insulation as specified for boiler shells. Finish with a 1/2" coat of insulating cement. After cement is dry, apply a resin base lagging adhesive and 8 oz. canvas finished with a final brush coat of lagging adhesive.

3.5 INSULATION OF REFRIGERATED WALK-IN BOX PENETRATIONS:

- A. Insulate all piping conduit and support hanger penetrations, through box ceiling, walls and partitions, using foamed-in-place polyurethane. Finish penetration points using two-piece locking (overlapping) escutcheons fabricated from same quality metal as adjoining surface, and fix in place with galvanized sheet metal screws.
- B. Insulate the following, from the finished external escutcheon plate for a distance of 48" or to its natural end, using 3/4" thick elastomeric pipe insulation, being careful to maintain the integrity of the vapor barrier:
 - 1. Exterior of electrical conduits.
 - 2. Meet rail support hangers
 - 3. Refrigerant liquid lines.
 - 4. Condensate drain piping
- C. Refer to previously specified refrigerant section and hot gas line piping insulation.

END OF SECTION

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 - GENERAL:

1.1 DESCRIPTION:

- A. Commissioning: Commissioning is a systematic process that helps ensure that all building systems perform interactively in accordance with the design intent and the owner's operational needs. This is achieved by implementing commissioning procedures beginning in the project's design phase; by documenting the design intent; and by continuing the commissioning procedures throughout the construction, acceptance, and warranty phases, conducting actual equipment / system performance verification. The commissioning process shall encompass, coordinate and / or help oversee the traditionally separate functions of: system documentation; equipment start up/checkout; control system calibration and point to point (PTP) checkout; testing and balancing; field functional performance testing / performance verification; and owner training.
- B. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning facility.
- C. Abbreviations: The following are common abbreviations used in these specifications and in the Commissioning Plan.
- | | | |
|-----|------------------|--|
| 1. | A/E | Architect / Engineer |
| 2. | CA | Commissioning Authority |
| 3. | CC | Controls Contractor |
| 4. | CM/GC | Construction Manager / General Contractor |
| 5. | Cx | Commissioning |
| 6. | Cx Plan | Commissioning Plan document |
| 7. | EC | Electrical Contractor |
| 8. | ES | Equipment Supplier |
| 9. | FIT | Functional Interface Test |
| 10. | FPT | Functional Performance Test |
| 11. | IETA | Independent Electrical Testing Agency |
| 12. | MC | Mechanical Contractor |
| 13. | PM | Owner's Project Manager (i.e. client) |
| 14. | EMD | Owner's Engineering Maintenance Director |
| 15. | PTP Verification | Point to point Verification |
| 16. | Subs | Subcontractors to CM/GC |
| 17. | TAB | Test and Balance |
| 18. | CT | Commissioning Team = CA, PM, EMD, CM/GC, A/E, MC, CC, EC, TAB Agency & IETA) |
- D. The Cx firm shall be a totally independent testing organization, with no corporate affiliation with any MC, CM/GC, CC or A/E firm, who specializes in independent testing / verification of HVAC / mechanical and electrical systems. The Cx firm shall carry professional liability insurance and shall employ both mechanical and electrical, graduate engineers, as well as Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) certified field-testing engineers. The Cx firm's principal CA shall be a registered professional engineer, with a minimum 20 years HVAC / mechanical design, Cx and field-testing experience.

1.2 COORDINATION:

- A. Commissioning Team (CT): The make-up of the Cx team shall be as follows: the commissioning authority (CA); the owner's construction representative or construction manager (CM/GC); the owner's project manager (PM); the architect and design engineers (A/E); the mechanical contractor (MC); the electrical contractor (EC); the TAB agency; the independent electrical testing agency (IETA); the controls contractor (CC); and any other applicable installing subcontractor or supplier of equipment. Also, if known, the owner's engineering maintenance director (EMD) shall also be considered a member of the Cx team.
- B. Management: The CA shall be either contracted directly by the owner, or by the owner's designated representative. The CA shall direct and coordinate the project Cx activities. All CT members shall work together as a unit to fulfill both their Cx responsibilities (as described herein, and in the Cx Plan) and their individually contracted responsibilities in order to meet the objectives of the Contract Documents, and the stated design intent.
- C. Scheduling: The CA shall work with the PM and CM/GC according to established protocols to schedule the Cx activities. The CA will provide sufficient notice to the CM/GC and PM for scheduling Cx activities. The CM/GC will integrate all Cx activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the Cx process. The CA will provide the initial schedule of milestone Cx events (on a percent project completion basis) at the Cx kickoff or scoping meeting, and the preliminary Cx Plan shall provide a format for implementing this schedule. As construction progresses, more detailed schedules will be developed by the CA and updated and submitted to the CM/GC, via revisions of the Preliminary Cx Plan.

1.3 COMMISSIONING PROCESS:

- A. Cx Plan: The purpose of the Cx plan shall be to provide guidance in the execution of the Cx process. A preliminary Cx Plan shall be provided at, or before, the initial Cx scoping meeting. The CA will update the Cx plan periodically as the project progresses, issuing a final Cx plan just prior to the start of acceptance phase testing. In the event of conflicts between the Cx Plan and Project Specifications, Project Specifications shall take precedence.
- B. Cx Process: The following is a brief overview of typical Cx tasks.
 - 1. Cx begins during the design phase and the CA shall participate in both reviews of design concept and intent, and later, the actual design documents.
 - 2. Cx during the construction phase shall begin with the initial Cx scoping meeting, which shall be conducted by the CA. During this meeting, the CA shall review the Cx process with the CT members, and distribute the preliminary Cx Plan.
 - 3. The CA shall periodically attend, as needed, regularly scheduled (by CM/GC) construction meetings throughout the construction phase in order to keep CT members apprised of: Cx process milestones and scoping / coordination issues; scheduling of Cx activities; and status / resolution of identified deficiencies and miscellaneous issues.
 - 4. Mechanical & electrical equipment / system submittals & documentation shall be submitted to the CA, during the normal submittal review process, for purposes of a concurrent review. Where applicable, submittals shall include detailed start up and checkout procedures.
 - 5. The CA shall work with the CT and applicable Subs in developing start up plans and start up documentation formats, including providing the Subs with sample prefunctional checklists (PCs), via the Cx Plan, to be completed during the start up process and submitted prior to the beginning of the TAB or IETA fieldwork.
 - 6. In general, Cx checkout and performance verification procedures shall proceed from component level to system level to inter-system level. Various equipment / system PCs shall be completed prior to the start of TAB or IETA fieldwork or functional performance testing.

7. The Subs, under their own initiative, shall execute equipment / system PCs and perform start up on equipment they have installed, but shall provide the CT with a tentative schedule prior to commencing these activities. The CA shall randomly witness equipment / system start up with appropriate personnel and document whether or not checklists and start up procedures have been completed in a satisfactory manner, and in accordance with the project documents.
8. The TAB agency shall be released on a system-by-system basis to begin TAB fieldwork, after signed & certified PCs have been received by the CT, from the installing contractor, for the applicable system.
9. At the completion of the TAB or IETA fieldwork, the Cx authority shall conduct a final TAB report verification on randomly selected systems. The CA shall randomly select a maximum of 25% of the final TAB report data for purposes of verification. If 10% or more of the retested items are found to be plus or minus 10% or more out-of-tolerance of published final TAB (or IETA) report values, then the TAB agency (or IETA) shall be liable for retesting part or all of the specific system before undergoing further performance verification. However, all out-of-tolerance values identified shall be corrected. The TAB agency (or IETA) shall make an allowance in their contract price for the additional time needed to complete any required retesting.
10. The CA shall, with the assistance of the CT, develop specific equipment and system FPT procedures.
11. The FPT procedures shall be executed by the Subs, under the supervision of the CA.
12. Items of non-compliance in material, installation or setup shall be corrected, and the system re-tested, at the Sub's expense.
13. The CA shall review the O&M documentation for completeness
14. All Cx / FPT procedures shall be completed prior to substantial completion, except for opposed season system checks.
15. The CA shall review, confirm the acceptability of, and help coordinate (together with the CM/GC) the training provided by the Subs and verify that all such training was completed satisfactorily.
16. CA shall issue a complete bound final Cx report to the owner.

1.4 RESPONSIBILITIES:

- A. The responsibilities of various parties in the Cx process (i.e. members of the CT) are described in this section. The project responsibilities of the mechanical contractor, TAB agency and controls contractor are itemized under Divisions 22, 23 & 25, those of the electrical contractor and IETA under Division 26, and those of the other sections where requirements of other divisions are found. It is noted that the services listed for the various CT members (other than the CA) are not provided for under this contract, but have been delineated here to help clarify the Cx process.
- B. Architect (of A/E)
 1. Does not manage the CA's contract; said contract managed directly by owner or owner's designated representative (i.e. owner's PM or program manager, etc.)
 2. Attend the initial Cx scoping meeting and regularly scheduled construction meetings where the CT's attendance has been requested.
 3. Perform normal submittal review, construction observation, as built drawing preparation, O&M manual preparation, etc., as contracted.
 4. Provide any design narrative documentation requested by the CA.
 5. Coordinate resolution of system deficiencies identified during Cx construction and acceptance phases, according to the Contract Documents.
 6. Prepare and submit final as built design intent documentation for inclusion in the Cx Manual. Review and approve the O&M manuals.
 7. Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period Cx.

- C. Mechanical and Electrical Designers/Engineers (of the A/E)
1. Perform normal submittal review, construction observation, as built drawing preparation, etc., as contracted. One site observation should be completed just prior to system start up.
 2. Provide any design narrative and control sequence documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed FPT procedures.
 3. Attend the initial Cx scoping meeting and regularly scheduled construction meetings where the CT's attendance has been requested.
 4. Participate in the resolution of system deficiencies identified during Cx construction and acceptance phases, according to the Contract Documents.
 5. Prepare and submit the final as built design intent and operating parameters documentation for inclusion in the Cx manual. Review and approve the O&M manuals.
 6. Provide a presentation at the first training session for the owner's personnel.
 7. Participate in the resolution of non-conformance and design deficiencies identified during warranty-period Cx.
- D. Cx Authority (CA)
1. The CA is not responsible for design content, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem solving and / or resolving non-conformance or deficiency issues, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CA shall be as follows: develop and coordinate the execution of the Cx plan; review project design documents and equipment submittals; inspect, observe and document the status of the construction as the installation progresses via periodic site inspections and follow-up written inspection reports; conduct performance verification of the final submitted TAB or IETA report; and conduct field FPT of completed HVAC / mechanical and electrical systems to verify compliance with the documented design intent and the Contract Documents. The installing contractors shall provide all applicable tools and/or personnel to start up, checkout and functionally test equipment and systems, except for specified testing with portable data-loggers (if applicable), which shall be supplied and installed by the CA.
 2. The CA shall coordinate and direct the Cx activities in a logical, sequential and efficient manner utilizing its technical expertise as well as the following: consistent test protocols and FPT forms; centralized documentation; clear and regular communications and consultations with all necessary parties (i.e. members of the CT); and periodically updated Cx event schedules.
 3. In conjunction with the CM/GC, coordinate Cx activities among all contractors, sub-trades and equipment suppliers to ensure that Cx activities are being scheduled into the master schedule.
 4. Plan and conduct initial Cx scoping meeting. Attend periodically, as needed, regularly scheduled (by CM/GC) construction meetings throughout the construction phase in order to keep CT members apprised of: Cx process milestones and scoping / coordination issues; scheduling of Cx activities; and status / resolution of identified deficiencies and miscellaneous issues.
 5. Prepare the Cx plan, and ensure its distribution for review and comment.
 6. Revise the Cx plan as required during construction phase.
 7. Request and review additional information required to perform Cx tasks including O&M materials, contractor start up and checkout procedures.
 8. Review and provide written comments on normal contractor submittals applicable to systems being commissioned for compliance with Cx needs concurrent with the A/E reviews.
 9. Write and distribute sample PCs and start up checklists.
 10. Develop start up and initial systems checkout plan with Subs.

11. Perform site visits, as necessary, to observe component and system installations. Attend selected construction and / or job-site planning meetings to obtain information on construction progress. Assist in resolving any discrepancies.
12. Before start up, gather and review the current control sequences and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed FPT procedures.
13. Randomly witness HVAC / mechanical systems piping testing and flushing procedures. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
14. Randomly witness ductwork air leakage testing (DALT) procedures. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
15. Monitor and randomly observe equipment start-ups and initial system operations tests and checks to ensure that all results are documented as the checks are done.
16. Confirm/verify pre-functional tests and start up checklist procedures have been accurately completed.
17. Review TAB execution plan and estimated time.
18. Monitor controls point to point checks done by the controls contractor, and ensure that all results are documented as the checks are done.
19. Perform random functional performance checks of the control system prior to TAB fieldwork being executed, to confirm that CC has implemented acceptable PTP checkout procedures.
20. Review final TAB (or IETA) report and conducts final TAB (or IETA) report performance verification.
21. With necessary assistance and review from installing contractors, write the FPT procedures for equipment and systems. This shall include any energy management control system trending, stand-alone data logger monitoring or manual functional testing, if required. Submit to PM for review and for approval, if required.
22. Direct the contractors to operate equipment and systems as required to ensure that all required FPTs are carried out for verification purposes.
23. Facilitate and oversee the conducting of all FPTs and document the results.
24. Analyze any functional performance trend logs and monitoring data to verify performance.
25. Randomly witness performance testing of smoke control systems and all other owner contracted tests or tests by manufacturer's personnel over which the CA may not have direct control. Document these tests and include this documentation in Cx Record in O&M manuals.
26. Maintain a master deficiency (i.e. Action Item Summary) and resolution log and a separate testing record. Provide the PM with written progress reports and test results with recommended actions and help the PM coordinate the resolution of non-compliance issues and design deficiencies identified during all phases of Cx.
27. Ensure that all required O&M manuals, instructions and demonstrations are provided to the Owner's designated operating staff.
28. Review equipment warranties to ensure that the owner's responsibilities are clearly defined. Verify that installing contractors have maintained appropriate maintenance logs, where applicable, of all interim maintenance tasks performed on all started-up equipment, so that manufacturer's warranties are not voided prior to the equipment being turned over to the owner. Verify that installing contractors' maintenance log is submitted when the equipment is officially released to the owner.
29. Prepare and submit a final Cx Report, which documents all checks and tests done throughout the Cx process, and the results obtained from same.
30. Oversee and confirm acceptability of the training of the owner's operating personnel.
31. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
32. Return to the site at 10-months into the 12-month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Cx. Also, interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under

warranty or under the original construction contract. Assist facility staff in developing reports, documents, and requests for services to remedy outstanding problems.

33. Alternate: Assist in the development of a preventative maintenance plan, a detailed operating plan, an energy and resource management plan, and as built documentation.

E. Owner's Project Manager (PM)

Facilitate the coordination of the Cx work by the CA and with the CM/GC and CA help ensure that Cx activities are being scheduled into the master schedule.

1. Review and approve the final Cx plan.
2. Attend the initial Cx scoping meeting and regularly scheduled construction meetings where the CT's attendance has been requested.
3. Perform the normal review of contractor submittals.
4. Ensure that a copy of all design & construction documents, addenda, change orders and mechanical and electrical equipment / systems submittals and shop drawing related to commissioned equipment has been furnished to the CA for purposes of a concurrent review.
5. Review and approve the FPT procedures submitted by the CA, prior to testing.
6. When necessary, observe and witness installing contractors' execution of PC & equipment start up and FPT of selected equipment.
7. Review Cx progress and submitted deficiency reports.
8. Coordinate the resolution of non-compliance issues and design deficiencies identified in all phases of Cx.
9. Assist the CM/GC in coordinating the training of the owner's personnel.
10. Manage the contract of the A/E, CM/GC and CA.
11. Warranty Period: Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

F. Construction Manager / General Contractor (CM/GC)

1. Participate in the mechanical / electrical systems Cx process by facilitating the coordination of the Cx work with the PM and CA to ensure that Cx activities are being scheduled into the master schedule.
2. Ensure that the various installing contractors perform all assigned Cx responsibilities as specified.
3. Ensure that the TAB agency and independent electrical testing agencies (IETA) perform all assigned Cx responsibilities as specified.
4. Furnish a copy of all design & construction documents, addenda, change orders and mechanical and electrical equipment / systems submittals and shop drawing related to commissioned equipment to the CA for purposes of a concurrent review.
5. Incorporate into each issued purchase order or subcontract, written requirements for submittal data, O&M data, Cx tasks and responsibilities, and owner training requirements.
6. The CM/GC shall facilitate communication among all contractors and suppliers and other CT members, and shall foster the necessary cooperative action. The CM/GC shall attend the initial Cx scoping meeting and as necessary, request the CA's and CT's attendance at applicable regularly scheduled construction meetings to facilitate the Cx process. In addition, the CM/GC shall help ensure that action items arising from meeting discussions are satisfactorily addressed, as required, to enable the Cx process to proceed on schedule.
7. Ensure that all Subs execute their Cx responsibilities according to the Contract Documents and schedule.
8. In the event that any scheduled equipment or system start ups or FPTs are terminated because the CA or the design engineer(s) discover deficient or incomplete work, or due to the non-attendance of required contractor or equipment manufacturer's personnel, the contractor or sub-contractor responsible for the termination shall also be held responsible for paying reasonable costs of time and travel expenses of any or all of the following representatives who were physically present for the purpose of witnessing the start up or the FPT: the CA, the mechanical engineer, the electrical engineer, the owner. The owner

may provide a statement to the general contractor identifying the specific activity that was terminated, the scheduled date, and a list of those in attendance, along with their reasonable time and travel expense costs.

9. Coordinate the training of the owner's personnel.
10. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequence of operation to as built conditions.
11. Warranty Period: Ensure that Subs execute seasonal or deferred FPT, witnessed by the CA, according to the specifications. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as built drawing for applicable issues identified in any seasonal testing.

G. Mechanical Contractor

1. The mechanical contractor's Cx team representative shall have the authority to make decisions on behalf of the mechanical contractor as they relate to the organization and scheduling of Cx. The representative shall help ensure that communications are maintained between Divisions 22, 23 & 25 contractors, equipment suppliers and all other Cx team members. One specific responsibility shall be to attend the initial Cx scoping meeting and all subsequent regularly scheduled construction meetings where the CA's and CT's attendance has been specifically requested. Help ensure that action items arising from mechanical issues are addressed in a timely manner to allow the Cx process to proceed on schedule.
2. Shall ensure that his sub-contractors include in their quotes, the cost of participating in the Cx process as described herein.
3. If applicable (i.e. the controls contractor is a subcontractor under the mechanical contractor), the mechanical contractor shall ensure that the HVAC / mechanical systems controls contractor performs its Cx responsibilities as listed in Section 01 91 13.
4. Provide instruction and demonstrations for the Owner's designated engineering maintenance staff, in conjunction with the Cx authority and the design engineer and with the participation of qualified technicians from major equipment suppliers and the controls contractor.
5. Include specified requirements for submittal data, O&M data and training information in each purchase order or sub-contract written.
6. Ensure cooperation and participation of specialty sub-contractors such as sheet metal, piping, refrigeration, and water treatment as applicable.
7. Ensure participation of major equipment manufacturers in appropriate start up, testing and training activities. In addition, ensure that copies of manufacturers' technician's equipment PCs or startup/checkout paperwork are submitted to the CT for its information and reference.
8. Notify the CA, in writing, a minimum of two weeks in advance of scheduled equipment and system start ups, so that the CA may witness system verifications, and equipment and system start-ups.
9. Provide sufficient personnel to assist the CA as required during system verification and FPT.
10. Prior to mechanical equipment / system start up, inspect, check and confirm the correct and complete installation of all equipment and systems, utilizing either the PCs included in the Cx plan, or an alternate startup checklist approved by the CT. Document the results of all inspections and checks on the checklists and sign them, certifying that startup work has been satisfactorily implemented. If deficient or incomplete work is discovered, ensure corrective action is taken and re-check until the results are satisfactory, and the system is ready for safe start up.
11. If applicable (i.e. the TAB agency is a subcontractor under the mechanical contractor), notify the CA a minimum of two weeks in advance, of the time when TAB fieldwork will begin. Attend the initial TAB scoping meeting for review of the TAB procedures.
12. Provide equipment and systems start up resources as specified and required. If during an attempted equipment or system start up, deficient or incomplete work is discovered that would preclude safe operation, the start up shall be aborted until corrective action has been

taken. Ensure such action is taken and verified before re-scheduling a new start up. Those responsible for deficient or incomplete work will be responsible for all associated costs in accordance with PART 3.06.

13. Implement system functional performance checks in advance, utilizing the sample FPT forms provided in the Cx plan, to ensure that all equipment and systems are fully functional and ready for the CA to witness formal FPT.
14. Operate equipment and systems for FPTs in accordance with the Cx plan and as directed by the Cx authority. If improper functionality, incomplete work, or other deficiencies affecting system performance are discovered, the FPTs will be aborted by the CA. Those responsible for deficient or incomplete work will be responsible for all associated costs in accordance with PART 3.06. Mechanical contractor shall ensure that all corrections necessary for full and complete system operation, as specified, are completed or otherwise satisfactorily addressed. Upon correction of submitted FPT action items, in conjunction with the CC and other applicable sub-contractors, carry out preliminary functional performance checks to confirm correct operation before requesting the CA to reschedule the FPTs for the system in question.
15. Prepare, for use by the CA, a preliminary schedule for: O&M manual submission (preliminary); pipe and duct system leakage testing; piping systems flushing and cleaning; equipment start up; mechanical system operation; TAB fieldwork; and other miscellaneous task completion. Update schedule as appropriate throughout the construction period.
16. Attend initial O&M staff training session, and conduct mechanical system orientation and inspection at the equipment placement completion stage.
17. Update drawings to as built condition and review with the CA. In addition, gather O&M data on all equipment, and assemble in binders as required by the Cx specification. Submit preliminary O & M manuals to CA as soon as all system / equipment submittals have been approved. O&M manuals shall be properly tabbed by equipment classification or Divisions 22, 23 & 25 specification number, and shall be as "user-friendly" as possible and shall include the following: copies of specific submitted performance data on the particular equipment; performance curves for all fans, pumps, airflow / water flow monitoring stations, pump triple-duty valves, circuit setter / auto-flow valves, etc.; operating and maintenance instructions including suggested equipment PC and required maintenance intervals; all applicable equipment maintenance logs; and appropriate applicable drawings.
18. Participate in, and schedule, vendors and contractors to participate in the O&M staff training sessions as set up by the CM/GC.
19. Provide written notification to the CM/GC and CA that the following work has been completed in accordance with the contract documents and the equipment, systems and sub-systems are operating as required.
 - a. HVAC / mechanical equipment including all fans, air handling units, dehumidification units, ductwork, dampers, terminals and all Division 23 equipment.
 - b. Refrigeration equipment, pumping systems and heat rejection equipment.
 - c. Fire stopping in all fire rated construction, including fire and smoke damper installation, caulking, gasketing and sealing of smoke barriers.
 - d. Dedicated smoke control systems including stairway pressurization and atrium systems.
 - e. Non-dedicated systems using the air-handling units for smoke control.
 - f. Fire detection and smoke detection devices furnished under other divisions of the specifications as they affect the operation of the smoke control systems.
 - g. That the building control system is functioning to control mechanical equipment and smoke control systems as specified.
 - h. Provide a complete set of as built drawings and O&M manuals to the CA as well as completing, signing, and submitting all mechanical systems / equipment PCs.

H. Controls Contractor

1. Include the cost in his contract of participating in the Cx process as described herein.
2. Review system design for controllability with respect to equipment selected for the project.

3. Review and confirm in writing that a proper hardware specification exists to permit FPT as required by the project specifications and control sequences of operation.
4. Review and confirm in writing that proper safeties and interlocks are included in the project design documents.
5. Ensure that control valves and actuators have been properly sized, based upon design pressure drops, and that selected control valves will result in the airflow / water flow capacity control specified. Include all valve sizing information in control valve submittal.
6. Ensure that control dampers have been properly sized to control airflows as specified. Review and confirm in writing proper damper positioning for mixing to prevent stratification. Ensure correct actuator vs. damper movement for smooth operation, and include damper sizing, control method and actuator selection data in control damper submittal.
7. Ensure that temperature, pressure, humidity, CO₂, airflow and water flow sensor ranges have been properly selected, and include supporting data with submittal.
8. Clarify all questions concerning control sequences of operation with the design engineer.
9. Attend initial Cx scoping meeting scheduled by the CA and all subsequent regularly scheduled construction meetings where the CA's and CT's attendance has been specifically requested. Help ensure that action items arising from control system issues are addressed in a timely manner to allow the Cx process to proceed on schedule.
10. Provide the following submittals to the CA for review:
 - a. All operation and maintenance manuals including all hardware and software (i.e. application software and project applications code manuals) submittals.
 - b. Control panel construction shop drawings.
 - c. Diagrams showing all control points, sensor locations, point names, actuators, controllers and where necessary, points of access, all superimposed on diagrams of the physical equipment.
 - d. Narrative description of all control sequences for each piece of equipment controlled.
 - e. Logic diagrams showing the logic flow of all control sequences.
 - f. A list of all control points, including analog inputs, analog outputs, digital inputs and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each stand-alone control unit.
 - g. Provide a program write-up, organized in the same manner as the control software. This narrative shall describe the logic flow of the software and the functions of each routine and sub-routine. It should also explain individual math or logic operations that are not clear from reading the software listing.
11. Inspect, check and confirm the proper installation and performance of controls/BAS hardware and software provided by others.
12. Integrate installation and programming scheduling with construction and Cx schedules.
13. Inspect, check and confirm the correct installation and operation of input and output field points and devices through documented and signed off point-to-point checkout sheets.
14. Provide thorough training to owner's engineering operations personnel on hardware operations and programming, and the application program for the system, in accordance with the O&M staff-training program in the Cx plan.
15. In conjunction with the mechanical contractor, demonstrate system performance to the CA including all modes of system operation (e.g. occupied, unoccupied, emergency, etc.) during FPT. If improper functionality, incomplete work, or other deficiencies affecting system performance are discovered, the FPTs will be aborted by the CA. Those responsible for deficient or incomplete work will be responsible for all associated costs in accordance with PART 3.06.
16. Provide control system technicians to assist during system verification and FPT. The BAS controls contractor shall make two (2) technicians available to the CA throughout the FPT phase of the commissioning process. One of the technicians shall be familiar with the controls software and programming and the other shall be capable of making controls system hardware repairs during FPT. The BAS controls contractor shall also submit a copy of his controls point-to-point (PTP) checkout sheets to the CA, prior to the start of the mechanical system FPT.

17. Provide support and coordination with TAB agency on all interfaces between controls and TAB scopes of work. Provide, at no additional cost to the TAB and Cx agencies, all devices, such as portable operator's terminals and all software for the TAB agency to use in completing TAB procedures.
- I. TAB Agency
1. Include the cost in his contract of participating in the Cx process as described herein.
 2. Attend initial Cx scoping meeting scheduled by the CA and all subsequent regularly scheduled construction meetings where the CA's and CT's attendance has been specifically requested, both prior to and during TAB fieldwork.
 3. Submit proposed TAB procedures to the CA and design engineer for review and acceptance within 90 days of contract award.
 4. Attend the TAB planning meeting scheduled by the CM/GC. Be prepared to discuss the procedures that shall be followed in testing, adjusting and balancing the HVAC / mechanical systems.
 5. Submit deficiency reports generated during TAB fieldwork to appropriate installing contractors, and to the CT, so that immediate attention can be given to addressing and resolving the various deficiencies identified.
 6. At the completion of the TAB work and prior to substantial completion, submit the final TAB report to the general contractor (or construction manager) with copies to the Owner, CA and the design engineer.
 7. Participate in performance verification of the final TAB report by the CA. The TAB agency shall provide one (1) technician with full instrumentation for the purpose of verifying the data submitted in the final TAB report. This will consist of repeating a sample (25%) of the measurements contained in the TAB report as directed by the CA.
- J. Electrical Contractor
1. Include the cost in his contract of participating in the Cx process as described herein.
 2. Review design with respect to providing power to the mechanical equipment and verify the following:
 - a. That proper hardware specifications exist to accomplish the specified functional performance and sequences of operation required by the project documents.
 - b. That proper safeties and interlocks are included in the design of electrical connections for mechanical equipment.
 3. Attend initial Cx scoping meeting scheduled by the CA and all subsequent regularly scheduled construction meetings where the CA's and CT's attendance has been specifically requested. Help ensure that action items arising from electrical system issues are addressed in a timely manner to allow the Cx process to proceed on schedule.
 4. Schedule work so that required electrical installations are completed, and so that systems verification checks and FPTs can be carried out on schedule.
 5. Inspect, check and confirm in writing the proper installation and performance of all electrical systems / services provided.
 6. Provide electrical system technicians to assist during system verification and FPT as required by the CA.
- K. Independent Electrical Testing Agency
1. Include the cost in his contract of participating in the Cx process as described herein.
 2. Attend initial Cx scoping meeting scheduled by the CA and all subsequent regularly scheduled construction meetings where the CA's and CT's attendance has been specifically requested, both prior to and during IETA fieldwork.
 3. Submit proposed electrical system testing procedures to the CA and design engineer for review and acceptance within 90 days of contract award.
 4. Attend the IETA planning meeting scheduled by the CM/GC. Be prepared to discuss the procedures that shall be followed in testing the electrical systems.

5. Submit deficiency reports generated during IETA fieldwork to appropriate installing contractors, and to the CT, so that immediate attention can be given to addressing and resolving the various deficiencies identified.
6. At the completion of the IETA work and prior to substantial completion, submit the final IETA report to the general contractor (or construction manager) with copies to the Owner, CA and the design engineer.
7. Participate in performance verification of the final IETA report by the CA. The IETA agency shall provide one (1) technician with full instrumentation for the purpose of verifying the data submitted in the final IETA report. This will consist of repeating a sample (25%) of the measurements contained in the IETA report as directed by the CA.

L. Equipment Suppliers

1. Provide all requested submittal data including detailed start up procedures and specific responsibilities of the owner to keep warranties in force.
2. Assist in equipment startup / checkout and testing per agreement with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the contractor, except for stand-alone data-logging equipment that may be used by the CA.
4. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
5. Review test procedures for equipment installed by factory representatives.

1.5 DEFINITIONS:

- A. Design Narrative or Design Documentation – Sections of either the Design Intent or Basis of Design.
- B. Factory Testing – Testing of equipment on site or at the factory-by-factory personnel with an owner's representative present.
- C. Functional Performance Test (FPT) – Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. FPT is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up or down to maintain the differential pressure set point). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through numerous control systems' sequences of operation, and components are verified to be responding per the specified design sequences. Traditional air or water test and balancing (TAB) is not FPT, in the Cx sense of the word. The TAB agency's primary work is setting up the systems flows and pressures as specified, while FPT is verifying that which has already been set up. However, prior to the commencement of FPT, the CA shall conduct a final TAB report verification. The Cx authority develops the FPT procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FPTs are performed after PCs have been submitted, equipment start-up / checkout have been completed, and all TAB or IETA fieldwork has been completed, and a report issued.
- D. Construction Manager – The prime contractor for this project. Generally refers to all the CM/GC's subcontractors as well. Also referred to as the Contractor, in some contexts.
- E. Indirect Indicators – Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

- F. Manual Test – Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrast to analyzing monitored data taken over time to make the “observation”).
- G. Monitoring – The recording of parameters (flow, current, status, temperature, pressure, etc.) of equipment operation using data-loggers or the trending capabilities of control systems.
- H. Simulated Signal – Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50°F to 75°F to verify economizer operation).
- I. Owner – Contracted Tests – Tests paid for by the owner outside the CM/GC’s contract and for which the CA does not oversee. These tests will not be repeated during FPTs, if properly documented.
- J. Phased Cx – Cx that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order to minimize the total construction time.
- K. Pre-functional Checklist (PC) – A list of items to inspect and elementary component tests to conduct to verify proper installation / startup / checkout of equipment. Sample PCs are provided by the CA in the preliminary Cx Plan; however, the Subs may utilize their own PCs or PCs provided by their equipment suppliers, provided that accepted industry startup procedures are followed. Correct start-up procedures & checklists are essential for ensuring that equipment and systems are checked out properly before being brought on-line and made operational. PCs are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some PC items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system, or the rotation on a pump or fan). The word pre – functional refers to before functional testing. PC augment and are combined with the manufacturer’s start up checklist. Even without a Cx process, contractors will typically perform some of the pre-functional checklist items a CA will recommend; however, few contractors document in writing the execution of these checklist items. Start-up checklists shall be utilized on this project to help ensure that the independent testing phases (i.e. TAB / IETA and FPT) of the project proceed smoothly without unnecessary delays. Each piece of equipment must undergo proper start-up procedures, no exceptions.
- L. Project Manager (PM) – The contracting and managing authority for the owner over the design and/or the construction of the project.
- M. Sampling – Functionally testing a fraction (i.e. representative sample) of the total number of identical or near identical pieces of equipment.
- N. Seasonal Performance Tests – FPT that is deferred until the system(s) will experience conditions closer to their design conditions.
- O. Simulated Condition – Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).
- P. Specifications – the construction specifications of the Contract Documents.
- Q. Start-up – The initial starting or activating of dynamic equipment, including executing PCs.
- R. Subs – The subcontractors to the CM/GC who provide and install building components and systems.

- S. Test Procedures – The step-by-step process, which must be executed to fulfill the test requirements. The test procedures are developed by the CA.
- T. Test Requirements – Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not detailed test procedures. The test requirements are specified in the Contract Documents.
- U. Trending – Monitoring using the building automation system (BAS).
- V. Vendor – supplier of equipment.
- W. Warranty Period – warranty period for the entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Document and accepted submittals.

1.6 SYSTEMS TO BE COMMISSIONED:

- A. The following systems shall undergo Cx on this project.

- HVAC / Mechanical Systems
- X Pumps
- X Mechanical Piping Systems
- X Ductwork & Duct Specialties
- X Fan Coil Units (4-pipe)
- X Variable Frequency Drives
- X Built-up Air Handling Unit
- X Terminal Units (Air)
- X Steam Converter
- X Steam Press. Reducing Station
- X Exhaust Fans
- X HVAC Control Systems
- X HVAC Control System Specialties
- X Fire And Smoke Dampers
- X Indoor Air Quality
- X Tab Fieldwork
- X Chemical Treatment Systems
- X Equipment Vibration Control
- Other

PART 2 - PRODUCTS:

2.1 TEST EQUIPMENT:

- A. All standard test equipment required to perform equipment / system start up, initial checkout (including PTP checkout) and required FPT shall be provided by the applicable (i.e. Divisions 22, 23, 25 or 26) contractor for the equipment / system being tested. For example, the Division 23 MC shall be responsible for all standard test equipment required for the checkout of HVAC / mechanical systems, except for equipment specific to and used by TAB in their Cx responsibilities, and the Division 25 CC shall be responsible for test equipment for checkout of the BAS system controls. Two-way radios shall be provided by the Division contractor.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for test equipment, according to these Contract Documents, shall be included in the base bid price to the CM/GC and left on site, except for stand-alone data logging equipment that may be used by the CA.

- C. All test equipment shall be of sufficient quality and accuracy to test and /or measure system performance with the tolerances required by the Specifications. If not otherwise noted, the following minimum requirements apply; Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of $\pm 0.1^{\circ}\text{F}$. Pressure sensors shall have an accuracy of $\pm 2.0\%$ of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION:

3.1 MEETINGS:

- A. Scoping Meeting – Within 60 to 90 days, depending on building size, prior to the commencement of construction, the CA will schedule, plan and conduct a Cx scoping meeting with the entire CT in attendance. The CA will also provide copies of the preliminary Cx Plan to all CT members, at or before this meeting. Meeting minutes will be compiled and distributed to all parties by the CA.
- B. Miscellaneous Meetings – The CM/GC shall periodically request the CA's and CT's attendance at applicable regularly scheduled construction meetings to facilitate the Cx process. These meetings will cover Cx process coordination, deficiency resolution and planning issues with members of the CT and various Subs. In addition, the CM/GC shall help ensure that action items arising from meeting discussions are satisfactorily addressed, as required, to enable the Cx process to proceed on schedule.

3.2 REPORTING:

- A. The CA will provide regular reports to the PM and CM/GC as deemed necessary, with increasing frequency as construction and Cx progresses.
- B. The CA will regularly communicate with all members of the Cx team, keeping them apprised of Cx progress and scheduling changes through memos, field inspection reports, miscellaneous progress reports, etc.
- C. The CA shall maintain a master deficiency (i.e. Action Item Summary) and resolution log and a separate testing record. In addition, the CA will help the PM & CM/GC coordinate the resolution of non-compliance issues and design deficiencies identified in the Action Item Summary and during all phases of Cx.
- D. A final summary report will be provided by the CA, which summarizes the results of the Cx process. The final Cx report shall include: an executive summary of the Cx process; a project narrative covering highlights of all project Cx phases; a detailed summary of all observations, comments and deficiencies noted throughout the Cx process; a summary of FPT results; appropriate conclusions and recommendations; and a value statement detailing the economic impact of Cx to the project. The conclusion and recommendations will focus on evaluating the Cx process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. PCs, TAB verification results, FPT results and monitoring reports will also be part of the final Cx report.

3.3 SUBMITTALS:

- A. The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the Cx work. These requests will be integrated into the normal submittal process and protocol of the construction team. As a minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed

start up procedures, full sequences of operation, and O&M data, performance data and performance curves, any performance test procedures, control drawings and details of owner contracted tests.

- B. The CA will review and submit written comments on submittals related to the commissioned equipment for conformance to the Contract Documents. This review is intended to aid in the development of FPT procedures as well as to verify compliance with equipment specifications. The CA will notify the PM, CM/GC and/or A/E where applicable, of omitted items or of items that are not in conformance with the Contract Documents and which require resubmission.
- C. The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and control sequences of operation provided with the specifications.
- D. The CA shall review O&M manual documentation for acceptability and completeness to ensure that O&M manuals are as follows: properly tabbed by equipment classification or Division 22, 23, 25 or 26 specification number; as “user-friendly” as possible; include copies of specific submitted performance data for specific equipment; include performance curves for all fans, pumps, airflow / water flow monitoring stations, pump triple-duty valves, circuit setter / auto-flow valves, etc.; include operating and maintenance instructions including suggested equipment PCs and required maintenance intervals; include all applicable equipment maintenance logs; include appropriate applicable drawings.

3.4 START-UP, PRE-FUNCTIONAL CHECKLISTS (PCs) AND INITIAL CHECKOUT:

- A. The following procedures apply to all equipment to be commissioned (See Section 1.06, Systems to be commissioned). Some systems that are not comprised of actual dynamic machinery, e.g., electrical system power quality, may have very simplified PCs and start up procedures.
- B. General: PCs are necessary for ensuring that equipment and systems are made properly operational for TAB or IETA fieldwork, and Cx FPT. PCs help ensure that FPT (and in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment shall receive a full pre-functional checkout, and no sampling strategies shall be used. The pre-functional testing for a given system must be successfully completed prior to the beginning of the TAB or IETA fieldwork, and prior to the start of formal FPT of equipment or systems.
- C. Start up and Initial Checkout Plan: The CA shall assist the CT members responsible for start up of any equipment in developing detailed start up plans for all equipment. The primary role of the CA in this process is to ensure that written documentation is produced that verifies that equipment / system manufacturer-recommended startup / checkout procedures have been completed. Parties responsible for PCs and start up are identified in the Cx scoping meeting and on the PC forms.
 - 1. The CA will adapt manufacturer's recommended startup / checkout procedures in preparing PC forms. These checklists indicate required procedures to be executed as part of start up and initial checkout of the systems and the responsible party.
 - 2. Sample PCs shall be provided by the CA to the CT members, via the preliminary Cx Plan. Installing contractor CT members shall determine which trade is responsible for executing and documenting the various line item tasks and notes indicated on the PCs. Most PC forms will have more than one trade responsible for its execution.
 - 3. The installing contractor CT members responsible for the purchase of various pieces of equipment shall develop the full startup plan (with the assistance provided by the CA as needed) for that equipment. This shall be accomplished by combining the CA's PCs with both the manufacturer's detailed start up and checkout procedures along with the contractors own standard field checkout sheets. The startup plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking

- and inspections of each procedure and a summary statement with a signature block at the end of the plan.
4. The full startup plan could consist of something as simple as:
 - a. The CA's PCs.
 - b. The manufacturer's standard written start up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by at the end of the form.
 - c. The manufacturer's normally used field checkout sheets.
 5. The installing contractor CT members shall submit full startup plans for all required equipment / systems to the CA for review and confirmation of acceptability. The CA shall review the startup plan and PC format for acceptability, noting any procedures that need to be added.
 6. The full startup procedures and all PC forms shall be provided to the A/E and PM for review and approval, depending on management protocol.
- D. Sensor Calibration: Control system PTP checkout and calibration of all sensors shall be included as part of the PCs performed by the Controls Contractor, according to the following procedures:
1. All Sensors: Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance of equal to 2% of the reading of each other, for pressure. Tolerances for critical applications will be stricter.
 2. Sensors without Transmitters – Standard Application: Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument measured value. If not, calibrate or replace sensor.
 3. Sensors with Transmitters – Standard Application: Disconnect sensor. Connect a signal generator in place of the sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4mA is read by the ammeter. Repeat for the maximum temperature matching 20mA to the potentiometer span or maximum and verify at the BAS. Reconnect sensor. Make a reading with the calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.
- E. Execution of Pre-functional Checklists and Start up
1. Six (6) weeks prior to start up, the Subs and vendors schedule start up with the PM, CM/GC and CA. The performance of the PC, start up and checkout are directed and executed by the Subcontractor or vendor. When checking off PC, signatures will be required of other Subs for verification of completion of their work.
 2. The CA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used as approved by the CA).
 3. For lower-level components of equipment, (e.g., VAV boxes, sensors, controllers), the CA shall observe a sampling of the pre-functional and start up procedures. The sampling procedures are identified in the Cx Plan.
 4. The Subs and vendors shall execute start up and provide the CA with a signed and dated copy of the completed start up and pre-functional tests and checklists and/or PTP checkout sheets.
 5. Only individuals that have direct knowledge and witness that a line item task on the pre-functional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

- F. Deficiencies, Non-Conformance and Approval in Checklists and Start up
1. The Subs shall clearly list any outstanding items of the initial start up and pre-functional procedures that were not completed successfully on an attached sheet. The procedures form and any outstanding deficiencies are to be provided to the CA within two (2) days of test completion.
 2. The CA will review the report and submit it with his comments to the Subcontractor and the PM. The CA shall oversee the Subs and the vendors in collecting and retesting deficiencies or uncompleted items. The installing Subs or vendors shall correct all areas that are deficient in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed the CA recommends approval of the execution of the checklists and start up of each system to the PM using a standard form.
 3. Items left incomplete, which later cause deficiencies or delays during functional testing, may result in back charges to the responsible party. Refer to Part 3.06 herein for details.

3.5 FUNCTIONAL PERFORMANCE TESTING:

- A. This sub-section applies to all Cx functional testing for all divisions.
- B. Objectives and Scope: The objective of FPT is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
- C. Development of Test Procedures: Before test procedures are written, the CA shall obtain all requested documentation, equipment or systems, including an updated points list, program code, control sequences and parameters. The CA will develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Prior to execution, the CA shall provide a copy of the test procedures to the Subcontractor(s) who shall review the tests of feasibility, safety, equipment and warranty protection. The CA shall submit the tests to the A/E for review, if requested.
- D. The CA shall review owner-contracted, factory testing or required owner acceptance tests, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized.
- E. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form. In general, the FPTs will be comprised of the following:
1. Sensor Calibration Checks / Equipment Room
 2. Sensor Calibration Checks / Space
 3. Device Calibration Checks
 4. Sequence of Operation Functional Tests
- F. Test Methods
1. FPT and verification will be achieved by a combination of manual testing (persons manipulate the equipment and observe performance) and simultaneous monitoring of the performance via the Building Automation System (BAS). Analysis of the results may also include using the control system's trend log capabilities or stand-alone data loggers. The CA may substitute specified methods referenced in other specification sections, or require an additional method to be executed, other than what was specified, with the approval of the A/E and PM. This may require a change order and adjustment in charge to the Owner. The CA will determine which method is most appropriate for tests that do not have a method specified.

2. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
 3. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable, e.g., for the above case, by heating the outside air sensor with a heat source rather than overwriting the value or by altering the appropriate set point to see the desired response.
 4. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
 5. Altering Set Points: Rather than overwriting sensor values, and when simulating conditions is difficult, altering set points to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55°F, when the outside air temperature is above 55°F, temporarily change the lockout set point to be 2°F above the current outside air temperature.
 6. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during pre-functional testing.
 7. Setup: Each function and test shall be performed under conditions as close as is practically possible. The Subcontractor executing the test shall provide all necessary materials, system modifications, etc. to produce necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Subcontractor shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
 8. Sampling: Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference.
 9. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA will stop the testing and require the responsible Subcontractor to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.
- G. Coordination and Scheduling: The Subs shall provide sufficient notice to the CA regarding their completion schedule for the PC and start up of all equipment and systems. The CA will schedule functional tests through the PM, CM/GC, and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.
- H. In general, FPT will be conducted after pre-functional testing and start up has been satisfactorily completed, and after verification of the final TAB report. The control system shall be sufficiently tested and all PTP checkout sheets submitted to the CA for review prior to the start of the TAB fieldwork. Once air balancing and water balancing has been completed and the final TAB report verification concluded, FPT of air-related or water-related equipment or systems can begin. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
- I. Test Equipment: Refer to Part 2.1. for test equipment requirements.
- J. Problem Solving: The CA will recommend solutions to problems found; however, the burden of responsibility to solve, correct and retest problems is with the CM/GC, Subs, and A/E.

3.6 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS:

- A. Documentation: The CA shall witness and document the results of all FPTs using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the PM for review and approval and to the Subs for review. The CA will include the filled out forms in the O&M manuals.
- B. Non-Conformance:
1. The CA will record the results of the FPT on the test forms. All deficiencies or non-conformance issues shall be noted and reported to the Owner and the PM via written interim reports.
 2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases, the deficiency and resolution will be documented on the procedure form.
 3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
 4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.
 - a. When there is no dispute on the deficiency and the Subcontractor accepts responsibility to correct it:
 5. The CA documents the deficiency and the Sub's response and intentions, and they go on to another test or sequence. After a days work, the CA submits the non-compliance reports to the PM/owner for signature. A copy is provided to the Subcontractor and CA. The Subcontractor corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be tested and sends it back to the CA.
 6. The CA reschedules the test, and the test is repeated.
 - a. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - 1) The deficiency shall be documented with the Sub's response and a copy given to the PM/Owner and the Sub's representative assumed to be responsible.
 - 2) Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner Representative.
 - 3) The CA documents the resolution process.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs a statement of correction and provides it to the CA. The CA reschedules the test, and the test is repeated until satisfactory performance is achieved.
 7. Cost of Retesting
 - a. The cost for the Subcontractor to retest a pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the CM/GC.
 - b. For a deficiency identified, not related to any pre-functional checklist or start up fault, the following shall apply. The CA and PM will direct the retesting of the equipment once at no "charge" to the CM/GC for their time. However, the CA's and PM's time for a second retest will be charged to the CM/GC, who may choose to recover costs from the responsible Sub.
 - c. The time for the CA and PM to direct any retesting required because a specific pre-functional checklist or start up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the CM/GC. The CM/GC may choose to recover costs from the party responsible for executing the faulty pre-functional test.

8. The contractor shall respond in writing to the CA and PM at least as often as Cx meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during Cx. Discussion shall cover explanations of any disagreements and proposals for their resolution.
 9. The CA retains the original non-conformance forms until the end of the project.
- C. Failure Due to Manufacturer's Defects: If 10% of identical pieces of equipment (size alone does not constitute a difference) fail to perform in accordance with the Contract Documents (mechanically or substantively) due to a manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM/GC or PM. In such case, the Contractor shall provide the Owner with the following:
1. Within one (1) week of notification from the PM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the PM within two (2) weeks of the original notice.
 2. Within two (2) weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
 3. The PM/Owner will determine whether a replacement of all identical units or a repair is acceptable.
 4. Two (2) examples of the proposed solution will be installed by the Contractor and the PM will be allowed to test the installations for up to one week, upon which the PM will decide whether to accept the solution.
 5. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- D. Approval: The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the PM, if necessary. The CA recommends acceptance of each test to the Owner using a standard form.

3.7 OPERATION AND MAINTENANCE MANUALS:

A. Standard O&M Manuals

1. The specific content and format requirements for the standard O&M manuals are detailed elsewhere throughout the specifications. Special requirements for the controls contractor and TAB agency are found in their respective sections of the specifications.
2. A/E Contribution: The A/E will include in the beginning of the O&M manuals a separate section describing the systems including:
 - a. The design intent narrative prepared by the A/E and provided as part of the bid documents, updated to as built status by the A/E.
 - b. Simplified professionally drawn single line system diagrams on 8 1/2" x 11" or 11" x 17" sheets. These shall include chillers, water system, condenser water system, heating systems, supply air systems, exhaust systems and others as designated. These shall show major pieces of equipment such as pumps, chillers, boilers, control valves, expansion tanks, coils, service valves, etc.
3. CA Review: Prior to substantial completion, the CA shall review the O&M manuals, documentation and redline as-builts for systems that were commissioned and list other systems documentation that the CA should review to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the PM or A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the PM or A/E. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are

clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

B. Cx Record in O&M Manuals

1. The CA is responsible for compiling, organizing, and indexing all Cx data by equipment into labeled, indexed and tabbed, three-ring binders and delivering them to the CM/GC, to be included with the O&M manuals. Three (3) copies of the manuals will be provided.
2. Other documentation will be retained by the CA.

3.8 TRAINING OF OWNER PERSONNEL:

A. The CM/GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is complete.

B. The CA shall be responsible for overseeing and approving the conduct and adequacy of the training of Owner personnel for commissioned equipment.

1. The CA shall interview the facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The Owner and CA shall decide how rigorous the training should be for. The CA shall communicate the results to the Subs and vendors who have training responsibilities.
2. In addition to these general requirements, the specific training requirements of Owner personnel by Subs and vendors is specified in Divisions 22, 23, 25 and 26 and list other sections where training requirements are found.
3. Each Subcontractor and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. The plan will cover the following elements:
 - a. Equipment (included in training)
 - b. Intended audience
 - c. Location of training
 - d. Objectives
 - e. Subjects covered (description, duration of discussion, special methods, etc.)
 - f. Duration of training on each subject
 - g. Instructor for each subject
 - h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
 - i. Instructor and qualifications
4. For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
5. The CA develops an overall training plan and coordinates and schedules, with the PM and CM/GC, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CA recommends approval of the training to the PM using a standard form. The PM also signs the approval form.
6. At one of the training sessions, the CA discusses the use of the blank functional test forms for the re-Cx equipment.
7. At the first training session, the mechanical design engineer will present the overall system design concept and the design concept of each equipment section. This presentation shall be one hour in length and include a review of all systems using the simplified system schematics (one-line drawings) including chilled water systems, condenser water or heat rejection systems, heating systems, and gas supply systems, supply air systems, exhaust systems and outside air strategies.

3.9 DEFERRED TESTING:

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional

testing may be delayed upon approval by the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

- B. Seasonal Testing: During the warranty period, seasonal testing (test delayed until weather conditions are closer to the system's design) specified in other sections of the specifications (e.g. Testing and Balancing) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

END OF SECTION

SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

1. GENERAL: Provide a complete electric and electronic system of automatic temperature controls as specified herein and as indicated on the drawings.
2. SCOPE: The control system shall consist of all thermostats, temperature sensors, controllers, automatic valves and dampers, damper operators, and a complete system of wiring interlocks to fill the intent of the specification and provide for a complete and operable system.
3. SERVICE AND GUARANTEE: After completion of the installation, this contractor shall completely adjust all control equipment provided under this contract; place the system in operation, and instruct the operating personnel in the operation of the control system.
4. TEMPERATURE CONTROL WIRING: All electrical wiring (other than power wiring) in connection with the automatic temperature control system shall be furnished by this contractor, in accordance with the electrical specification. (See Division 26).
5. SUBMITTAL AND APPROVAL: This contractor shall submit copies of complete temperature control diagrams with written "sequence of control" and factory-printed specification data sheets covering each control device.
6. CONTROL COMPONENTS:
 - A. Fan Coil Unit: Each vertical fan coil unit will have an integral thermostat. Each horizontal fan coil unit will have a wall mounted thermostat. See Section 23 09 23, part 2.2 for thermostat information.
 - B. Toilet exhaust fans: Toilet exhaust fans shall be controlled by local light switches.
 - C. Thermostats to be mounted a minimum of 50-60" above finish floor.

END OF SECTION

SECTION 23 31 13

METAL DUCTS(LOW PRESSURE)

PART 1 - GENERAL:

1.1 WORK INCLUDED:

- A. The work required under this section includes all work necessary for the complete installation of a low-pressure system.
- B. The work of these sections is subject to the requirements of the Mechanical General Provisions and Basic Materials specifications.
- C. All ductwork shall be fabricated and installed per "SMACNA" HVAC Duct Construction Standards" 2005 Edition, hereinafter called "DM".
- D. Low pressure applies to system up to 2" WG total static pressure at velocities to 2000 FPM.
- E. Medium and high pressure applies to systems above 2" WG total static pressure at velocities over 2000 FPM, including all ductwork downstream of fan discharge and through air valve or similar device reducing air pressure below 2" WG.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods, Section 23 01 05
- B. Duct Insulation, Section 23 07 13.
- C. Fans, Section 23 34 00.
- D. Air Duct Accessories, Section 23 33 00.
- E. Air Terminal Units, Section 23 36 13 & Section 23 36 16

PART 2 - PRODUCTS:

2.1 LOW PRESSURE SHEET METAL DUCTWORK:

- A. Sheet metal work, unless noted otherwise, shall be fabricated of Armco Zincgrip-Paintgrip galvanized steel where exposed to weather or to be painted. Sheet metal for concealed ductwork shall be fabricated of hot dipped galvanized steel. ASTM 3A-527, with gauge marking on bottom outside of duct. Where ducts are bare, use Group 1, 1.25 oz. galvanized. Where painted, use Group 4 1.25 oz galvanized and phosphatized. All metal fasteners, supports, etc. shall be galvanized steel or non-corrosive metal.
- B. Ducts shall be sizes shown on the drawings, cross-braced, rigidly braced, adequately supported and securely fastened in place. Fabricate and install ducts in accordance with SMACNA Duct manual details.

C. Kitchen hood exhaust ducts, where exposed shall be 18 gauge 304 stainless steel. Exhaust ducts from ceiling to exhaust fan shall be 16 gauge. All joints shall be made liquid tight with a continuous external weld per NFPA-96. Provide 12" x 12" cleanouts at each change in direction and every 20' with welded joints.

D. Insulated Grease Duct:

1. The duct shall be of the double wall, factory-built type for exhausting grease-laden air, as described in NFPA-96, from equipment, which produces exhaust air at temperatures up to 500°F continuously, and 2000°F intermittently.
2. The duct sections shall be constructed of an inner wall and an outer wall with a 1" annual space. The outer wall shall be constructed of Type 304 stainless steel, .026" thickness. The inner wall, forming the grease-laden air-carrying pipe, shall be constructed of 304 stainless steel, .035" thickness.

Inner and outer walls shall be connected by means of spacer clips, which shall maintain concentricity of the annual space and allow unobstructed differential thermal expansion of inner and outer walls.

3. The duct shall include a 1" thickness of ceramic fiber insulation between the inner and outer walls. The duct shall have listed clearance to combustibles of not more than:

<u>SIZE</u>	<u>CLEARANCE</u>
6"	2"
8" – 16"	3"
18" – 24"	4"
26" – 36"	18"

The duct manufacturer shall submit suitable evidence of tested clearances.

4. The duct shall be UL listed for installation without a fire rated chase when penetrations of fire rated partitions are stopped with a UL or UL approved firestop.
5. All duct parts exposed to the atmosphere shall be 304 stainless steel.
6. All duct supports, drains fittings, cleanouts, roof penetrations, hood or fan adapters, fittings and expansion joints required to install the duct shall be included.
7. All inner pipe joints shall be held together by means of formed vee bands and sealed with P080 fire retardant sealant for Insulated Grease Duct.
8. Nuts for the inner and outer bands shall be retained by means of free-floating cages to allow easy alignment.
9. Screws shall be of the hex head type with shoulder stops and tapered 'lead-in' threads for easy starting.
10. Duct shall be Model IPIC insulated Grease Duct as manufactured by Metal-Fab, Inc.

E. Dishwasher exhaust ducts; S.S. drip proof joints.

F. Laboratory hood exhaust ductwork shall be stainless steel Series 316L. Ductwork shall be welded construction and in compliance with "Specifications for Welding of Sheet Metal (ASW 1985)." Welding wire shall match specified stainless steel series. Rectangular duct shall be a minimum of 18 gauge.

G. Duct connections 24" wide and larger to be made using the "Ductmate System" or approved substitute. The installation to be complete using angles, corners, cleats, gaskets, sealer, and bolts. Install according to Manufacturers instructions.

H. Seal all joints in ductwork with either Hardcast Flexgrip 550 Duct Sealant or Hardcast 1403-181BFX Rolled Sealant Tape. Duct Sealants and tapes to be compliant with South Coast Air

Quality Management District Rule #1168. Sealants to meet UL-181-BM. Rolled sealant to meet UL-181B-FX.

2.2 TRANSITIONS:

- A. Increase-in-area transition: Transformation slope not to exceed 20°.
- B. Decrease-in-area transition: Transition slope to be maximum 30°, but 20° is preferable.
- C. Angle of transformation at connections to heaters or other equipment not to exceed 30° on approaching side of equipment and 45° on leaving side. Angle of approach may be increased to meet space conditions when transformation section is provided with vanes.

2.3 ELBOWS:

- A. Unvaned elbows may be used if throat radius equal to width of duct and full heel radius less than 36" in width.
- B. Unvaned elbows may be used if throat radius equal to 3/4 width of duct and full heel radius, over 36" in width.
- C. Square heel - 3" square throat elbow with large class single thickness vanes thru 36" unsupported vane length and large double thickness vanes for unsupported vane length of 37" thru 72". As per SMACNA Manual Figures 4-3 and 4-4.

2.4 BRANCH CONNECTIONS:

- A. Main Supply Branch: See SMACNA manual Figure 4-1, 4-5, and 4-6 - use unvaned radius transition elbow with splitter damper when branch width is 36" or smaller, and vaned square throat transition elbow when branch width is larger than 36".
- B. Sub-Branch Supply – See SMACNA manual Figure 7-6, - use straight tap with extractor, having manual control rod extended thru main branch side, when extractor weight is 50 lbs, use 45° or radius entry clinch lock collar – See SMACNA Figure 4-6, and manual balancing dampers when specifically noted on plans.
- C. Sub-Branch Return – See SMACNA manual Figure 4-6, use 45° or radius entry clinch lock collar.
- D. Round Supply Take-Offs – Use factory fabricated beaded straight spin-in type galvanized steel fillings with 45° extractor and manual balancing damper.
- E. Round Return/Exhaust Tap-ins – Use factory fabricated beaded straight spin-in type galvanized steel tap fittings.
- F. For low pressure return and/or exhaust application of duct connectors to square ceiling mounted grilles or registers, use factory fabricated square-to-round galvanized steel minimum 3" deep adapter boxes having 2" long beaded round collar.

2.5 SPLITTERS:

- A. Splitter dampers for adjustment of distribution to respective branches to be installed where

indicated on drawings. Splitters to be as shown in Figure 4-5, of SMACNA manual.

2.6 MANUAL DAMPERS:

- A. Hand operated butterfly type dampers to be galvanized steel, 18 U.S. gauge or heavier.
- B. Dampers for ducts to 12" depth and 12" diameter to be one blade carried on a 3/8" round steel rod mounted inside of duct without frame and fitted with locking type quadrant and brass end bearing plate accurately drilled and secured to duct. Refer to Figures A, B, and C, Figure 7-4, of the SMACNA manual for construction details.
- C. Dampers for ducts of greater depth to be multi-blade type, 12" maximum blade width up to 30" blade length and 10" maximum blade width over 30" blade width. Blades to be mounted on frame with brass sleeve bearings, interconnected for operation from one locking type hand quadrant.
- D. Round pivot rods to have section faced flat to receive locking setscrew in locking quadrant. Notching of blades to fit linkage permitted. Refer to Figure A and B Figure 7-5, of SMACNA manual.

2.7 VANES AND DEFLECTORS:

- A. Vanes and deflectors, to be galvanized steel sheet same thickness as used in ductwork of corresponding size. Vanes to be securely anchored to duct or casing and have freestanding edges braced as necessary for making rigid.

2.8 ACCESS DOORS:

- A. Access doors to be provided for access to all heaters, fire dampers, automatic dampers, smoke dampers, and other equipment installed in ducts and at other points indicated on drawings. Access doors in masonry walls to be furnished and installed under another heading.
- B. Access door to be double-panel construction, galvanized metal with rigid insulation between panels. The rigid insulation is to have an R-value that matches the R-value of the duct insulation. Doors to mount in rigid frame formed galvanized metal. Angle iron bracing to be used as required to provide rigid assembly.
- C. Access doors in ductwork, refer to Door A, B, Figure 7-2, 7-2M, and 7-3 of SMACNA manual. Casing access doors, refer to Figure 9-15 and 9-16 of SMACNA manual.
- D. Doors to close against felt gasket seal.

2.9 FLEXIBLE DUCT CONNECTION TO UNITS:

- A. Duct connections to fan units and air handling units to be made with UL approved flame resistant, self-extinguishing, water and airtight heavy glass fiber woven material impregnated with synthetic elastomer. Duro-Dyne "Durolon" Ventfabrics "Ventlon" or approved equal. See Figure 7-8, of SMACNA manual for construction details.

2.10 DUCT LINING:

- A. Where called for or noted on the drawings, certain ducts shall be internally insulated for both acoustic and thermal reasons per Section 23 07 13. The duct sizes shown on the drawings are net sizes and when internally lined they shall be increased in size in both dimensions to accommodate the insulation material.

- B. Lining shall be discontinued a minimum of 18" upstream and 30" downstream from electric resistance and gas heaters and fire or smoke dampers. This duct shall be insulated with duct wrap. See Section 23 07 13.

2.11 FABRIC DUCT:

- A. Fabric ductwork shall be constructed of a woven fire retardant fabric complying with the following physical characteristics:
 - a. Fabric Construction: 100% Flame Retardant Polyester
 - b. Weight: 7.0 oz
 - c. Color: As selected by architect
 - d. Air Permeability: 2 cfm/sf. Tested per ASTM D737
 - e. Temperature Range: 0° F to 250° F
 - f. Fire Retardancy: Meets testing requirements of fabric air dispersion systems as defined in NFPA 90A & 90B. Our product achieves a Class 1 rating per ASTM E-84.
- B. Design & Fabrication Requirements:
 - a. Lengths to include required zippers as specified by manufacturer.
 - b. Inlet transition and end cap to include zippers for easy removal/maintenance.
 - c. Dispersion by Linear Slots
 - d. Width of and location of linear slots to be specified and approved by manufacturer per the drawing requirements.
 - e. Fabric System to include connectors to attach to suspension system listed below.
 - f. Inlet connection to metal duct via metal band supplied by manufacturer.
 - g. Fabric ductwork shall be designed for 0.5-inch water gage, producing a maximum operating pressure of 3.1 inches of water.
 - h. Duct lengths, static pressure and design CFM shall be signed/approved by the manufacturer.
 - i. All deviations from a straight run shall be designed by the manufacturer to meet job specifications.
- C. Suspension Hardware:
 - a. One & Two Row Cable: Systems shall include plastic coated cable, eyebolts, cable clamps, thimbles, and turnbuckles. Attachment shall be made using snap clips spaced 24 inches apart. Vertical support hardware for longer and larger diameter applications is required. These supports should be installed approximately every 25 feet.

PART 3 - EXECUTION:

3.1 HANGING:

- A. Ducts to be supported from building structure with galvanized steel hangers per Figure 5-1 and Tables 5-1 and 5-2, of the SMACNA manual. Hangers to be secured to masonry portion of building by means of inserts or other acceptable anchors, similar to Figures 5-2, 5-3 and 5-4 of the SMACNA manual. All straps or band hangers extending down both sides of duct and under bottom, fasten to side and bottom with sheet metal screws. In general, vertical risers and other duct runs where method of support specified above is not applicable to be supported by angle brackets as shown on Figures 5-8 and 5-9 of the SMACNA manual. Seal-off such openings between ducts and floor with No. 12 gauge iron.

3.2 OBSTRUCTIONS AND RESTRICTIONS:

- A. Obstructions may not be located within ducts without specific permission of engineer for each instance. When obstructions cannot be avoided, obstructions shall be eased in accordance with Figure 4-8, of the SMACNA manual.

3.3 INSULATION:

- A. Where drawings and insulating specifications indicate that ducts are to be insulated make provision for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices.

3.4 FLEXIBLE DUCT CONNECTORS:

- A. Install in ducts crossing building expansion joints.
- B. Minimum length of 3" flame retardant fabric each side of joint per SMACNA Fig. 7-8, sew corners.
- C. Provide at intake and supply connections of all fan units and air-handling units, except those handling grease-laden air.

3.5 FIBROUS DUCT CONSTRUCTION:

- A. In addition to the SMACNA requirements, the following shall be observed.
- B. All joints shall be stapled with a galvanized flare door staple 2" O.D. and closed by one of the following techniques: (1) a layer of Owens-Corning Fiberglass Duct System, Class I rated mastic and a glass reinforcing tape, Owens-Corning Fiberglass II taping system, or (2) a pressure sensitive 3-mil aluminum tape 2 1/2" wide, which carries a UL Duct System Class I rating and is SMACNA approved.
- C. All manual dampers, fire dampers, turning vanes, lifters, register connectors shall be installed according to SMACNA or manufacturer's approved methods.
- D. All ducts shall be supported: (1) at all turns and transitions, (2) 8' or less, O.D. for straight ducts 0-35" maximum dimension, (3) 6', or less, O.D. 36-59" maximum dimension, (4) and 4' O.D. for 60" or larger, maximum dimensions.
- E. Adhesive tape shall not be applied when ambient temperature is below 5°F. Surfaces to which tape is applied shall be clean, dry and free of oil or grease. Sealing tool must also be used to apply.
- F. Use 2 1/2", or wider, tape for duct board joints. Use 3", or wider, for sealing mitered corners and seaming insulation boards butted together on same plane. Use 5" wide tape on unmitered corners, over joint ribs, etc.
- G. Store tape at 60°F temperature or higher prior to application.

3.6 FLEXIBLE DUCT:

- A. Ducts must be installed without kinks or sags and supported with 3/4" wide metal bands. The minimum inside radius of any bend should be one-half the diameter of the duct.

3.7 WARRANTY:

- A. Insulated Grease Duct shall be warranted by the manufacturer against defects in material and workmanship for a period of four (4) years from the date of the original installation. Any portion of the duct repaired or replaced under warranty shall be warranted for the remainder of the original warranty period.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL:

1.1 WORK INCLUDED:

- A. The work required under this section includes all work necessary for the complete installation of ductwork accessories and specialties.
- B. The work of this section is subject to the requirements of the Mechanical General Provisions and Basic Materials specifications.
- C. All ductwork shall be fabricated and installed per latest "SMACNA" edition of "HVAC" Construction Standards.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods, Section 23 01 05.
- B. Duct Insulation, Section 23 07 13.
- C. Fans, Section 23 34 00.
- D. Low Pressure Ductwork, Section 23 31 13.
- E. Medium and High Pressure Ductwork, Section 23 31 22.
- F. Instrumentation and Control for HVAC, Section 23 09 00.
- G. Variable Air Volume Units, Section 23 36 16.

PART 2 - PRODUCTS:

2.1 DUCT ACCESSORIES:

- A. Louvers - Louvers in outside walls shall be high performance weather louver. Louver to be of extruded aluminum construction with anodized finish, color by Architect. Louver shall be a minimum 4" thickness unless otherwise specified. Adjustable louvers to have vinyl blade gasket. Louvers to have 0.15" wg. pressure drop maximum at 900 fpm velocity through free area with no water carryover. All louvers to have aluminum bird screen and exterior frame. All louvers are stationary type unless noted on drawings, and shall have AMCA seal.
- B. Manual Balancing Dampers:
 - 1. Manual balancing dampers in rectangular ducts shall be opposed blade type constructed of 16 ga galvanized steel, with vinyl seals, and with a maximum leakage of 5 cfm per sq.ft at 1" wg differential pressure. All dampers to be caulked with silicone between damper duct, and have external adjustment marked Open-Closed. Quadrants for dampers in insulated ducts shall be mounted on 1-1/4" white pine blocks. Dampers shall be furnished with controls where indicated on the drawings.

2. Manual Balancing Dampers in round ducts shall be minimum two blade opposed blade type 16 ga galvanized steel with a maximum leakage of 15 cfm per square foot at 1" wg differential pressure. Quadrants for dampers shall be mounted on 1-1/4" white pine blocks.
 3. Manual balancing dampers in ducts with pressure over 2" wg shall have multiple opposed blade 18 gauge airfoil blades with seals. Leakage to be 15 cfm per square foot at 1" wg differential pressure. Quadrants for dampers shall be mounted on 1-1/4" white pine blocks.
- C. Air Intake Shutters shall be parallel blade type construction with minimum 20 ga. galvanized steel blade and 16 ga. galvanized steel frames. 3/16" diameter steel and rods and nylon bearings. Maximum differential pressure 1" wg.
- D. Back draft and Pressure Relief Dampers shall be parallel blade type construction. Blade shall be minimum 24 ga. aluminum construction with .063" aluminum frame. Seals shall be polyurethane sponge on sill and felt on blades. 3/16" diameter steel axle rods and nylon bearings. Maximum differential pressure 1" w.g.
- E. Dampers, Fire:
1. Provide UL approved and labeled, fire damper where shown, where required by NFPA-90A, and/or State Fire Marshall. Fasten damper to duct and building in precise accord with UL approval.
 2. Provide 160° F fusible links and/or as required by NFPA 90A, except at range hoods use 280° F. Provide 10% extra fusible links with at least two of each operating characteristics.
 3. Provide clinch locked, access door and frame at each fusible link.
 4. Where noted, provide motorized reset mechanism.
 5. Downstream of all fire dampers in ducts handling 2000 FPM velocity and above, install a combination access opening, viewing window and vacuum relief valve section similar to United Type AR-2.
 6. When fully open, the clear inside dimensions of frame shall equal, or exceed, the size of the mating ducts.
- F. Smoke Dampers:
1. For rectangular ducts shall be a parallel blade design, minimum 16 ga galvanized steel blade and frame. Seals shall be of non-toxic elastomeric or silicone rubber. Entire unit shall meet NFPA 90. Requirements shall be 1983 UL555S Classified leakage Class I. Unit shall be equipped with electric or pneumatic operator rated at temperature rating of 250°F.
 2. For round duct two-piece unit with style blade construction minimum 14 ga. galvanized steel and 20 ga galvanized steel frame. Seals and requirements same as rectangular damper.
 3. When fully open, the clear inside dimension of frame shall equal or exceed size of mating ducts.

2.2 GRILLES, REGISTERS, AND CEILING OUTLETS:

- A. Unit rating shall be tested and certified in an ADC Certified Laboratory, or other approved laboratories, per ADC Test Codes.
- B. All flat grilles and registers shall be as scheduled on drawings, with baked enamel finish; color as selected by Architect.

- C. All outlets and inlets to have sealing gaskets and volume control dampers unless otherwise noted. On ceiling diffusers provide equalizing deflectors. Provide frame suitable for wall or ceiling installation used. Verify with Architectural drawings.

2.3 DUCT SILENCERS:

- A. Type - The silencers shall be of the round or rectangular type suitable for use in ductwork.
- B. General - Noise within the ductwork of the air handling system shall be satisfactorily controlled by the installation of prefabricated sound traps, and adhere to the specified requirements in all respects. Sound attenuators must be manufactured in supplier's own facilities under his own quality control.
- C. Materials - The attenuators shall be constructed of 22 gauge or heavier galvanized steel sheets. Lock formed seams shall be mastic filled. The interior configuration shall be straight thru passages of consistently exact dimension to insure uniform performance. All interior components of the sound traps shall be held in place by spot-welding not more than 3 inches on center. The acoustical filler shall be fiberglass compressed to 4.5 pounds density. The Subcontractor shall be required to furnish suitable transition sections from the specified silencer units to the required duct size where the opening in the silencer system differs from the duct size.
- D. Assembly in Banks - Where the rectangular silencers are assembled in banks, they should be encased with sheet metal as specified under "Duct-Work" for the pressure involved.
- E. Attenuation - Shall be shown by the schedule on the drawings.
- F. Pressure Drop - Shall not exceed the values shown on the drawing and where the measured pressure drop is greater than that shown, the sound trap shall be replaced with a sound trap of suitable pressure drop.

2.4 FLEXIBLE CONNECTORS:

- A. Provide flexible connectors between each air unit or fan and the duct distribution, on both the supply side and the return side.
- B. Connectors shall not exceed 10 inches in length.
- C. Connectors to be of an approved flame retardant fabric with a maximum flame spread of (25) and a maximum smoke development rating of (50).

PART 3 - EXECUTION:

3.1 INSTALLATION:

- A. Install Air Distribution Equipment and Specialties as specified above and as recommended by manufacturer.
- B. Do not install flexible ducts that have more than a 90° turn, or more than 4 feet total length.
- C. Provide all screws, bolts, nuts, inserts, etc. required for attaching accessories and items to ducts, walls, floors and ceilings.

3.2 EXCESSIVE NOISE AND VIBRATION:

- A. All air distribution equipment was selected for a noise level recommended for the space it serves. Any equipment causing excess noise or vibration will be replaced at the Contractor's expense.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 - GENERAL:

1.1 WORK INCLUDED:

- A. The work required under this section includes all work necessary for the complete installation of all fans.
- B. The work of these sections is subject to the requirements of the Mechanical General Provisions and Basic Materials specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods, Section 23 01 05.
- B. Duct Insulation, Section 23 07 13.
- C. Air Terminal Devices, Section 23 36 13 & Section 23 36 16.
- D. Controls, Section 23 09 23.

1.3 CERTIFIED RATINGS:

- A. All fans shall conform to AMCA and bear the AMCA certified rating seal.
- B. Sound Power Data: Rated in accordance with AMCA 300.

1.4 EXPLOSION-PROOF FANS:

- A. Each Fan in an explosion-proof area shall have a spark-proof wheel, an explosion proof motor and explosion proof starter.

PART 2 - PRODUCTS:

2.1 FANS:

- A. Roof Exhaust Fans shall be low contour power roof type, each complete with: aluminum weatherproof housing with square turned down flanged base for curb mounting, centrifugal wheel; vertical grease lubricated ball bearing motor; vibration absorbing mountings for all rotating parts; aluminum bird screen; gravity back draft shutters; motor and drive mounted outside of air stream; and direct or belt drive, as required for the fan involved. Belt drive fans shall have sealed permanently lubricated ball bearings, Vee belt drives, adjustable pitch motor sheaves, and belt adjusting means. Each 1/2 hp and smaller single-phase roof fan shall have suitable toggle type disconnect switch furnished and mounted in the fan enclosure by the fan manufacturer.

- 1. Roof curbs: provide for each roof exhaust fan a factory fabricated roof curb assembly, 12" high standard type as required for the fan involved. All roof curbs shall be of galvanized steel construction with flashings, roof fastenings, and 1" thick fiberglass anti-

sweat thermal insulation. Roof curb shall match roof slopes as required.

2. Excessive noise: at Contractor's expense, each roof exhaust fan which has a sound level higher than that scheduled for the fan involved or is otherwise excessively noisy shall be removed and replaced with an acceptable roof exhaust fan.
- B. Ceiling fans shall be direct drive centrifugal type with grille, insulated housing, wall switch, back draft damper, and discharge duct to roof with roof jack or wall louver (brick vent) when discharging to outside wall.
 - C. In-Line Fans shall be duct mounted type, direct connected or belt driven as scheduled, each complete with: square or tubular metal housing, with duct connection flanges: NEMA standard 1800 maximum rpm sealed grease lubricated ball bearing motor; centrifugal wheel; and vibration absorbing mountings for rotating parts or entire fan assembly. Each belt drive fan shall have: fan shaft mounted on grease lubricated ball bearings, either sealed type or with accessible lubricating fittings on housing exterior; Vee belt drive; adjustable pitch motor sheave ONLY for fan with single belts; belt adjusting means; and belt guard.
 - D. Up blast propeller roof fans shall be industrial exhaust type direct connected or belt driven as scheduled. Each fan shall have: weatherproof housing, with up blast fan cylinder and square turned down flanged base for curb mounting constructed of aluminum, galvanized steel, or steel with phosphatized and baked-on rust-inhibitive painted finish; free operating automatic aluminum butterfly type discharge dampers, with nylon or oil-lite bronze bearings, and magnetic latches which will positively prevent closed dampers from fluttering or rattling; propeller fan wheel; NEMA standard vertical 1,800 maximum rpm grease lubricated sealed ball bearing motor; vibration absorbing mountings for rotating parts; and suitable rain-tight disconnect switch factory mounted on outside of fan housing ONLY for fans with 3/4 hp and smaller single phase motors.
 1. Direct drive fans: motors for these shall be totally enclosed type.
 2. Belt driven fans: each of these shall have: fan wheel shaft mounted on sealed grease lubricated ball bearings; Vee belt drive; adjustable pitch motor sheave ONLY for fans with single belts; belt adjusting means; and weather proof motor enclosure.
 3. Roof curbs: provide for each up blast propeller roof fan a factory fabricated standard type roof curb assembly of aluminum or galvanized steel construction, with flashings, and anti-sweat thermal insulation.
 - E. Propeller Wall Fans shall be direct or belt drive type as scheduled. Each fan shall have: rectangular steel wall mounting plate, with rounded orifice ring and mounting devices; propeller wheel; NEMA standard 1800 maximum rpm grease lubricated sealed ball bearing motor; wire safety guard on room side of fan; gravity back draft shutters on discharge side of fan; and vibration absorbing mountings for rotating parts. Belt drive fans shall have: sealed grease lubricated ball bearings mounted fan shafts; Vee belt drives; adjustable pitch motor sheaves ONLY for fans with single belts; and belt adjusting means.
 1. Corrosion resistant provisions: where scheduled ONLY entire fan including back draft shutter assembly, shall have factory-applied epoxy or other chemical resistant coating suitable for protecting fans and shutter from chemical fumes involved, and shall have a totally enclosed motor.
 - F. Utility Sets shall be packaged fully factory-assembled centrifugal type, direct connected or belt driven as scheduled. Each utility set shall be complete with steel scroll housing, arrangement as indicated or required for application involved, with inlet and outlet duct collars, motors mounting provisions, and unit mounting base; single inlet-single width centrifugal wheel; NEMA standard 1,800 maximum rpm sealed grease lubricated ball bearing motor; vibration absorbing mountings for rotating parts; and weatherproof construction ONLY for sets exposed to weather. Each belt driven sets shall have fan wheel shaft mounted on sealed grease lubricated ball bearings; Vee belt drive; adjustable pitch motor sheave ONLY for fan sets with single belts; belt adjusting means; and belt guard.

- G. Centrifugal Wall Sets shall be direct drive type conforming to all applicable requirements for low contour roof fans, EXCEPT that centrifugal wall fans shall be arranged for horizontal mounting, and disconnect switches are not required.
- H. Centrifugal Airfoil Blade Fans:
1. Housings: Class I and II, having wheel diameter 36" and smaller shall be convertible for various directions of discharge. Side sheets shall be fastened to scroll sheets by means of a deep lock seam. Housing supports of 1-piece welded construction. Housings for all Class III, and fans in Class I and II having wheel diameters over 36", shall have side sheets welded to scroll sheets. Single width fans 81" in diameter and larger, and double width fans 73" in diameter and larger, shall be split horizontally with heavy flanges on both sections for assembly. Flanged joints shall be gasketed. Sealer shall be applied to joints between housing, inlet and housing support to prevent air leakage. Inlet collars on all sizes of single width fans shall extend beyond the fan housing to provide an uninterrupted duct connection. Both inlet and discharge duct collars shall be drilled or punched at uniform intervals. Inlet cones shall provide smooth airflow into the wheel with minimum shock and turbulence.
 2. Fan Wheels: Constructed of airfoil blades backward inclined from the direction of rotation, welded to the spun rim and hub plate. All wheels shall be carefully trued after assembly and shall be dynamically balanced.
 3. Fan Shafts: Of SAW 1040, or 1045, hot rolled steel, turned, ground and polished.
 4. Fans: Equipped with precision anti-friction bearings of the self-aligning, grease-packed, pillow block type having a grease seal that will prevent loss of lubricant and exclude dirt.
 5. Where shown on the drawings, provide adjustable vanes mounted in the fan inlet. The number of vanes shall be one less than the number of blades in the fan wheel. Vanes shall be operated from a center mechanism. Each vane shall be supported at the ends by machined bronze bearings. Vanes on double inlet fans shall be interconnected through a linkage that will operate vanes in unison. When vanes are to be operated manually, provide a means of securely clamping in the desired position. When automatic operation is indicated, furnish the proper arm for easy connection of damper motor linkage.
 6. Where indicated on the drawings, fans shall be provided with a damper mounted at the discharge. Damper blades shall be of heavy stamped steel arranged for opposed operating mounted in a rigid flanged frame. Bronze or ball bearings shall be provided at each end of the damper blades. Dampers shall be provided with complete linkage having either a quadrant for manual operation or extended rod for automatic control as required.
 7. Heavy 2" wire mesh inlet screens shall be furnished when indicated on drawings. Where inlet bearings are used, screens shall be mounted inside these drawings.
 8. All fan parts shall be given a bonding coat before painting. After the cleaning and surface conditioning process, but before assembly, parts shall be spray painted with 1 coat of grey primer-finisher. A second coat of the same paint shall be applied to the exterior and all accessible interior surfaces after the fan is assembled. Shafts shall have a rust-preventative coating.
 9. Fan ratings shall be based upon tests performed in accord with AMCA Standard 210-67 Test Code for Air Moving Devices. Each fan shall carry the AMCA seal.
- I. Centrifugal Fans, Axial Flow:
1. Fans shall have a sharply rising pressure characteristic, which shall extend throughout the operating range and continue to rise well beyond the efficiency peak to insure quiet, stable operation under all conditions. The horsepower characteristic shall be truly non-overloading and shall peak at maximum efficiency and within the normal selection range.
 2. Housings shall be tubular type to provide straight through inline airflow entrance to discharge. Multiple aerodynamic conversion vanes shall be located immediately following the wheel to redirect the airflow to minimize noise. Inlet and outlet diameters shall be identical to accommodate a single duct size and shall be flanged. All fans shall be V-belt driven, arrangement 9 with motor mounted on an adjustable platform welded securely to the tubular housing. All vertical fans shall be designed to withstand the

vertical thrust load.

3. Fan wheels 27" in diameter and larger shall be centrifugal backwardly inclined type with die-formed airfoil blades for maximum efficiency and QUIET operation. Smaller wheels shall be all welded with single plate blades curved to the mean radius of the airfoil blade. Wheel diameters shall be in accordance with the standard sizes adopted by AMCA for non-overloading centrifugal fans.
4. Provide spin ring volume control to permit volume reduction with a corresponding horsepower saving. Spinning control shall be designed for inlet duct attachment, girth as an integral part of the fan inlet, and removable as an assembly for maintenance or accessibility to the fan wheel. An inlet deflection disc shall be provided to insure air re-entry into the fan inlet. A regulating level shall be provided to position the orifice plate for either manual or automatic operation.

J. Vane Axial Fans With Acoustical Enclosure:

1. 14 gauge steel hydraulically expanded to form integral inlet bell and diffuser sections. Hydraulically expanded stuffing ring welded in area of wheel raceway. On VAV variable speed fan units, fan inlet supports to be structurally reinforced for extra stresses due to variable speed fan modulation.
2. Fan Wheels: Constructed of airfoil blades, aluminum single piece precision casting with eight radially projected blades. All wheels shall be carefully tured after assembly and shall be dynamically balanced and jeyed to fan shaft.
3. Fans: Tapered inlet and outlet shells over fan hub assembly. End belts shall cover fan drive assembly. Fan parts to be painted with enamel primer prior to final assembly. Finish coat to be enamel and applied to the exterior surfaces after assembly.
4. Acoustical Enclosure:
 - a. Fans, internally isolated on spring isolators and then flex connected inside of an airtight acoustical enclosure. Walls, 16 gauge steel, internally lined with 2" thick three-pound per square foot density fiberglass. Airside surface of acoustical lining, coated with black matte faced lining to prevent scuffing. Exterior surfaces to be cleaned, conditioned and painted with enamel finish.
 - b. Access to fans shall be provided by two large full size side panels. Panels shall be fully gasketed and mechanical attached to casing for easy removal.
 - c. Fan grease lines to be extended through enclosure for easy servicing of fan. Fan motor leads shall be extended through casing for easier installation.
 - d. Fan to be internally isolated. Enclosure to be supported on rails for mounting per plans.
 - e. Enclosure shall be rated for 4" negative or 5" positive pressure.
5. Diffuser:
 - a. Diffuser shall be cast aluminum with radially projected straightening vanes with airfoil cross-sections. Leading edge of vanes, curved to reduce tone noise generation. Clips shall be applied to harmonic ring potential.
 - b. V-Belt Drive: Cast iron or steel sheaves, computer selected for low noise, low maintenance operation. Center distance and arc of contact maintained within prefixed limits. Constant speed fans use variable or constant pitch drives; variable speed modulated fans use fixed drives only.
6. Fan sound power levels per octave band not to exceed the following:

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000
Outlet (DB)	84	83	82	80	79	74	69
Radiated (DB)	73	69	71	66	61	52	48
Inlet (DB)	80	80	83	83	83	78	73

Sound power levels, especially sound radiated to the equipment room, must be attenuated to above minimum levels. Submittal must show the acoustical enclosure around fan and

provide sound power data. Care must be taken by the manufacturer to reduce the lower

frequency sound power levels. The manufacturer and contractor will, at no additional cost to the owner, be responsible for a quiet system.

K. Fume Hood Fans:

Fume Hood Fans shall be packaged fully factory-assembled centrifugal type, direct connected or belt driven as scheduled. Each fan set shall be designed for fume hood use set shall be complete with heavy cast iron scroll housing, arrangement as indicated or required for application involved, with inlet and outlet duct collars, motors mounting provisions, and unit mounting base; single inlet-single width centrifugal wheel; NEMA standard 1,800 maximum rpm sealed grease lubricated ball bearing motor; vibration absorbing mountings for rotating parts; and weatherproof construction for sets exposed to weather. Each belt driven sets shall have: fan wheel shaft mounted on sealed grease lubricated ball bearings: Vee belt drive: cast iron adjustable pitch motor sheave; belt adjusting means; and belt guard. Fan wheel, housing, frame etc. shall be coated with a corrosion-resistant, baked phenolic coating.

PART 3 - EXECUTION:

3.1 INSTALLATION:

- A. Install fans per manufacturer's recommendation.
- B. Check for proper alignment, belt tension and rotation.
- C. All exposed openings in fan housing shall be protected with screens or gratings. All fans shall have belt guards on exposed drives.
- D. Provide access doors and/or panels for servicing of belts, shafts, dampers, damper controllers, motors, etc.

END OF SECTION

SECTION 23 82 39

UNIT HEATERS

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. The work required under this section of the specification includes all work necessary for the complete installation of steam/hot water unit heaters.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials & Methods, Section 23 01 05.
- B. Hydronic Piping & Specialties, Section 23 21 13.
- C. Steam & Condensate Heating Piping, Section 23 22 13.
- D. Duct Insulation, Section 23 07 13.
- E. Coils, Section 23 82 16.

PART 2 - PRODUCTS:

2.1 UNIT HEATERS, HORIZONTAL BLOW:

- A. Components: (1) coil encased in two-piece front formed into wrap-around sides with adjustable horizontal louvers across face, (2) back panel with deep drawn fan orifices, (3) propeller fan with aluminum blades factory balanced, (4) fan guard, (5) coil, etc.
- B. Supply and return connections shall be horizontal at back corners; connections in top or bottom are not acceptable.
- C. Casing phosphatized to prevent corrosion and finished with baked enamel.

2.2 UNIT HEATERS, VERTICAL BLOW:

- A. Components: (1) casing formed by two square or circular steel plates, bottom plate forming an orifice for air delivery with coil in return plates, (2) propeller fan-motor with aluminum blades factory balanced, (3) multiple circuit coils.

2.3 UNIT HEATERS, CABINET TYPE:

- A. Cabinets: Furniture steel; 16 ga. fronts, tops and bottoms; 18 ga. backs; fronts removable for access to motor, fan, and heating element. Directional type grilles, die-formed in cabinet. Cabinet bonderized and finished with enamel baked at 250 degrees F.
- B. Motors: Permanent split capacitor type, resiliently mounted.

PART 3 - EXECUTION:

- 3.1 Install per manufacturers best recommendation.

END OF SECTION

SECTION 23 83 13

ELECTRIC RADIANT HEATERS

PART 1 - GENERAL:

1.1 WORK INCLUDED:

- A. The work required under this section includes all work necessary for the installation of electric heating equipment.
- B. The work of this section is subject to the requirements of the Mechanical and Electrical General Provisions and Basic Materials Specifications.
- C. All electrical equipment shall be UL listed and comply with National Electrical Code.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Material and Methods, Section 23 01 05 & 26 01 05
- B. Controls, Section 23 09 13.

PART 2 - PRODUCTS:

2.1 DUCT HEATER, ELECTRIC:

- A. Heaters consist of open coils held by floating ceramic insulators, maximum 3-1/2" centers, in galvanized steel frame. Terminal bolts, nuts, washers, of corrosion resistant materials, stainless steel or equal; shake-proof washers on heater terminals. Resistance wire, 80% nickel, 20% chromium, no iron. Install so that coils are mounted horizontally.
- B. Provide (1) primary protection automatic reset temperature limiting control, (2) built-in contactors, to de-energize heater circuits, (3) built-in dual element fuses, one set for each smaller, heating circuit, (4) secondary protection of manual reset, thermal type in each heater circuit, (5) built-in pressure type, UL listed, air flow switch to interlock heater and fan all contained in totally enclosed terminal box. All items shall be serviceable through terminal box without removing heater from duct. Where control circuit transformer is used, it shall be dry type with fused primary windings and built into terminal box. Thermal cut off units shall be mounted near top of unit, and shall be "Linear" type.
- C. Unit shall be factory wired from single set of main lugs. Where total unit load exceeds 48 amperes, sub-divide heating elements to 48 amps or less; protect each branch at not over 60 amps. Where more than one step of heat is specified, locate stages for uniform face heating.
- D. Automatic limit controls shall open all underground conductors.
- E. Provide (1) green pilot light on side of terminal box to show when each heater is "on", (2) toggle switch on side of box to open all contactors, (3) an interlocking disconnect, (4) magnetic contactors, (5) terminal block, etc.
- F. Complete unit listed by Underwriter's Laboratories, Inc. as suitable for zero clearance to combustibles, and subjected to a 2000 volt dielectric test, or to twice rated voltage plus 1,000

whichever is larger. All internal wiring insulation shall be 105 degrees C. minimum.

2.2 CABINET HEATER:

- A. Electric Cabinet Heaters shall include: chassis, single-speed motor and fan assembly, electric heating element assembly, high-limit cutout switches (one per element), fan switch, magnetic contactor and unit on-off switch.
- B. Cabinet: 18 ga. steel, removable side panels, adjustable louvers to control air throw, finished with baked enamel.
- C. Heating element: covering entire air discharge area, warranted for five years, non-glowing design consisting of resistance wire enclosed in a steel sheath to which steel plate fins are brazed.
- D. Fan Motor: totally enclosed, impedance protected, with high starting and running torques. For 240 volt and lower, heaters, motor and controls shall operate directly off of line voltage of heaters; on 277 volt and higher heaters, a transformer shall provide proper fan motor and control voltage.
- E. Fan control on 5 KW and larger models shall activate fan after heating element reaches operating temperature, and continue to operate fan after the thermostat is satisfied and until heating element is cool.
- F. Control box, housing all heater wiring and controls, shall be located at bottom of heater and designed to permit servicing without dismounting heater.
- G. All heaters shall have a built-in 3-pole contactor.
- H. All heaters drawing 48 amps or more shall have built-in branch circuit fusing.
- I. Manual, reset thermal safety cutout shall automatically shut off heater in event of over-heating.

2.3 WALL HEATERS, FORCED FLOW:

- A. Downflow, force flow, wall heaters having: finned, sheathed heating element; fan delay switch to run fan whenever heating element is up to temperature; thermal limit switch; and automatic built-in thermostat.
- B. Meet NEMA and UL Standards; be UL certified as a complete unit.

2.4 CEILING HEATERS:

- A. Units: designed for ceiling mounting; shall meet UL and NEMA Standards; and be UL certified as a complete unit.
- B. Enclosure:
 - 1. Enclosure shall be designed to provide even distribution of heated air to the space by drawing return air around the periphery of the heater, across and thru the elements and then discharge thru the center section.
 - 2. All parts of enclosure shall be constructed of heavy gauge steel. The surface mounted type shall have horizontal steel louvers. The recessed mounted type shall have a grille assembly of heavy gauge steel with 1/4" square slots for the return air.
 - 3. Motors: The motor shall be a permanently lubricated unit bearing, shaved pole type with impedance protection.

4. Elements shall consist of two or more corrosion resistant steel sheathed elements mechanically bonded to common corrosion resistant steel fins.
5. Thermal overload shall be provided which disconnects the motor and elements should normal operating temperature be exceeded. Overload shall remain open until manually reset by turning heater off for five minutes.
6. Controls: Units shall be controlled by 24 volt wall thermostat and heater shall be provided with remote line voltage to 24 volt relay and contactor, and line duct tape to 24 volt transformer.

2.5 ELECTRIC RADIANT HEATERS:

- A. Units shall be complete with built-in thermal protection and built-in thermostat switch.
- B. Unit shall meet UL and NEMA Standards and be UL certified as a complete unit.

2.6 BASEBOARD HEATERS:

- A. Units shall meet NEMA HE2 Standards, and shall be UL certified as a complete unit.
- B. Units shall be surface mounting, and shall have integral line voltage thermostat and switch, thermal cutouts, frame supports on 16" centers, junction box, etc.
- C. Capacity shall not exceed 250 watts per lineal foot.
- D. Units shall be provided with convenience outlet where so indicated.

2.7 CONVECTOR HEATERS:

- A. Units shall be UL certified as a complete unit.
- B. Units shall have: 16 ga. steel cabinet; finned-sheathed heating element; thermal cut-off protection; built-in thermostat and/or relay; necessary filler pieces, blank sections, control sections, etc. as required for complete installation.

2.8 UNIT HEATERS, HORIZONTAL BLOW, ELECTRIC:

- A. Unit Heaters: UL approved and designed for either wall or ceiling mounting without modification.
- B. Heating Elements: nickel-chrome resistance coils embedded in refractory material, enclosed within a steel sheath. Sheath provided with spirally wound, extended fins. Elements housed in galvanized-steel enclosure.
- C. All wiring heating element circuit shall be high temperature, heat resistant wire, fully enclosed in metal boxes or conduit.
- D. High limit cutout switches: Automatically re-setting thermal switch wired in series with each element and located in discharge air stream shall protect against overheating.
- E. Fan Switch: To prevent overheating within element bank, a thermally activated fan switch shall keep fan motor operating until all residual heat is dissipated.
- F. Motors: Resilient mounted on a cushion base, and furnished standard for constant speed

operation unless multiple speeds noted. All motors shall have built-in, automatic re-set thermal overload protection. For multiple speed motors provide a speed selector switch which simultaneously de-energizes heating elements and decreases fan speed. All motors shall be 230 volt, single phase. Where heater voltage is 480 volt, provide a step-down transformer to operate motor.

- G. Fans: Multiple forward-curved, double-inlet, aluminum fans.
- H. Filters: All air shall be filtered prior to entering the fans or heating elements, using throw-away filters.
- I. Electric Control: Provide automatic electric controls, factory mounted and wired; include the following:
 - 1. Magnetic Contactor: Activates main heater power and fans in response to thermostat.
 - 2. Unit-Mounted Thermostat: Controls heating elements in response to return-air sensing device.
 - 3. Safety Disconnect Switch: Disconnect power to unit.

PART 3 - EXECUTION:

- 3.1 Bottom of wall heaters shall be at top of baseboard, or higher as noted.
- 3.2 Install all equipment for manufacturers recommendations and installations.

END OF SECTION

SECTION 22 01 01

PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, material, etc. required to complete installation specified herein and/or shown or scheduled on the drawings.
- B. Equipment and materials used in the work shall be in accordance with the contract documents, of the best quality and grade for the use intended, shall be new and unused and shall be the manufacturer's latest standard or current model for which replacement parts are readily available.
- C. All apparatus and equipment shall be installed and connected in accordance with the best engineering practices and in accordance with the manufacturer's recommendations. All auxiliary piping, water seals, valves, electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.

1.2 SPECIAL CONDITIONS, PLUMBING:

- A. By the act of submitting a bid, this Contractor agrees that all of the "Contract Documents" and each of the Divisions of the complete specifications have been reviewed and studied, and all requirements and coordination resulting there from are included.
- B. In this section, the word "Contractor" means the Plumbing Contractor. The word "provide" means furnish, install and connect.
- C. Do not scale drawings having 1/4" or smaller scale. Because of small scale, it is not possible to indicate all offsets, fittings, and accessories; provide such as are required for complete installation.
- D. The right is reserved to move any element as much as ten (10) feet at no increase in cost provided Contractor is notified before work in question is installed.
- E. Contractor shall be responsible for determining and verifying the characteristics of electrical current available to operate the plumbing equipment prior to ordering such equipment.
- F. Contractor shall be responsible for reviewing all drawings (Architectural, Mechanical, Electrical, Structural, Civil etc.). If any discrepancies are discovered between drawings, the contractor shall notify the Architect/Engineer prior to bidding so that an addendum may be issued for clarification.

1.3 CODES AND STANDARDS:

- A. The intent is that the complete installation shall comply with applicable laws and ordinances, utility company regulations, and applicable requirements of the following:
 - 1. International: Building Code, Gas Code, Mechanical Code, and Plumbing Code.
 - 2. NFPA: National Fire Protection Association.
 - 3. National Plumbing Code

4. AGA: American Gas Association.
5. FM: Association of Factory Mutual Fire Insurance Company.
6. ASME: American Society of Mechanical Engineers.
7. ASTM: American Society of Testing Materials.
8. NSF: National Sanitary Foundation.
9. PDI: Plumbing Drainage Institute.
10. UL: Underwriters Laboratories.
11. NEC: National Electrical Code.
12. NEMA: National Electrical Manufacturer's Association.
13. SMACNA: Sheet Metal and Air Conditioning Contractors National Association.
14. ARI: American Refrigeration Institute.
15. PFMA: Power Fan Manufacturer's Association.
16. MSS: Manufacturer's Standard Society of Valve and Fittings Ind.
17. ANSI: American National Standard Institute.
18. API: American Petroleum Institute.
19. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers.
20. Tennessee Energy Code.
21. TOSHA: Tennessee Occupational Safety & Health Act.

1.4 COORDINATION OF WORK:

- A. Furnish and locate required anchor bolts, sleeves, inserts, supports, etc.
- B. Lines which pitch shall have right-of-way over lines whose elevations can be changed. Offsets, transitions and changes in direction in pipe and ducts shall be made as required to maintain proper headroom, pitch, etc.
- C. Coordinate all fixtures, etc. with floor, wall and ceiling patterns.
- D. All work shall be installed as neatly as possible in the locations shown but shall be subject to such deviations, modifications and relocations as may be necessary to conform to the requirements of the architectural drawings and as necessary to avoid interferences with the structural work and the work of other trades, and interferences between the various trades. This shall be done at no cost to the Owner. No piping or equipment shall be installed which would require ceilings to be lower than required by drawings, unless approval is obtained from the Architect.
- E. If necessary to coordinate and expedite the work, the Contractor shall prepare "interference drawings" and submit them to the Architect for approval. Such drawings shall show the work of the various trades involved, illustrate proposed details of construction and arrangement of equipment and apparatus, and clearly indicate any deviations from contract requirements.
- F. Minor changes in arrangement may be made to suit unforeseen conditions, but no major deviation shall be made without written approval from the Architect. If any deviations are deemed necessary, submit all details of proposed changes and all reasons therefore, in writing, to the Architect for approval prior to making installation of such work.
- G. Contractor shall coordinate requirements for utility connections with municipal utility departments and utility companies. Installation of service taps, extensions, valves and metering provisions shall comply with criteria of appropriate authority, and any cost associated therewith shall be included in the bid amount.

1.5 DATA AND SHOP DRAWINGS:

- A. Prior to ordering, submit certified prints and/or descriptive data for major pieces of equipment, fixtures, valves, insulation, controls, etc. Stamp, sign and certify to be correct and in compliance with the Contract Documents, each drawing submitted for review. Drawing submitted without signed certification will be returned without review.
- B. Any deviation in submittal from contract documents of materials, capacities, space requirements in items furnished, etc. shall be listed in a letter accompanying submittal stating deviation and reason requested for consideration of acceptance.
- C. Submittals shall include one paper copy and one electronic copy, clearly marked, and in order as indicated on drawings. Items submitted partially and in an unorganized manner shall be returned without review.
- D. Submittal shall show: manufacturer's catalog number, performance data with indicated operating points, finishes, optional features and modifications. Each sheet of printed submittal data shall be clearly marked (using arrows, underlining, or circling) to show the particular size, type, model number, ratings and options actually being proposed.
- E. When work in accordance with manufacturer's recommendation is specified, a copy of recommendations shall be kept in the job office.
- F. Furnish the number of copies required by the General and Special conditions of the contract.
- G. Shop drawings shall show sizes and details of required concrete and steel machine foundation, location of anchor bolts, physical dimension of equipment, equipment weight or other pertinent data required for equipment support or installation.
- H. Approved shop drawings do not mean that drawings have been checked in detail; said approval does not in any way relieve the contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings or specifications.

PART 2 - PRODUCTS:

2.1 REFERENCE TO DRAWINGS:

- A. Reference shall be made to drawing schedules and details for: manufacturer, model, catalog number, size, capacity, performance, installation, etc. of equipment and material. Equipment of manufacturers other than those named, will be acceptable provided, in the opinion of the Engineer, it is of equal substance, function, performance and appearance.

2.2 CHOICE OF MATERIALS AND EQUIPMENT:

- A. In submitting substitutions, bidders should note the following minimum considerations: (1) capacities shown are absolute minimum and must be equaled, (2) physical size limitation for space allotted, (3) static and dynamic weight limitation (4) structural properties, (5) noise level, (6) vibration generation, (7) interchangeability, (8) accessibility for maintenance and replacement, (9) compatibility with other materials, assemblies, and (10) similar items shall be same manufacturer and style wherever possible.

- B. All material and equipment, for which a UL Standard, an AGA approval, or an ASME requirement is established, shall be so approved and labeled or stamped. Label or stamp shall be conspicuous and not covered, painted or otherwise obscured from visual inspection.
- C. Adhesives are not acceptable as a mounting, supporting, or assembling technique.
- D. Contractor shall pay any costs added to total contract as a result of any substitutions.
- E. Equipment, fixtures, piping, etc. shall not be purchased without Engineer's written approval.

PART 3 - EXECUTION:

3.1 EXISTING SERVICES:

- A. No service shall be interrupted without permission of the Owner. Owner must receive written request a minimum of 72 hours in advance of any anticipated shutdown.
- B. When encountered in work, whether or not indicated, cap or plug to otherwise discontinue existing inactive: sewer, water, gas, electric, other utility services, structures which interfere with work execution. Notify Engineer in writing of action taken. If removal is required, request instructions.

3.2 DRAWINGS:

- A. Drawings are diagrammatic. Contractor shall install the work in such manner that the equipment, piping, vents, etc. will fit in space provided, maintain headroom, and if in finished areas, be as neatly installed and "out-of-the-way" as physically possible. All equipment, piping, , etc., shall be installed to provide needed maintenance and passage space.

3.3 FEES:

- A. The contractor shall pay for fees and inspections as may be required for water and sanitary sewers, gas service, sprinkler systems, and all other systems requiring inspections by agencies having jurisdiction.

3.4 INSPECTION OF SITE:

- A. The drawings are prepared from the best information available and reflect the conditions commensurate with this information. However, the Contractor shall visit the site prior to submitting a proposal and shall verify the locations, sizes, depth, pressures, etc., of all existing utilities; and familiarize himself with working conditions, hazards, existing grades, soil conditions, obstructions, etc. If it becomes evident that existing site conditions will impair the proper operation of the utilities, or the construction process, the Architect shall be notified in writing.
- B. All proposals shall take these existing conditions and any revisions required into account, and the lack of specific site information on the drawings shall not relieve the Contractor of his responsibility.

END OF SECTION

SECTION 22 01 03

PLUMBING COMPLETION ITEMS

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

1.2 CONNECTION TO EQUIPMENT:

- A. Work shall include all labor, material, equipment, etc. required including, but not limited to, the following: (1) provide domestic hot and cold water supply, drain, vent, etc., and (2) connections to all equipment specified in this or other sections requiring such services.
- B. Indicated locations and sizes of equipment connections are approximate; exact locations and sizes of piping, valves, etc. shall conform to approved shop drawings. Connection sizes shall not be smaller than scheduled size or equipment outlet size, whichever is larger.
- C. Verify all connections and rough-in locations with the Architect and/or the equipment supplier or contractor prior to the start of their work.

1.3 ADJUSTING AND TESTING:

- A. Before testing, protect from damage any control and indicating devices, etc. not designed to stand test pressures. Test all elements before covering or "closing in".
- B. Provide labor, material, instruments, fuel, electricity, water and other costs in connection with all tests. Installed instruments may be used for tests if calibrated and approved for the purpose.
- C. Conduct pressure, as directed by and in presence of Engineer.
- D. Test all piping hydrostatically to 1.5 times maximum working pressure, but in no case less than 125 PSIG, for at least 4 hours. Caulking or peening repairs not permitted.
- E. Obtain certificates of approval, acceptance and compliance with regulations from agencies having jurisdiction.

PART 2 - PRODUCTS:

2.1 RECORD AND AS-BUILT DOCUMENTS:

- A. Maintain at job site a set of contract record documents kept current by indicating thereon all changes, substitutions, etc. between work as specified and as installed.
- B. Furnish Engineer one (1) complete set of record drawings and electronic drawing files showing installed location, size, etc. of all work and material.

- C. Show on record documents actual water flow rates, valve positions after balancing, etc.; also show, by actual dimension, location of all underground work.

PART 3 - EXECUTION:

3.1 OPERATING INSTRUCTIONS:

- A. Furnish to the Architect written operating and maintenance instructions for each system and each piece of equipment. Include in equipment data binder specified above: (1) instructions to start and stop each piece of equipment winterization (2) itemized maintenance schedule, (3) submittals.
- B. When systems are completely adjusted, furnish personnel for one (1) full day to instruct Owner's operators.

3.2 CLEANING AND FLUSHING:

- A. Fixtures, Equipment, Etc.
 - 1. Fixtures, piping, equipment, etc. shall be cleaned per manufacturer's printed instructions and Engineer's instructions.
- B. Clean-Up of Piping:
 - 1. Piping shall be: (1) flushed with clean water, (2) "blown out" with steam or compressed air, or (3) "swabbed out" as required, except where specified otherwise. All temporary connections required for flushing shall be provided and subsequently removed by the Contractor.
 - 2. Care shall be exercised by contractor to prevent any other foreign matter from entering pipe or components of system during construction. Plug pipe ends or cover with burlap, or other material to keep out foreign materials. Before erection, each piece of pipe, fitting or valve shall be visually examined and all dirt or other foreign matter removed.
 - 3. Check system to determine that no leaks exist. Any leaks in piping shall be repaired before proceeding. Pipe shall be opened at lowest points and highest points for initial flush and blow down.

3.3 PAINTING:

- A. All equipment shall present a clean, painted appearance; touch-up, or repair, as required.
- B. Paint all equipment and other ferrous metal, which is not otherwise protected against corrosion. Paint exposed pipe threads with Bitumastic #50. Clean thoroughly all surfaces before painting.

3.4 IDENTIFICATION:

- A. Identify all pipe by providing colored pipe markers, identifying the piping using flow arrows and colored bands: (1) in all accessible locations at 20 ft. intervals, (2) at each valve, (3) at each branch takeoff point, and (4) where a pipe leaves or enters a wall or floor so that lines may be traced from start to finish. PIPE LABELS AND BANDS SHALL BE SNAP ON OR STRAP ON "SETMARK" AS MANUFACTURED BY SETON NAME PLATE CORPORATION, NEW HAVEN, CONNECTICUT 06519, or approved equivalent meeting this level of quality. Identification colors, legend, letter sizes shall conform to ANSI and/or OSHA specifications.

- B. Identify location of outside underground piping by: 4"x4"x18" concrete stakes, flush with finish grade, located above lines at ends and/or corners, and by 2"x2" brass plates imbedded in building walls above pipes. On stakes provide plate secured to post indicating size and type of line below, along with depth of pipe below grade.

3.5 QUIETNESS OF OPERATION:

- A. Pumps, motors and other apparatus shall be selected and installed for reasonably quiet operation. Any objectionable noise, which develops, shall be corrected before the work will be accepted. Equipment, which produces objectionable noise, shall be adjusted or insulated so as to eliminate the noise, or shall be removed and replaced by satisfactory equipment. Provide spring or rubber machine mounting isolators and flexible piping connections where necessary to prevent transmission of vibration to building structure or to piping system.

END OF SECTION

SECTION 22 01 04

PLUMBING GUARANTEE AND WARRANTY

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

1.2 TEST PERIOD: Each piece of equipment shall meet performance specifications after one (1) year's actual operation.

PART 2 - PRODUCTS:

Not used.

PART 3 - EXECUTION:

- 3.1 The Contractor shall replace, or make good, any defect due to faulty workmanship or material, which shall develop within one (1) year from date of acceptance at no cost of Owner. This guarantee shall cover both material and labor and shall include: (1) refrigerant and oil replacement, (2) any adjustments or service required. The Contractor is responsible to replace work found not in conformance with the contract at any time during the life of the installation. Replacement of non-conforming work is not subject to the one-year warranty limitation.
- 3.2 Date of Acceptance shall be certified by the Engineer as that date on which the contract has been satisfactorily completed in accord with Contract Documents. If a whole or partial system, or equipment is put into use for benefit of any party, other than contractor and with prior written permission of the Owner, this agreed date shall become the "Date of Acceptance" for that piece of equipment or system.
- 3.3 CERTIFICATE: Prior to completion and final acceptance of the facility, furnish to the Engineer certification that the mechanical systems have been tested and that the installation and performance of those systems conform to the Contract Documents.
- 3.4 See other sections for additional warranty requirements.

END OF SECTION

SECTION 22 01 05

PLUMBING BASIC MATERIALS AND METHODS

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

1.2 ACCESS PANELS:

- A. Provide access panels, or doors, at concealed valves, shock absorbers, vents, traps, trap primers, inspection points, etc. and where noted. Panels shall be galvanized steel, 16 gauge frame, 14 gauge door with mounting accessories, spring hinges, screwdriver operated lock, and prime coat paint. Milcor "A" for acoustic tile, "M" for exposed masonry, "K" for plaster finishes, stainless steel for ceramic, or glazed structural tile. Where ceiling is "lift out" construction, ceiling access panels are not required. Panels shall be 18" x 18" or larger, as required for service intended.
- B. Access panels in fire rated construction shall have a UL label, Class B rating.

PART 2 - EXECUTION:

2.1 EXCAVATION, SHORING AND BACKFILL:

- A. Provide any excavation required for this Division below that is needed for general construction. Unless specifically noted, no extra shall be paid if rock or excavation difficulties are encountered.
- B. Provide separate trench for each utility.
- C. Provide: (1) bracing, shoring, etc. to protect sides of excavation, (2) staging, suitable ladders, barricades, etc. Comply with local regulations, or absence thereof with Division of the Manual of Accident Prevention provided for in Construction of the AGC.
- D. When trench excavation is required to cross traffic areas, one-half of the traveled portion of the pavement must remain open to traffic at all times, unless a plan approved by the City Traffic Engineer permits otherwise.
- E. Existing pavements, bases, curbs and gutters and sidewalks shall be cut and brought to a straight, vertical edge by mechanically sawing. Expansion joints removed shall be replaced.
- F. Maximum trench width is as shown on plans or 1.5 feet + O.D. of pipe or cable.
- G. Minimum trench width shall be sufficient to permit thorough compaction of the bedding material under and around the pipe or cable.

- H. All soft or otherwise unsuitable material shall be removed from the trench bottom and replaced with compacted crushed stone or other approved material.
- I. Bedding materials shall be the superior of class shown on approved plans or clean washed stone of 3/4-inch maximum particle size. Bedding shall provide a minimum of 6-inches cover above the pipe or cable unless otherwise shown on approved plans. Stone shall be brought up evenly on both sides of the pipe in 6-inch layers and tamped, rodded, or vibrated as required to provide a firm base and bedding around the pipe or cable.
- J. Remove all timber before backfilling. Backfill simultaneously on both sides of tanks, piping, etc. Backfill material shall be approved clay or chert, free of debris, rock larger than 1"Ø or other harmful material.
- K. All backfilling shall be compacted to 90% under sidewalks, or grass areas, and to 95% when under paved areas, structures, building slabs, and steps. etc. These percentages refer to "Percent of Maximum Density" per ASTM #D-1557. If more stringent, compact backfill to a dry density equal to that required by G.C.
- L. Backfill material for utility cuts in City of Chattanooga Streets and extending 18 inches beyond edge of pavement or back of curb shall be mineral aggregate, class "A", grading "D", (previously "33P", or "pugmix") in accordance with TDOT specification. This backfill material shall be placed and compacted in 6-inch layers by means of a mechanical tamp to a density not less than 83 percent of the solid volume density as determined from the bulk specific gravity and the dry weight of the aggregate. Material that is too dry for adequate compaction shall receive a prior admix of sufficient water to secure optimum moisture content.
- M. Pavement shall be replaced in kind as shown on the city's standard drawings. The patch shall be finished so as to not leave a bump or dip in the finish grade.
- N. If permanent pavement repairs cannot be made within (2) days, then temporary replacement shall be made with 2-inches cold mix or hot bituminous seal coat. Permanent repair MUST be made within 10 workdays from date of pavement cut.
- O. Whenever trench openings are within state highways, the permit holder shall comply with all requirements and provisions of the Standard Method of the Tennessee Department of Transportation for opening trenches through highways and replacing pavements. All such work shall be subject to inspection and approval by the Tennessee Department of Transportation and/or the City of Chattanooga.
- P. Restore existing pavement, curbs, sidewalks, sodding, etc. removed or damaged in connection with work.
- Q. For insulated piping below grade, provide a bed of 6" sand minimum. After the insulation finish has cured, backfill with sand around the installation and over the insulation to a minimum of 6".

2.2 CUTTING AND PATCHING:

- A. Provide all cutting, patching, etc. incident to this work.
- B. Do not cut into any structural element without written approval of Engineer.
- C. Patching shall be: (1) of quality equal to, and of appearance matching existing construction, and (2) shall restore all services and construction which remains in use to its condition prior to this

contract, unless otherwise noted.

2.3 PIPING THRU RATED WALLS AND FLOORS:

- A. Insulation on pipe passing thru fire rated walls must stop at pipe sleeve. Space between metal pipe and sleeve shall be protected with 3M Fire Barrier Penetration Sealing System or approved substitute. Installation shall be in accordance with the manufacturers recommendations for the hourly fire rating of the partition. The system shall be U.L. listed. Maintain vapor barrier on insulated chilled water and refrigerant suction piping.
- B. PVC pipe passing through rated walls or floors shall have 3M UL modified fire protection system.
- C. Refer to details on drawing for pipe and duct penetration thru rated walls and floors.

2.4 FLASHING:

- A. Where pipes, pass through roof, flash per drawing details. Where no detail is shown, use National Roofing Contractors Association Details.
- B. Locate pipes, etc. through roof to clear parapets, etc. by at least 18".
- C. Provide flashing or caulking as required at each opening through outside walls or roof. Flashing through roof of same materials and methods as under "Moisture Protection Division"; through walls shall be aluminum unless noted otherwise.
- D. Flashing shall provide watertight seal with 8" depth of water on roof.
- E. Provide necessary curbs to receive flashing. See SMACNA Plate #65 and/or drawing details.
- F. Sheet lead shall be FS #QQ-L-201A.

2.5 PROTECTION:

- A. Work shall be protected at all times. Pipes openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered if necessary, to protect against dirt, water, chemical or mechanical damage or defacement.

2.6 TEMPORARY WORK:

- A. Provide 3/4" water service with hose faucet 18" above grade located per instructions. Provide freeze protection. Upon completion of project: (1) close branch cock, (2) cap at point 18" below grade, (3) mark with concrete post.
- B. Water and electricity consumed during construction shall be paid for by General Contractor.

END OF SECTION

SECTION 22 01 06

PIPES, FITTINGS, JOINTS

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

1.2 EQUIPMENT CONNECTIONS:

- A. Provide unions or flanged connections at all: equipment connections, control valves, traps, etc. Do not conceal.
- B. Provide valves or stops, to isolate: risers and/or branches from mains, each pipe or equipment, and/or fixture from system, when ball valves are used, install "full-port" type only.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. CP: Brass pipe, chrome-plated, ASTM #B-43, fittings, cast, chrome-plated, ANSI #B-16.15.
- B. CIS: Cast iron pipe, ASTM #A-74 coated inside and outside with hot coal tar enamel, AWWA #C-203; positive-seal, 1-piece, elastomeric compression type gasket joints, or hubless pipe joints using neoprene gasket and S.S., full-length retaining sleeve are acceptable joints. Threaded drainage fittings: C.I. coal-tar enamel coated ANSI #B-16.12.
- C. CHD: Copper pipe, hard-drawn, Types K, L, and M, ASTM #B88-66. Fittings shall be wrought copper or as specified in Paragraph 2.2, solder joint type ANSI #B-16.11; cast fittings not acceptable.
- D. CSD: Copper pipe, soft drawn, Types K, L, and M, ASTM #B88. Flare fittings, ANSI #B-16.26, shall be used in connecting to equipment, solder fittings at all other joints. Where soft drawn copper runs below grade, there shall be no joints below 6" above floor.
- E. DWV: Copper pipe, hard-drawn, Type CWV, ASTM #B-306. Fittings shall be cast ANSI #B-16.23. Joints will be solder type.
- F. PVC: Plastic pipe, PVC #D-1785 for water. Fittings copper compression type, rubber ring seal or PVC-ASTM #D-2456 using solvent cement ASTM #D-2464. Use Type PSP-PVC ASTM #D-3033 for outside sewers. Use PVC-DWV ASTM #D-2665 for inside sewers.

PART 3 - EXECUTION:

3.1 LOCATION OF PIPING:

- A. No underground pipe shall be installed parallel to footings, or outside bearing walls, closer than 3'. Piping deeper than footings or bearing walls shall not be routed for the bearing "Region" after structure as defined by the volume at a 45-degree angle out from either side plus 3'.

Piping required to pass under or through a footing or bearing wall must be sleeved in a schedule 80 steel pipe with I.D. of 1" greater than pipe O.D.

- B. All pipe shall be concealed wherever possible, except in mechanical spaces.
- C. All exposed lines shall run at least 6-1/2' above finished floor, shall parallel building lines whenever practical and shall be as close as practical to building surfaces with a minimum of 1/2" clearance.
- D. Piping shall run in the most direct manner, avoiding unnecessary joints. All changes necessary to make the piping conform to the building construction shall be made without extra charge.
- E. Where necessary to run below grade, joints other than welded, soldered, or specified for sewers, are prohibited.

3.2 INSTALLATION:

- A. Provide unions, flanged or flared type connections, at all: equipment connections, control valves, traps, etc. Do not conceal.
- B. Where size changes on horizontal lines, use-reducing fittings, and bushings are prohibited. On liquid lines, have eccentricity down hold top level. On gas or vapor lines have eccentricity up hold bottom level.
- C. Use dielectric unions when dissimilar metallic piping is joined.
- D. For soldering joints on copper water and control pipe, use solder having 95% tin and 5% antimony. Use non-acid flux after mechanical cleaning. All copper joints shall be soldered, whether hard or soft drawn,
- E. Where plastic pipe is installed underground, bed in 1/4" gravel with minimum thickness of 4" on all sides.
- F. Where copper pipes are installed and run through metal studs, provide durable polypropylene grommets to isolate copper pipe from metal studs, similar to Pipe-Type, or approved equal.

END OF SECTION

SECTION 22 05 29

SUPPORTS AND ANCHORS

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.
- B. Support (1) from wood using coach screws on open construction and hanger flanges on sheeting, (2) from concrete using inserts, (3) from steel using beam clamps, rivets or bolts, (4) from concrete blocks using toggle or through bolts. Fasten supports to building in following order of preference: (1) steel framing, (2) concrete, (3) wood framing, (4) masonry, (5) wood sheathing. Do not support from roof deck without approval. All hangers, rods, and inserts shall be Underwriters Laboratories approved for the service intended and shall meet MSS #SP-58 & 69, and SMACNA guidelines for Seismic restraints of mechanical systems and plumbing piping system, October 3, 1982.
- C. Adhesives are not acceptable as mounting or supporting devices.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Plumbing General Provisions, See Section 22 01 01.
- B. Plumbing Basic Materials and Methods, Section 22 01 05.

PART 2 - PRODUCTS:

2.1 HANGERS:

- A. Use adjustable swivel ring band type for pipe 2-1/2" and smaller, except C.I. For pipe 3" and larger and for cast iron pipe, unless otherwise noted, use adjustable steel, clevis type.
- B. At each hanger on insulated pipe provide: (1) pipe covering protection saddles on hot lines and (2) insulation shields on cold lines.
- C. Shields/saddles to be 16 gauge, minimum 120° saddles arc with the following minimum saddle lengths:

<u>PIPE SIZE</u>	<u>MINIMUM SADDLE LENGTH</u>
1	12"
2	12"
3	12"
4	12"

- D. Hanger surface material shall be such that there will be no possibility of electrolytic corrosion

between hanger and pipe.

- E. Anchors requiring explosive charges **shall not be used**. Phillips "Red-head" shields can be used for loads under 300 lbs.

PART 3 - EXECUTION:

3.1 HORIZONTAL PIPING SUPPORT SCHEDULE:

<u>PIPE SIZE</u>	<u>ROD DIA.</u>	<u>STEEL MAX. SPACE</u>	<u>COPPER MAX. SPACE</u>	<u>PVC MAX. SPACE</u>
Up to 1/2"	1/4"	6'	4'	3-1/2'
3/4" to 1"	3/8"	7'	5'	4'
1-1/4"	3/8"	7'	7'	5'
1-1/2"	3/8"	8'	8'	5'
2"	3/8"	10'	8'	5'
2-1/2"	1/2"	11'	9'	6'
3"	1/2"	12'	10'	6'
4"	5/8"	14'	11'	6-1/2'

3.2 METHOD:

- A. Support horizontal cast iron pipe with hanger, or pier, located close to the hub; use one support for each pipe length, or every other joint, whichever is closer.
- B. Provide hanger within 18" of each elbow, also provide hanger within 18" of connection to each piece of equipment.
- C. Support vertical pipe at base and at each floor. In addition, 1" or smaller copper pipe shall be supported at 5-foot intervals.
- D. Support hubless cast iron at every length near fitting. Where maintenance requirements may impose torque, as at a cleanout, support on both sides of torque point.
- E. When supporting PVC pipe, provide 18 ga. 12" long shield at each hanger.
- F. Pipes passing thru walls shall not bear on building construction.
- G. Hangers shall be sized to fit outside diameter of insulation and shield/saddle. Provide shields at each hanger. On 2 1/2" and larger pipe, provide an "insert" 18" longer than the shield/saddle specified above; use Foamglass or calcium silicate or polyurethane foam with a jacket (same as insulation) on the "run" of the pipe. Hanger shall not bear on insulation.
- H. All floor-mounted equipment shall be mounted on a reinforced concrete base covering the complete floor area of equipment. This concrete base shall be 4" high and shall extend 6" beyond the equipment on all sides. The concrete base shall be doweled into the building concrete slab. Provide all necessary anchor bolts and templates. Provide 1/4" thick layer of non-shrinking grout between floor-mounted machinery and concrete pad. Where equipment mounts on structural steel, provide shims. Chamfer each edge a minimum of 3/4" x 3/4".
- I. Any piece of equipment installed in a finished ceiling, or wall area, shall be supported independently of the building finish. Ceiling-mounted items shall be supported directly from the

building structure.

- J. Suspended equipment shall be supported from building structure by adjustable rods.

END OF SECTION

SECTION 22 05 33

HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. General Provisions, Section 22 01 01.
- B. Basic Materials and Methods, Section 22 01 05.
- C. Domestic Water Piping, Section 22 11 16.

PART 2 - PRODUCTS:

2.1 FREEZE PROTECTION:

- A. Provide heating tape units in unheated areas and/or as shown on the documents. Furnish and install Chromalox self-regulating rapid-trace heating cable-low temperature, Cat. No. SRL-8-CR, 8 watts per foot, 120 volts, with tinned copper braid covering and TPR jacket over braid. Control shall be with type DL temperature control with bulb and capillary, Code "BC", 22 amps, 120 volts, with 1/4" OD x 7-1/4" long S.S. bulb and 10 foot S.S. capillary, Cat. No. RTBC-2.
- B. Spiral wrap pipe with heating cable so that there is a minimum watt density of 8 watts per linear foot of pipe and 16 watts for valves and fittings. Cover heating cable with a minimum of 2" of insulation. Cover insulation with a weatherproof outer jacket. Tape all insulation and outer jacket joints with weatherproof tape to seal.
 - 1. Apply "Electric Traced" signs to the outside of the thermal insulation.
- C. Provide self-regulating heating cable units consisting of two (2) resistance-type conductors for condenser water lines and cooling tower makeup water lines outside of building. Provide rain-tight thermostat (AMC-1A) with bulb for each heater section, 40°F (adjustable). Provide separate cable and thermostat for each pipe.
 - 1. The self-regulating heater shall consist of two (2) 16 AWG tinned-copper bus wires embedded in paralleled in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed over itself without overheating, and to be cut to length in the field. In order to provide energy conservation and to prevent overheating, the heater shall have a self-regulating factor of at least 90% reduction, without thermostatic control, of the heater output going from 40°F pipe temperature operation to 150°F pipe temperature operation. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
 - 2. The heater shall operate on line voltages as shown on drawings. Heater output shall be 8 watts per lineal foot of pipe and 16 watts for valves and fittings at 50°F temperature with 1" fiberglass insulation.
 - 3. Power connection, end seal, splice and tee kits components shall be applied in the field.
 - 4. Apply the heater linearly on the pipe after piping has been successfully pressure tested.

Secure the heater to piping with cable ties or fiberglass tape. Apply "Electric Traced" signs to the outside of the thermal insulation.

5. Test Heater Cable: After installation and before and after installing the thermal insulation, subject heat to testing using a 1,000 VDC megger. Minimum insulation resistance should be 20 to 1,000 megohms regardless of length.
6. The heater shall be XL-Trace as manufactured by Raychem Corporation, Thermon Manufacturing Company, or approved equal.

PART 3 - EXECUTION:

- 3.1 All lines shall maintain uniform grades from each low point to the adjacent high points.
- 3.2 All lines shall be installed so that they can be vented and drained completely.
- 3.3 Unless noted, provide vents at high points and manual drains at low points. The intent is that all piping can be vented and/or drained. Provide ball valve and standard hose bib threads with cap on all drains.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION OF PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL:

1.1 WORK DESCRIPTION:

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

PART 2 - PRODUCTS:

PART 3 - EXECUTION:

3.1 IDENTIFICATION:

- A. Identify all pipe by providing colored pipe markers, identifying the piping using flow arrows and colored bands: (1) in all accessible locations at 20 ft. intervals, (2) at each valve, (3) at each branch takeoff point, and (4) where a pipe leaves or enters a wall or floor so that lines may be traced from start to finish. **PIPE LABELS AND BANDS SHALL BE SNAP ON OR STRAP ON "SETMARK" AS MANUFACTURED BY SETON NAME PLATE CORPORATION, NEW HAVEN, CONNECTICUT 06519**, or approved equivalent meeting this level of quality. Identification colors, legend, letter sizes shall conform to ANSI and/or OSHA specifications.
- B. Identify all major items of equipment, including control panels and associated starters, switches, relays, etc. by 2-1/2" x 3/4" metal nameplates. Secure with screws or brads, adhesives alone are not acceptable. Nameplates after installation shall be easily visible and shall bear notations corresponding to those shown on record drawings.
- C. Identify location of outside underground piping by: 4"x4"x18" concrete stakes, flush with finish grade, located above lines at ends and/or corners, and by 2"x2" brass plates imbedded in building walls above pipes. On stakes provide plate secured to post indicating size and type of line below, along with depth of pipe below grade.
- D. Contractor shall mark the location of each duct smoke detector and all fire dampers. The mark shall consist of red marking tape acceptable to the Architect location on the ceiling grid at the location of each device.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL:

1.1 WORK INCLUDED:

- A. Work required under this section consists of insulation for piping and duct systems and equipment as hereinafter specified.
- B. Certain equipment and/or systems to be factory insulated by manufacturer. Factory insulation materials to be as specified in applicable sections of the specifications.
- C. Treat insulated pipe and duct surfaces in equipment rooms and where exposed to normal view, so surfaces may be painted with paint similar to Foster (BF) "Lagtone" color paint or good quality water base latex paint. Use of mastics, adhesives or jacketing which cause "bleeding" is prohibited.
- D. Thermal resistance "R" values used herein are expressed in units of "Hour degrees F sq. ft/BTU per inch of thickness" on a flat surface at a mean temperature of 75 degrees F, unless specifically noted.
- E. Note that where electric cable wrap is called for, insulation to be applied over cable. (See Section 22 11 19)
- F. All valves, flanges, fittings, etc. shall be insulated with same thickness of insulation as specified for piping.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Mechanical General Provisions, Section 23 01 01.
- B. Basic Materials and Methods, Section 23 01 05.
- C. Plumbing Piping, Section 22 10 00.
- D. Heat Exchangers, 22 35 00

1.3 CERTIFICATION:

- A. Insulation for above grade, inside building, pipe and equipment coverings, to be certified by manufacturer as having fire hazard classification rating, when tested in accordance with ASTM E 84, NFPA 225 and UL 723, not exceeding the following. "Insulation" to consist of insulating material, fittings, jacket, tapes, mastic, attachments and adhesive, either as a "system" or as an individual component when used separately.
 - 1. Piping insulation flame spread less than 25, fuel contribution less than 50, and smoke development less than 200. Piping system located inside ceiling plenums or equipment rooms utilized for return air plenums to have maximum smoke development of 50.
- B. Pipe, for above grade exposed to weather outside building, insulation to be certified as being self-extinguishing for 1.5" thickness in less than 53 seconds when tested in accordance with

ASTM D1692.

- C. Certify that all piping insulation meets the minimum requirements of the current issue of the "Local and/or State Code for Energy Conservation in New Building Construction.

rooms and where exposed to weather. Where piping insulation has metal jacket, fittings, etc. shall be covered with factory formed humped aluminum covers equivalent to "Eljacs."

PART 2 - PRODUCTS:

2.1 GLASS FIBER:

- A. Provide factory-formed, factory-jacketed "system" type conforming strictly to fire-resistive qualities hereinbefore specified in ""Certification" paragraph. Jacket to be ASJ-SSL factory applied reinforced with vapor barrier. System" density to be not less than 4 pounds per cubic foot. Product must be guaranteed by manufacturer to have continuous operational temperature limit of not less than 500 degrees F and a minimum "R" value of 4.00. All service jacket to be fiberglass reinforced white Kraft paper with aluminum foil. Provide insulation for following services:
 - 1. Domestic cold water - .5" thick; domestic hot water – 1.5" thick; hot water recirculating lines – 1.5" thick.

2.3 MATERIALS FOR FITTINGS, VALVES AND SPECIAL COVERINGS:

- A. Provide coverings and finishes for specific items hereinafter specified.
 - 1. Provide factory pre-molded glass fiber fitting covers, matching basic insulation, equivalent to those manufactured by Hamfab, for all insulated pipe fittings (elbows, tees, etc.) and finished with glass fabric and vapor barrier mastic. Glass fiber blanket inserts with PVC covers are not acceptable for pipe fitting insulation.
Shop or site segment mitered fittings are acceptable for fittings 8" and larger."

PART 3 - EXECUTION:

3.1 GENERAL:

- A. Pipe systems shall have been tested and found free of all leaks prior to installation of insulation covering. Verify with Engineer.
- B. Insulation shall be continuous through walls, floors, partitions, etc. Do not insulate finished surfaces on fixture trim. On fixture connections, bring insulation to inside face of wall. Escutcheon shall be sized to cover pipe and insulation.
- C. No insulation shall be cut where a hanger is located.
- D. All surfaces to be cleaned of grease, dirt, dust, scale and dry when covering is applied. Covering to be dry when installed and before and during application of any finish, unless such finish requires specifically a wetted surface for application.
- E. All adhesive, cements and mastics to be compatible with materials applied and shall not attack materials in either wet or dry state.
- F. Install all insulation products in strict accordance with manufacturer's instructions using

professional insulators who have adequate experience and ability.

- G. Exposed to view insulation shall have a well-tailored appearance.
- H. All items requiring service such as strainers, balancing valves, etc. provide removable insulation caps of insulation equal in thickness to pipe covering.
- J. Secure fiberglass pipe insulation, using self-sealing 3" side sealing strip and butt joints. Install longitudinal jacket laps concealed from normal view.
- K. Cover all joints, rips, tears, punctures, disc heads, staples, or breaks in vapor barrier jacket with 4" wide woven glass fabric tape embedded in gray or white vapor barrier fire resistant coating.

3.2 INSTALLATION OF PIPE COVERING:

- A. Where glass fiber insulation is used on piping sized 3" and larger, insert a section of foamed glass insulation, at hanger or support points, between pipe and metal shield for full length of shield, to prevent crushing of insulation. Insulation thickness to be same as adjoining glass fiber insulation.
- E. Fabricate and install readily removable insulation caps to facilitate service and maintenance accessibility to all valves, strainers, etc. in systems operating below 70 degrees F., such as refrigerant suction lines, chilled and dual chilled/hot water system. Material for caps to be either cellular glass or rigid cellular plastic and of same thickness as adjoining pipe covering.
- G. All valves, including body bonnet, flanges, fittings, etc. shall be insulated with same type and thickness of insulation as adjoining piping.

END OF SECTION

SECTION 22 11 13

PLUMBING PIPING

PART 1 - GENERAL:

1.1 DESCRIPTION OF WORK:

- A. Provide all labor, material, equipment, services, etc. required to provide a complete installation specified herein and/or shown or scheduled on the drawings.
- B. Examine carefully architectural, equipment, electrical, mechanical and structural drawings and each division of this specification for items not a part of this plumbing section, which may require plumbing connections. Unless explicitly indicated to the contrary, Contractor shall provide necessary supply, waste and vent lines, and make final connections to such items. It shall be Contractor's responsibility to locate supply, waste and vent lines, to such items in conformity with approved manufacturer's rough-in drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Plumbing General Provisions Section 22 01 01.
- B. Plumbing Completion Items, Section 22 01 03.
- C. Plumbing Guaranty and Warranty, Section 22 01 04.
- D. Plumbing Basic Materials and Methods Section 22 01 05.
- E. Hangers and Supports for Plumbing Piping and Equipment, Section 22 05 29.
- F. Plumbing Piping Insulation Section 22 07 19.
- G. Domestic Water Piping Specialties, Section 22 11 19.

1.3 PLUMBING SYSTEMS: Work included under this section consists of plumbing work, principal systems of which are as follows:

- A. Water Supply System: Make connections to utility water supply. Extend and connect hot and cold water to fixtures and equipment provided under this and other sections.

1.4 CONNECTIONS FOR EQUIPMENT FURNISHED BY OTHERS:

- A. The Contractor shall provide all roughing-in connections for and all equipment requiring water, drains, etc. The equipment manufacturer shall furnish shop drawings to the Contractor who shall rough-in accordance with these shop drawings, and make final connections after the equipment supplier has set his equipment.

PART 2 - PRODUCTS:

2.1 METER BOX AND WATER PIPING:

- A. Tap existing water main with a tapping sleeve and valve and provide meter box with covers, valves, etc., in accordance with local utility company's recommendations and requirements. Verify pricing schedule and utility company's participation prior to bidding.
- B. Contractor shall pay all tap fees required by utility company.

2.2 POTABLE WATER PIPING MATERIALS:

- A. 3" and smaller, outside building: Type L hard-drawn copper with wrought copper solder fittings type CHD. Contractor's option for sizes 1-1/4" and smaller: Type L, type CSD.
- B. 1-1/4" and smaller below grade, inside building: Type L soft-drawn copper, Type CSD.
- C. Brass or bronze adapter fitting shall be used where necessary and shall be iron pipe size and thickness where required for fixture or equipment connections. Connections of copper pipe to ferrous pipe shall be made with dielectric unions or couplings.

2.3 VACUUM VALVES:

- A. Meet ASSE #1001 or 1020 as applicable, and SBC Plumbing Code, Paragraph 1204.2.

2.4 MANUAL VALVES, COCKS AND FAUCETS:

- A. Valves for Domestic Water:
 - 1. On exposed C.P. connections, use C.P. valves.
 - 2. Ball valves shall be used in sizes to and including 2-1/2" size. Valves shall be designed for service without removing from line and have Teflon seats, use only "full port" type. Valves to be NIBCO 585 series or approved equal.
 - 3. Valves 3" and larger shall be butterfly type with 150 PSI bubble-tight shutoff. Bronze Disc, EPT seat, multi-position handle and one-piece stainless steel stem. Valves 8" and larger will have weatherproof gear operators suitable for exposed service, with hand wheel. Overhead valves shall be chain operated. Valves to be Grinnell LD-8000 (through 5"), ZMB (6" and larger) or approved.
 - 4. Check valves shall be horizontal swing type, with grindable seat and metal disc. Size 2" and smaller shall be Y pattern all bronze size 2-1/2" and larger shall be iron body with bronze trim. Valves to be Stockham B-321 (2" and smaller), G-931 (2-1/2" and larger) or approved equal.
 - 5. Valves in outside domestic water lines 3" and larger shall meet AWWA requirements.

PART 3 - EXECUTION:

3.1 DOMESTIC WATER PIPING:

- A. From cold water main extend distribution mains, risers, and branches to all equipment and fixtures requiring cold-water connections. From hot water generators extend similar lines to all equipment and fixtures requiring hot water connections. Install a "full port" ball valve in each

major branch take-off in the hot and cold-water distribution mains and elsewhere as necessary for control of the system or as shown on the drawings.

- B. Water piping shall be run so that the system can be drained at the low point by opening valves; provide drain valves at low points, 3/4" size if not otherwise noted. Run piping concealed in chases, pipe shafts, and space above ceilings throughout finished spaces, except at fixture connections and elsewhere as specifically noted otherwise. Vent all high points when piping is installed below grade, joints other than welded or soldered are prohibited.
- C. Water piping shall have a minimum pitch of 1" to 40'.
- D. Refer to fixture connection schedule on drawings for branch sizes to individual fixtures.
- E. Positively support water pipes immediately behind each flush valve, each showerhead, each service sink, each clinical sink; no piping shall be loose.
- F. Provide sealed bellows type shock absorbers for each self-closing faucet, quick-closing valve, solenoid valve, flush valve and/or where noted. When in battery install shock absorbers per P.D.I. Standard.
- G. Where not possible to provide minimum air gap per ANSI #A-40.4.42, provide a reduced pressure backflow preventer or vacuum breaker.
- H. Provide vacuum breakers at: (1) all flush valves, (2) all hose faucets, (3) all laboratory cocks, etc. Install on discharge side of final control valve.
- I. Use dielectric unions where dissimilar metals are joined.
- J. Backflow preventer must be installed above grade in a "non-flooding" location.
- K. Pipes passing thru fire rated walls shall be sealed off in accordance with detail on drawings.
- L. Tests:
 1. Test water piping hydrostatically not less than 125 PSI or 1-1/2 times the maximum working pressure, whichever is greater. Test when water and average ambient temperatures are approximately equal. Maintain test for not less than 4 hours without appreciable drop. Leaks in screwed fittings shall be corrected by remaking the joints. Leaks in welded joints shall be cut out and re-welded.
 2. Test underground lines with joints uncovered and with backfill deposited to 12" over 8" and smaller pipe, and 24" over larger pipe, except at joints.
- M. Coordinate timing for shutting off existing water service with appropriate officials and local utility company.
- N. Contractor shall notify Owner of interruption of service 72 hours prior to disconnection. Contractor to receive written approval from Owner prior to interruption.

3.2 CHLORINATION OF DOMESTIC WATER LINES:

- A. Flush entire system, until water flows clear from all openings. Drain and clean strainers and dirt pockets.
- B. After the domestic water piping system has been tested and cleaned, the system shall be sterilized in accordance with the requirements of the State Department of Public Health by the

following methods:

1. Introduce HTH solution, chlorine gas, or similar chlorination agent in sufficient quantity to produce a residual of 50 ppm of chlorine, as determined by residual chlorine tests at the ends of lines, and allow to stand for not less than 24 hours. Fill the lines slowly and open and close all valves while the chlorine is being introduced into the system. Operate valves, pumps, etc. at least 5 times, or 5 minutes.
 2. After the disinfecting solution has been left standing for 24 hours flush out the system until chlorine content is less than 1.0 PPM and/or water is comparable to that supplied by the water utility. If after flushing out the system, bacteriological samples are not satisfactory, repeat the disinfection process until satisfactory bacteriological samples can be obtained.
- C. Disinfection of new supply mains shall be performed before these mains are connected to the existing water supply mains. Where connecting into the existing mains and it is not practical to include the connecting pieces (i.e., pipe, fittings, and valves) in the normal disinfecting process, these connecting pieces shall be swabbed with chlorine solution containing not less than 100 ppm available chlorine prior to making the connection.
- D. Have samples obtained from end of longest piping run, analyzed by water utility chemist and submit copy of test to Engineer. If test results are unsatisfactory, rechlorinate system until test is satisfactory, at no cost to the Owner.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL:

1.1 DESCRIPTION OF WORK:

- A. Provide all labor, material, equipment, services, etc. required to provide a complete installation specified herein and/or shown or scheduled on the drawings.
- B. Examine carefully architectural, equipment, electrical, mechanical and structural drawings and each division of this specification for items not a part of this plumbing section, which may require plumbing connections. Unless explicitly indicated to the contrary, Contractor shall provide necessary supply, waste and vent lines, and make final connections to such items. It shall be Contractor's responsibility to locate supply, waste and vent lines, to such items in conformity with approved manufacturer's rough-in drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. General Provisions Section 22 01 01.
- B. Completion Items, Section 22 01 03.
- C. Guaranty and Warranty, Section 22 01 04.
- D. Basic Materials and Methods Section 22 01 05.
- E. Hangers and Supports for Plumbing Piping, Section 22 05 29.
- F. Plumbing Piping Insulation Section 22 07 19.
- G. Domestic Water Piping Specialties, Section 22 11 19.
- H. Plumbing Fixtures, Section 22 40 00.

1.3 DOMESTIC WATER PIPING SYSTEMS: Work included under this section consists of plumbing work, principal systems of which are as follows:

- A. Water Supply System: Make connections to utility water supply. Extend and connect hot and cold water to fixtures and equipment provided under this and other sections.

1.4 CONNECTIONS FOR EQUIPMENT FURNISHED BY OTHERS:

- A. The Contractor shall provide all roughing-in connections for and all equipment requiring water, drains, etc. The equipment manufacturer shall furnish shop drawings to the Contractor who shall rough-in accordance with these shop drawings, and make final connections after the equipment supplier has set his equipment.
- B. The Contractor shall provide all stops, supplies, traps, tailpieces, reducing valves, vacuum

breakers, etc. as required to make each sink or piece of equipment operable.

PART 2 - PRODUCTS:

2.1 METER BOX AND WATER PIPING:

- A. Tap existing water main with a tapping sleeve and valve and provide meter box with covers, valves, etc., in accordance with local utility company's recommendations and requirements. Verify pricing schedule and utility company's participation prior to bidding.
- B. Contractor shall pay all tap fees required by utility company.

2.2 POTABLE WATER PIPING MATERIALS:

- A. 3" and smaller, outside building: Type L hard-drawn copper with wrought copper solder fittings type CHD. Contractor's option for sizes 1-1/4" and smaller: Type L, type CSD.
- B. Inside building: Type L hard-drawn copper in wrought copper solder fittings Type CHD.
- C. 1-1/4" and smaller below grade, inside building: Type L soft-drawn copper, Type CSD.
- D. Brass or bronze adapter fitting shall be used where necessary and shall be iron pipe size and thickness where required for fixture or equipment connections. Connections of copper pipe to ferrous pipe shall be made with dielectric unions or couplings.

PART 3 - EXECUTION:

3.1 DOMESTIC WATER PIPING:

- A. From cold water main extend distribution mains, risers, and branches to all equipment and fixtures requiring cold-water connections. From hot water generators extend similar lines to all equipment and fixtures requiring hot water connections. Install a "full port" ball valve in each major branch take-off in the hot and cold-water distribution mains and elsewhere as necessary for control of the system or as shown on the drawings.
- B. Water piping shall be run so that the system can be drained at the low point by opening valves; provide drain valves at low points, 3/4" size if not otherwise noted. Run piping concealed in chases, pipe shafts, and space above ceilings throughout finished spaces, except at fixture connections and elsewhere as specifically noted otherwise. Vent all high points when piping is installed below grade, joints other than welded or soldered are prohibited.
- C. Water piping shall have a minimum pitch of 1" to 40'.
- D. Refer to fixture connection schedule on drawings for branch sizes to individual fixtures.
- E. Positively support water pipes immediately behind each flush valve, each showerhead, each service sink, each clinical sink; no piping shall be loose.
- F. Provide sealed bellows type shock absorbers for each self-closing faucet, quick-closing valve, solenoid valve, flush valve and/or where noted. When in battery install shock absorbers per P.D.I. Standard.
- G. Where not possible to provide minimum air gap per ANSI #A-40.4.42, provide a reduced pressure backflow preventer or vacuum breaker.

- H. Provide vacuum breakers at: (1) all flush valves, (2) all hose faucets, etc. Install on discharge side of final control valve.
- I. Use dielectric unions where dissimilar metals are joined.
- J. Backflow preventer must be installed above grade in a "non-flooding" location.
- K. Pipes passing thru fire rated walls shall be sealed off in accordance with detail on drawings.
- L. Tests:
 1. Test water piping hydrostatically not less than 125 PSI or 1-1/2 times the maximum working pressure, whichever is greater. Test when water and average ambient temperatures are approximately equal. Maintain test for not less than 4 hours without appreciable drop. Leaks in screwed fittings shall be corrected by remaking the joints. Leaks in welded joints shall be cut out and re-welded.
 2. Test underground lines with joints uncovered and with backfill deposited to 12" over 8" and smaller pipe, and 24" over larger pipe, except at joints.
- M. Coordinate timing for shutting off existing water service with appropriate officials and local utility company.
- N. Contractor shall notify Owner of interruption of service 72 hours prior to disconnection. Contractor to receive written approval from Owner prior to interruption.

3.2 ELECTRICAL GROUND:

- A. This Contractor shall make provisions for maintaining the electrical ground properties of water lines by strapping over valves or equipment whose removal for service work in future would break grounding service. Strapping over shall be done with a length of braided copper cable, which shall be attached to pipe at either end.

3.3 CHLORINATION OF DOMESTIC WATER LINES:

- A. Flush entire system, until water flows clear from all openings. Drain and clean strainers and dirt pockets.
- B. After the domestic water piping system has been tested and cleaned, the system shall be sterilized in accordance with the requirements of the State Department of Public Health by the following methods:
 1. Introduce HTH solution, chlorine gas, or similar chlorination agent in sufficient quantity to produce a residual of 50 ppm of chlorine, as determined by residual chlorine tests at the ends of lines, and allow to stand for not less than 24 hours. Fill the lines slowly and open and close all valves while the chlorine is being introduced into the system. Operate valves, pumps, etc. at least 5 times, or 5 minutes.
 2. After the disinfecting solution has been left standing for 24 hours flush out the system until chlorine content is less than 1.0 PPM and/or water is comparable to that supplied by the water utility. If after flushing out the system, bacteriological samples are not satisfactory, repeat the disinfection process until satisfactory bacteriological samples can be obtained.

- C. Disinfection of new supply mains shall be performed before these mains are connected to the existing water supply mains. Where connecting into the existing mains and it is not practical to include the connecting pieces (i.e., pipe, fittings, and valves) in the normal disinfecting process, these connecting pieces shall be swabbed with chlorine solution containing not less than 100 ppm available chlorine prior to making the connection.
- D. Have samples obtained from end of longest piping run, analyzed by water utility chemist and submit copy of test to Engineer. If test results are unsatisfactory, rechlorinate system until test is satisfactory, at no cost to the Owner.

END OF SECTION

SECTION 22 13 13

FACILITY SANITARY SEWERS

PART 1 - GENERAL:

1.1 DESCRIPTION OF WORK:

- A. Provide all labor, material, equipment, services, etc. required to provide a complete installation specified herein and/or shown or scheduled on the drawings.
- B. Examine carefully architectural, equipment, electrical, mechanical and structural drawings and each division of this specification for items not a part of this plumbing section, which may require plumbing connections. Unless explicitly indicated to the contrary, Contractor shall provide necessary supply, waste and vent lines, and make final connections to such items. It shall be Contractor's responsibility to locate supply, waste and vent lines, to such items in conformity with approved manufacturer's rough-in drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Plumbing General Provisions Section 22 01 01.
- B. Plumbing Completion Items, Section 22 01 03.
- C. Plumbing Guaranty and Warranty, Section 22 01 04.
- D. Plumbing Basic Materials and Methods Section 22 01 05.
- E. Facility Drainage Manholes Section 22 05 73

1.3 PLUMBING SYSTEMS: Work included under this section consists of plumbing work, principal systems of which are as follows:

- A. Facility Sanitary Sewer Piping System: Provide sanitary sewer piping, and fittings.

PART 2 - PRODUCTS:

2.1 SANITARY SEWERS AND VENTS:

- A. Sanitary Sewer piping below grade shall be Schedule 40 PVC with solvent welded D.W.V.fittings FOAM CORE PIPING IS NOT ACCEPTABLE

2.2 CLEANOUTS AND ACCESS COVERS:

- A. Provide cleanouts in underground piping with extensions and covers as follows:
 - 1. For extension to grade, Type 7, terminate flush with grade in 12" x 12" 4" concrete pad.

PART 3 - EXECUTION:

3.1 FACILITY SANITARY SEWER:

- A. Test all elements of system under 10' hydrostatic head (minimum pressure on highest joint). System may be tested in sections. System shall stand for four (4) hours without showing leaks.

3.2 CLEANOUTS:

- A. Locate line size cleanouts (or 4" minimum) at each 90° change in direction in sanitary sewer lines; spacing not to exceed 100' outside the building.
- B. Set cleanout plugs using graphite and oil.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL:

1.1 DESCRIPTION OF WORK:

- A. Provide all labor, material, equipment, etc. required to complete fixture installation as specified herein and/or scheduled on the drawings.
- B. Examine carefully architectural, equipment, electrical, mechanical and structural drawings and each division of this specification for items not a part of this plumbing section, which may require plumbing connections. Unless explicitly indicated to the contrary, Contractor shall provide necessary supply, waste and vent lines, and make final connections to such items. It shall be Contractor's responsibility to locate supply, waste and vent lines, to such items in conformity with approved manufacturer's rough-in drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. General Provisions Section 22 01 01.
- B. Basic Materials and Methods Section 22 01 05.
- C. Sanitary Waste and Vent Piping Section 22 13 16.
- D. Sanitary Waste Piping Specialties, Section 22 13 19.
- E. Hangers and Supports for Plumbing Piping and Equipment, Section 22 05 29.
- F. Plumbing Piping Insulation Section 22 07 19
- G. Domestic Water Piping, Section 22 11 16
- H. Facility Water Distribution Piping, Section 22 11 13
- I. Sanitary Waste Piping Specialties, Section 22 13 19.
- J. Plumbing Fixture, Section 22 40 00.

PART 2 - PRODUCTS:

2.1 FIXTURES:

- A. Wherever a catalogue number is scheduled, it is intended that all material covered by this catalogue number and any required accessories shall be furnished.
- B. All exposed metal trim and piping shall be chrome-plated and polished.

- C. Trim which can be removed, or disassembled, without tools is not acceptable.
- D. Water closet seats shall be open front, elongated style with self-sustaining and concealed hinge, less cover, of solid urea formaldehyde, fire proof plastic, unless noted otherwise in plumbing fixture schedule.
- E. All water closets shall flush with 1.6 gallons or less and meet ANSI A112.19.2M Standards.

2.2 TRIM:

- A. Flush valves shall meet Fed. No. WW-P-541 and shall have: screwdriver control stop, vacuum breaker, adjustable tailpiece, non-hold open handle, and optional equipment as scheduled. Flush valves shall be compatible with water closet and use 1.6 gallons or less per flush.
- B. Provide closets with bolt caps with retainer clips. Use all mineral gasket with plastic discharge sleeve having ethane core reinforcement.
- C. Closet floor flanges shall be C.I., 1/4" thick with 2" caulking depth.
- D. Lavatory and sink faucets shall be provided with 3 GPM flow restrictors on hot and cold water, unless otherwise specified.
- E. Traps shall be cast brass with cleanout. Supplies shall be flexible chrome-plated brass or copper with heavy duty 1/2" x 3/8" stop.
- F. Trim for handicap fixtures shall meet ANSI A117.1

2.3 HYDRANTS:

- A. Freeze-proof: anti-siphon with integral backflow preventer, all bronze interior parts, bronze casing and non-turning operator rod with free floating compression closure valve. Nickel bronze faceplate with operating key. Must be able to replace seat through front face of hydrant.

PART 3 - EXECUTION:

3.1 SUPPORTS:

- A. Support wall-hung fixtures: (1) from steel studs with steel plates secured to studs per detail, (2) from masonry with thru-bolts, (3) from carriers.
- B. All fixtures designed for handicap use shall be mounted at handicap height as indicated by handicap code used in local area.
- C. All lavatories for handicapped, use offset P-traps to maximize knee space. Insulate exposed HW and CW water piping with 1" fiberglass insulation per Section 22 07 19.

3.2 FIXTURE CONNECTIONS:

- A. Connect to plumbing fixtures and equipment provided under this and other sections of specifications.

- B. See schedule on plans for connections sizes to fixtures.
- C. Connect wall-hung urinals to waste piping with red brass nipples.
- D. Each fixture, floor drain, and piece of equipment requiring connection to drainage system to have separate traps installed as close to fixture as possible.
- E. Provide deep seal P-traps with Trap Guards under floor drains.

3.3 CLEANING AND TESTING:

- A. Test plumbing systems in accordance with test procedures and pressure as specified in Section 22 11 13.
- B. Clean and sterilize domestic water supply in accordance with test procedures as specified in Section 22 11 13.

3.4 VALVES:

- A. Provide shut-off valves at all water connections to fixtures, equipment, etc.

END OF SECTION

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