

HIGHWAY WORK PROPOSAL

Wisconsin Department of Transportation
DT1502 01/2020 s.66.0901(7) Wis. Stats

Proposal Number: **028**

<u>COUNTY</u>	<u>STATE PROJECT</u>	<u>FEDERAL</u>	<u>PROJECT DESCRIPTION</u>	<u>HIGHWAY</u>
Manitowoc	1225-10-73	WISC 2025022	Manitowoc - Green Bay; Sra 51 Maribel/Sra 52 Denmark	IH 043

ADDENDUM REQUIRED ATTACHED AT BACK

This proposal, submitted by the undersigned bidder to the Wisconsin Department of Transportation, is in accordance with the advertised request for proposals. The bidder is to furnish and deliver all materials, and to perform all work for the improvement of the designated project in the time specified, in accordance with the appended Proposal Requirements and Conditions.

Proposal Guaranty Required: \$100,000.00 Payable to: Wisconsin Department of Transportation	Attach Proposal Guaranty on back of this PAGE.
Bid Submittal Date: November 12, 2024 Time (Local Time): 11:00 am	Firm Name, Address, City, State, Zip Code
Contract Completion Time May 01, 2026	SAMPLE NOT FOR BIDDING PURPOSES
Assigned Disadvantaged Business Enterprise Goal 4%	This contract is exempt from federal oversight.

This certifies that the undersigned bidder, duly sworn, is an authorized representative of the firm named above; that the bidder has examined and carefully prepared the bid from the plans, Highway Work Proposal, and all addenda, and has checked the same in detail before submitting this proposal or bid; and that the bidder or agents, officer, or employees have not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with this proposal bid.

Do not sign, notarize, or submit this Highway Work Proposal when submitting an electronic bid on the Internet.

Subscribed and sworn to before me this date _____

(Signature, Notary Public, State of Wisconsin)

(Bidder Signature)

(Print or Type Name, Notary Public, State Wisconsin)

(Print or Type Bidder Name)

(Date Commission Expires)

(Bidder Title)

Notary Seal

Type of Work:

For Department Use Only

Rest Area Building Construction.

Notice of Award Dated

Date Guaranty Returned

**PLEASE ATTACH
PROPOSAL GUARANTY HERE**

PROPOSAL REQUIREMENTS AND CONDITIONS

The bidder, signing and submitting this proposal, agrees and declares as a condition thereof, to be bound by the following conditions and requirements.

If the bidder has a corporate relationship with the proposal design engineering company, the bidder declares that it did not obtain any facts, data, or other information related to this proposal from the design engineering company that was not available to all bidders.

The bidder declares that they have carefully examined the site of, and the proposal, plans, specifications and contract forms for the work contemplated, and it is assumed that the bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and quantities of work to be performed and materials to be furnished, and as to the requirements of the specifications, special provisions and contract. It is mutually agreed that submission of a proposal shall be considered conclusive evidence that the bidder has made such examination.

The bidder submits herewith a proposal guaranty in proper form and amount payable to the party as designated in the advertisement inviting proposals, to be retained by and become the property of the owner of the work in the event the undersigned shall fail to execute the contract and contract bond and return the same to the office of the engineer within fourteen (14) days after having been notified in writing to do so; otherwise to be returned.

The bidder declares that they understand that the estimate of quantities in the attached schedule is approximate only and that the attached quantities may be greater or less in accordance with the specifications.

The bidder agrees to perform the said work, for and in consideration of the payment of the amount becoming due on account of work performed, according to the unit prices bid in the following schedule, and to accept such amounts in full payment of said work.

The bidder declares that all of the said work will be performed at their own proper cost and expense, that they will furnish all necessary materials, labor, tools, machinery, apparatus, and other means of construction in the manner provided in the applicable specifications and the approved plans for the work together with all standard and special designs that may be designed on such plans, and the special provisions in the contract of which this proposal will become a part, if and when accepted. The bidder further agrees that the applicable specifications and all plans and working drawings are made a part hereof, as fully and completely as if attached hereto.

The bidder, if awarded the contract, agrees to begin the work not later than ten (10) days after the date of written notification from the engineer to do so, unless otherwise stipulated in the special provisions.

The bidder declares that if they are awarded the contract, they will execute the contract agreement and begin and complete the work within the time named herein, and they will file a good and sufficient surety bond for the amount of the contract for performance and also for the full amount of the contract for payment.

The bidder, if awarded the contract, shall pay all claims as required by Section 779.14, Statutes of Wisconsin, and shall be subject to and discharge all liabilities for injuries pursuant to Chapter 102 of the Statutes of Wisconsin, and all acts amendatory thereto. They shall further be responsible for any damages to property or injury to persons occurring through their own negligence or that of their employees or agents, incident to the performance of work under this contract, pursuant to the Standard Specifications for Road and Bridge Construction applicable to this contract.

In connection with the performance of work under this contract, the contractor agrees to comply with all applicable state and federal statutes relating to non-discrimination in employment. No otherwise qualified person shall be excluded from employment or otherwise be subject to discrimination in employment in any manner on the basis of age, race, religion, color, gender, national origin or ancestry, disability, arrest or conviction record (in keeping with s.111.32), sexual orientation, marital status, membership in the military reserve, honesty testing, genetic testing, and outside use of lawful products. This provision 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 further agrees to ensure equal opportunity in employment to all applicants and employees and to take affirmative action to attain a representative workforce.

The contractor agrees to post notices and posters setting forth the provisions of the nondiscrimination clause, in a conspicuous and easily accessible place, available for employees and applicants for employment.

If a state public official (section 19.42, Stats.) or an organization in which a state public official holds at least a 10% interest is a party to this agreement, this contract is voidable by the state unless appropriate disclosure is made to the State of Wisconsin Ethics Board.

BID PREPARATION

Preparing the Proposal Schedule of Items

A. General

- (1) Obtain bidding proposals as specified in section 102 of the standard specifications prior to 11:45 AM of the last business day preceding the letting. Submit bidding proposals using one of the following methods:
 1. Electronic bid on the internet.
 2. Electronic bid on a printout with accompanying diskette or CD ROM.
 3. Paper bid under a waiver of the electronic submittal requirements.
- (2) Bids submitted on a printout with accompanying diskette or CD ROM or paper bids submitted under a waiver of the electronic submittal requirements govern over bids submitted on the internet.
- (3) The department will provide bidding information through the department's web site at:

<https://wisconsin.gov/Pages/doing-bus/contractors/hcci/bid-let.aspx>

The contractor is responsible for reviewing this web site for general notices as well as information regarding proposals in each letting. The department will also post special notices of all addenda to each proposal through this web site no later than 4:00 PM local time on the Thursday before the letting. Check the department's web site after 5:00 PM local time on the Thursday before the letting to ensure all addenda have been accounted for before preparing the bid. When bidding using methods 1 and 2 above, check the Bid Express™ on-line bidding exchange at <http://www.bidx.com/> after 5:00 PM local time on the Thursday before the letting to ensure that the latest schedule of items Expedite file (*.ebs or *.00x) is used to submit the final bid.

- (4) Interested parties can subscribe to the Bid Express™ on-line bidding exchange by following the instructions provided at the www.bidx.com web site or by contacting:

Info Tech Inc.
5700 SW 34th Street, Suite 1235
Gainesville, FL 32608-5371
email: <mailto:customer.support@bidx.com>

- (5) The department will address equipment and process failures, if the bidder can demonstrate that those failures were beyond their control.
- (6) Contractors are responsible for checking on the issuance of addenda and for obtaining the addenda. Notice of issuance of addenda is posted on the department's web site at:

<https://wisconsin.gov/Pages/doing-bus/contractors/hcci/bid-let.aspx>

or by calling the department at (608) 266-1631. Addenda can ONLY be obtained from the department's web site listed above or by picking up the addenda at the Bureau of Highway Construction, 4th floor, 4822 Madison Yards Way, Madison, WI, during regular business hours.

- (7) Addenda posted after 5:00 PM on the Thursday before the letting will be emailed to the eligible bidders for that proposal. All eligible bidders shall acknowledge receipt of the addenda whether they are bidding on the proposal or not. Not acknowledging receipt may jeopardize the awarding of the project.

B. Submitting Electronic Bids**B.1 On the Internet**

- (1) Do the following before submitting the bid:
 4. Have a properly executed annual bid bond on file with the department.
 5. Have a digital ID on file with and enabled by Info Tech Inc. Using this digital ID will constitute the bidder's signature for proper execution of the bidding proposal.
- (2) In lieu of preparing, delivering, and submitting the proposal as specified in 102.6 and 102.9 of the standard specifications, submit the proposal on the internet as follows:
 1. Download the latest schedule of items reflecting all addenda from the Bid Express™ web site.
 2. Use Expedite™ software to enter a unit price for every item in the schedule of items.
 3. Submit the bid according to the requirements of Expedite™ software and the Bid Express™ web site. Do not submit a bid on a printout with accompanying diskette or CD ROM or a paper bid. If the bidder does submit a bid on a printout with accompanying diskette or a paper bid in addition to the internet submittal, the department will disregard the internet bid.
 4. Submit the bid before the hour and date the Notice to Contractors designates.
 5. Do not sign, notarize, and return the bidding proposal described in 102.2 of the standard specifications.
- (3) The department will not consider the bid accepted until the hour and date the Notice to Contractors designates.

B.2 On a Printout with Accompanying Diskette or CD ROM

- (1) Download the latest schedule of items from the Wisconsin pages of the Bid Express web site reflecting the latest addenda posted on the department's web site at:
<https://wisconsindot.gov/Pages/doing-bus/contractors/hcci/bid-let.aspx>
Use Expedite™ software to prepare and print the schedule of items. Provide a valid amount for all price fields. Follow instructions and review the help screens provided on the Bid Express™ web site to assure that the schedule of items is prepared properly.
- (2) Staple an 8 1/2 by 11 inch printout of the Expedite□□ generated schedule of items to the other proposal documents submitted to the department as a part of the bidder's sealed bid. As a separate submittal, not in the sealed bid envelop but due at the same time and place as the sealed bid, also provide the Expedite™ generated schedule of items on a 3 1/2 inch computer diskette or CD ROM. Label each diskette or CD ROM with the bidder's name, the 4 character department-assigned bidder identification code from the top of the bidding proposal, and a list of the proposal numbers included on that diskette or CD ROM as indicated in the following example:

Bidder Name

BN00

Proposals: 1, 12, 14, & 22

- (3) If bidding on more than one proposal in the letting, the bidder may include all proposals for that letting on one diskette or CD ROM. Include only submitted proposals with no incomplete or other files on the diskette or CD ROM.
- (4) The bidder-submitted printout of the Expedite□□ generated schedule of items is the governing contract document and must conform to the requirements of section 102 of the standard specifications. If a printout needs to be altered, cross out the printed information with ink or typewriter and enter the new information and initial it in ink. If there is a discrepancy between the printout and the diskette or CD ROM, the department will analyze the bid using the printout information.

- (5) In addition to the reasons specified in section 102 of the standard specifications, proposals are irregular and the department may reject them for one or more of the following:
1. The check code printed on the bottom of the printout of the ExpediteTM generated schedule of items is not the same on each page.
 2. The check code printed on the printout of the ExpediteTM generated schedule of items is not the same as the check code for that proposal provided on the diskette or CD ROM.
 3. The diskette or CD ROM is not submitted at the time and place the department designates.

B Waiver of Electronic Submittal

- (1) The bidder may request a waiver of the electronic submittal requirements. Submit a written request for a waiver in lieu of bids submitted on the internet or on a printout with accompanying diskette or CD ROM. Use the waiver that was included with the paper bid document sent to the bidder or type up a waiver on the bidder's letterhead. The department will waive the electronic submittal requirements for a bidding entity (individual, partnership, joint venture, corporation, or limited liability company) for up to 4 individual proposals in a calendar year. The department may allow additional waivers for equipment malfunctions.
- (2) Submit a schedule of items on paper conforming to section 102 of the standard specifications. The department charges the bidder a \$75 administrative fee per proposal, payable at the time and place the department designates for receiving bids, to cover the costs of data entry. The department will accept a check or money order payable to: "Wisconsin, Dept. of Transportation."
- (3) In addition to the reasons specified in section 102 of the standard specifications, proposals are irregular and the department may reject them for one or more of the following:
 1. The bidder fails to provide the written request for waiver of the electronic submittal requirements.
 2. The bidder fails to pay the \$75 administrative fee before the time the department designates for the opening of bids unless the bidder requests on the waiver that they be billed for the \$75.
 3. The bidder exceeds 4 waivers of electronic submittal requirements within a calendar year.
- (4) In addition to the reasons specified in section 102 of the standard specifications, the department may refuse to issue bidding proposals for future contracts to a bidding entity that owes the department administrative fees for a waiver of electronic submittal requirements.

PROPOSAL BID BOND

DT1303 1/2006

Wisconsin Department of Transportation

Proposal Number	Project Number	Letting Date
Name of Principal		
Name of Surety	State in Which Surety is Organized	

We, the above-named Principal and the above-named Surety, are held and firmly bound unto the State of Wisconsin in the sum equal to the Proposal Guaranty for the total bid submitted for the payment to be made; we jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns. The condition of this obligation is that the Principal has submitted a bid proposal to the State of Wisconsin acting through the Department of Transportation for the improvement designated by the Proposal Number and Letting Date indicated above.

If the Principal is awarded the contract and, within the time and manner required by law after the prescribed forms are presented for signature, enters into a written contract in accordance with the bid, and files the bond with the Department of Transportation to guarantee faithful performance and payment for labor and materials, as required by law, or if the Department of Transportation shall reject all bids for the work described, then this obligation shall be null and void; otherwise, it shall be and remain in full force and effect. In the event of failure of the Principal to enter into the contract or give the specified bond, the Principal shall pay to the Department of Transportation **within 10 business days of demand** a total equal to the Proposal Guaranty as liquidated damages; the liability of the Surety continues for the full amount of the obligation as stated until the obligation is paid in full.

The Surety, for value received, agrees that the obligations of it and its bond shall not be impaired or affected by any extension of time within which the Department of Transportation may accept the bid; and the Surety does waive notice of any such extension.

IN WITNESS, the Principal and Surety have agreed and have signed by their proper officers and have caused their corporate seals to be affixed this date: **(DATE MUST BE ENTERED)**

PRINCIPAL

(Company Name) **(Affix Corporate Seal)**

(Signature and Title)

(Company Name)

(Signature and Title)

(Company Name)

(Signature and Title)

(Company Name)

(Signature and Title)

NOTARY FOR PRINCIPAL

(Date)

State of Wisconsin)
) ss.
_____ County)

On the above date, this instrument was acknowledged before me by the named person(s).

(Signature, Notary Public, State of Wisconsin)

(Print or Type Name, Notary Public, State of Wisconsin)

(Date Commission Expires)

Notary Seal

(Name of Surety) **(Affix Seal)**

(Signature of Attorney-in-Fact)

NOTARY FOR SURETY

(Date)

State of Wisconsin)
) ss.
_____ County)

On the above date, this instrument was acknowledged before me by the named person(s).

(Signature, Notary Public, State of Wisconsin)

(Print or Type Name, Notary Public, State of Wisconsin)

(Date Commission Expires)

Notary Seal

IMPORTANT: A certified copy of Power of Attorney of the signatory agent must be attached to the bid bond.

CERTIFICATE OF ANNUAL BID BOND

DT1305 8/2003

Wisconsin Department of Transportation

Time Period Valid (From/To)	
Name of Surety	
Name of Contractor	
Certificate Holder	Wisconsin Department of Transportation

This is to certify that an annual bid bond issued by the above-named Surety is currently on file with the Wisconsin Department of Transportation.

This certificate is issued as a matter of information and conveys no rights upon the certificate holder and does not amend, extend or alter the coverage of the annual bid bond.

Cancellation: Should the above policy be cancelled before the expiration date, the issuing surety will give thirty (30) days written notice to the certificate holder indicated above.

(Signature of Authorized Contractor Representative)

(Date)

LIST OF SUBCONTRACTORS

Section 66.0901(7), Wisconsin Statutes, provides that as a part of the proposal, the bidder also shall submit a list of the subcontractors the bidder proposes to contract with and the class of work to be performed by each. In order to qualify for inclusion in the bidder's list a subcontractor shall first submit a bid in writing, to the general contractor at least 48 hours prior to the time of the bid closing. The list may not be added to or altered without the written consent of the municipality. A proposal of a bidder is not invalid if any subcontractor and the class of work to be performed by the subcontractor has been omitted from a proposal; the omission shall be considered inadvertent or the bidder will perform the work personally.

No subcontract, whether listed herein or later proposed, may be entered into without the written consent of the Engineer as provided in Subsection 108.1 of the Standard Specifications.

[illegible]

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS - PRIMARY COVERED TRANSACTIONS

Instructions for Certification

1. By signing and submitting this proposal, the prospective contractor is providing the certification set out below.
2. The inability of a person to provide the certification required below will not necessarily result in denial of participation in this covered transaction. The prospective contractor shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective contractor to furnish a certification or an explanation shall disqualify such person from participation in this transaction.
3. The certification in this clause is a material representation of fact upon which reliance was placed when the department determined to enter into this transaction. If it is later determined that the contractor knowingly rendered an erroneous certification in addition to other remedies available to the Federal Government the department may terminate this transaction for cause or default.
4. The prospective contractor shall provide immediate written notice to the department to whom this proposal is submitted if at any time the prospective contractor learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
5. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549. You may contact the department to which this proposal is being submitted for assistance in obtaining a copy of those regulations.
6. The prospective contractor agrees by submitting this proposal that, should this contract be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department entering into this transaction.
7. The prospective contractor further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," which is included as an addendum to PR- 1273 - "Required Contract Provisions Federal Aid Construction Contracts," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
8. The contractor may rely upon a certification of a prospective subcontractor/materials supplier that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A contractor may decide the method and frequency by which it determines the eligibility of its principals. Each contractor may, but is not required to, check the Disapproval List (telephone # 608/266/1631).

9. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
10. Except for transactions authorized under paragraph 6 of these instructions, if a contractor in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department may terminate this transaction for cause or default.

Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions

1. The prospective contractor certifies to the best of its knowledge and belief, that it and its principals:
 - (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
 - (b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements or receiving stolen property;
 - (c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offense enumerated in paragraph (1)(b) of this certification; and
 - (d) Have not within a three-year period preceding this proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
2. Where the prospective contractor is unable to certify to any of the statements in this certification, such prospective contractor shall attach an explanation to this proposal.

Special Provisions

Table of Contents

Article	Description	Page #
1.	General	2
2.	Scope of Work	2
3.	Prosecution and Progress.	2
4.	Traffic.....	3
5.	Holiday and Special Event Work Restrictions.	3
6.	Utilities.	4
7.	Other Contracts.	5
8.	Referenced Construction Specifications.....	5
9.	New Utility Service Connections.....	5
10.	Hauling Restrictions.....	6
11.	Information to Bidders, U.S. Army Corps of Engineers Section 404 Permit.....	6
12.	Information to Bidders, WPDES General Construction Storm Water Discharge Permit.	6
13.	Information to Bidders, Site Preparation under Project 1225-10-72.....	7
14.	Information to Bidder, Abatement of Asbestos Containing Material 1225-10-72.....	7
15.	Erosion Control.....	7
16.	Notice to Contractor – Pre-Bid Meeting.....	7
17.	Notice to Contractor – Field Office.....	8
18.	Removals, General.....	8
19.	Rest Area 51 Building, General Construction, Item SPV.0060.01; Rest Area 52 Building, General Construction, Item SPV.0060.02; Rest Area 51 Building, Plumbing, Item SPV.0060.03; Rest Area 52 Building, Plumbing, Item SPV.0060.04; Rest Area 51 Building, Heating and Ventilation, Item SPV.0060.05; Rest Area 52 Building, Heating and Ventilation, Item SPV.0060.06; Rest Area 51 Building, Electrical, Item SPV.0060.07; Rest Area 52 Building, Electrical, Item SPV.0060.08; Rest Area 51 Maintenance Building, Item SPV.0060.09; Rest Area 52 Maintenance Building, Item SPV.0060.10.	8
20.	Picnic Shelter Large Item SPV.0060.11; Picnic Shelter Small, Item SPV.0060.12.....	615
21.	Pitless Adapter, Item SPV.0060.13.....	615
22.	Well System Controls, Item SPV.0060.14.....	615
23.	Well Pump, Item SPV.0060.15.....	617
24.	Construction Staking, Water System, Item SPV.0060.16.....	617
25.	Construction Staking, Building, Item SPV.0060.24.....	618
26.	Coring Manhole, Item SPV.0060.25.....	619
27.	Underground Copper Water Line, 3-Inch, Item SPV.0090.01; Underground Copper Water Line, 1-Inch, Item SPV.0090.02.....	619
28.	Sanitary Sewer PVC, 6-Inch, Item SPV.0090.03; Sanitary Sewer PVC, 8-Inch, Item SPV.0090.04.....	620
29.	Construction Staking Sanitary Sewer System, Item SPV.0090.05.....	621

SPECIAL PROVISIONS

1. General.

Perform the work under this construction contract for Project 1225-10-73, Manitowoc – Green Bay, SRA 51 Maribel/SRA 52 Denmark), IH 43, Manitowoc County, Wisconsin, Wisconsin as the plans show and execute the work as specified in the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, 2025 Edition, as published by the department, and these special provisions.

If all or a portion of the plans and special provisions are developed in the SI metric system and the schedule of prices is developed in the US standard measure system, the department will pay for the work as bid in the US standard system.

100-005 (20240703)

2. Scope of Work.

The work under this contract shall consist of Rest Area 51 Comfort Building, Rest Area 52 Comfort Building, Rest Area 51 Maintenance Building, Rest Area 52 Maintenance Building, picnic shelters, high-capacity water wells, geothermal wells, sanitary sewer, electrical and communication hookups and all incidental items necessary to complete the work as shown on the plans and included in the proposal and contract.

104-005 (20090901)

3. Prosecution and Progress.

Begin work within 10 calendar days after the engineer issues a written notice to do so. Begin work within 10 calendar days after the engineer issues a written notice to do so.

Provide the start date to the engineer in writing within a month after executing the contract but at least 14 calendar days before the preconstruction conference. Upon approval, the engineer will issue the notice to proceed within ten calendar days before the approved start date.

To revise the start date, submit a written request to the engineer at least two weeks before the intended start date. The engineer will approve or deny that request based on the conditions cited in the request and its effect on the department's scheduled resources.

The site preparation required to occur prior to the work under this contract will be performed under ID 1225-10-72, see Article Other Contracts. Contract 1225-10-72 stipulates that site preparation at the comfort building location is completed by May 30, 2025. Begin construction no later than May 30, 2025.

Winter Maintenance

Manitowoc County will perform snow removal operations along IH 43 for freeways and ramps open to traffic. Provide for snow removal along the Rest Area 51 and Rest Area 52 exit and entrance ramps to facilitate safe construction operations and as required to eliminate snow melt run-off from crossing IH 43 and ensure snow and ice are not tracked onto the IH 43 traffic lanes by construction vehicle traffic using the exit and entrance ramps during construction operations.

Interim Completion and Liquidated Damages – IH 43 Rest Areas 51 and Rest Area 52: Friday, August 29, 2025

Complete construction operations on the contract items on Rest Areas 51 and Rest Area 52 to the stage where as the utility connections are made with the match point provided in the plans, with contract 1225-10-72. The maintenance building and comfort building are completed to the point where the footings are poured, the utilities (electricity, water and sanitary sewer and communications) are connected and the exterior building framework is completed by Friday, August 29, 2025.

If the contractor fails to complete the work necessary, Rest Areas 51 and Rest Area 52 to the stage listed above by Friday, August 29, 2025, the department will assess the contractor \$10,000 in interim liquidated damages for each calendar day the contract work remains incomplete beyond 12:01 AM on Friday, August 29, 2025. An entire calendar day will be charged for any period of time within a calendar day that the work remains incomplete beyond 12:01 AM.

*If contract time expires prior to completing all work specified in the contract, additional liquidated damages will be affixed according to standard spec 108.11.

Northern Long-eared Bat (*Myotis septentrionalis*)

Northern long-eared bats (NLEB) have the potential to inhabit the project limits because they roost in trees, bridges, and culverts. Roosts may not have been observed on this project, but conditions to support the species exist. The species and all active roosts are protected by the federal Endangered Species Act. If an individual bat or active roost is encountered during construction operations, stop work, and notify the engineer and the WisDOT Regional Environmental Coordinator (REC).

Ensure all operators, employees, and subcontractors working in areas of known or presumed bat habitat are aware of environmental commitments and avoidance and minimization measures (AMMs) to protect both bats and their habitat.

Direct temporary lighting, if used, away from wooded areas during the bat active season: April 1 to October 31, both dates inclusive.

The department has contracted with others and will cut down and clear all required trees for this project prior to April 1.

4. Traffic.

Rest Areas 51 and 52 will be closed (long-term) to the public from April 28, 2025, through June 19, 2026. A short-term closure of each rest area will occur for one week in March 2025 for tree clearing and removal. Only construction traffic will be allowed during either closure period. Contact the BHM OSOW Permit section two weeks prior to closure to allow permit coordination.

Only construction traffic will be allowed during closure. Traffic control devices along IH 43 will be installed and maintained under Project 1225-10-72.

Conduct operations in a manner that will cause the least interference to traffic movements on IH 43. Vehicles exiting or entering IH 43 shall be equipped with amber flashing warning lights visible from 360 degrees from the vehicle. Warning lights will be activated during ingress and egress operations from the rest areas.

Do not haul across, unload material from, stop in, or otherwise interfere with traffic on any portion of IH 43. Do not directly cross the live lanes of IH 43 with any vehicle or piece of construction equipment. Flagging operations will not be permitted on IH 43.

Do not use maintenance crossings connecting northbound and southbound roadways of IH 43.

Do not disturb, remove, or obliterate any traffic control signs, advisory signs, shoulder delineators or beam guard in place without the approval of the engineer.

Restore traffic control devices along IH 43 installed under Project 1225-10-72 at the end of each workday if responsible for any traffic control devices becoming out of place due to work operations performed by the prime or subcontractors under this contract to deter the traveling public from entering or exiting IH 43 at the rest area ramps.

5. Holiday and Special Event Work Restrictions.

Do not perform work on, nor haul materials of any kind along or across any portion of the highway carrying IH 43 traffic, and entirely clear the traveled way and shoulders of such portions of the highway of equipment, barricades, signs, lights, and any other material that might impede the free flow of traffic during the following holiday and special event periods:

- From 6:00 AM Tuesday, April 22, 2025 to 6:00 AM Monday, April 28, 2025 for 2025 NFL Draft;
- From noon Friday, May 23, 2025 to 6:00 AM Tuesday, May 27, 2025 for Memorial Day;
- From noon Thursday, July 3, 2025 to 6:00 AM Monday, July 7, 2025 for Independence Day;
- From noon Friday, August 29, 2025 to 6:00 AM Tuesday, September 2, 2025 for LaborDay;
- From noon Friday, November 21, 2025 to 6:00 AM Monday, December 1, 2025 for Thanksgiving;
- From noon Friday, December 19, 2025 to 6:00 AM Monday, January 5, 2026 for Christmas and New Year's Day;
- From noon Friday, May 22, 2026 to 6:00 AM Tuesday, May 26, 2026 for Memorial Day;
- From noon Friday, July 3, 2026 to 6:00 AM Monday, July 6, 2026 for Independence Day.

stp-107-005 (20210113)

6. Utilities.

This contract comes under the provision of Administrative Rule Trans 220.

The utility work plan includes additional detailed information regarding the location of known discontinued, relocated, or removed utility facilities. These can be requested from the department during the bid preparation process, or from the engineer after the contract has been awarded and executed.

Some of the utility work described below is dependent on prior work being performed by the contractor at a specific site. In such situations, provide the engineer and the affected utility a good faith notice of when the utility is to start work at the site. Provide this notice 14 to 16 calendar days in advance of when the prior work will be completed, and the site will be available to the utility. Follow-up with a confirmation notice to the engineer and the utility not less than 3 working days before the site will be ready for the utility to begin its work.

stp-107-065 (20240703)

Brightspeed – Communications has underground facilities at each rest area as described below.

Rest Area 51

Brightspeed serves the existing rest area from the distribution network on CTH T with the facility being located underground along the south right-of-way line of IH 43 and enters the existing plaza from the east.

Brightspeed plans to abandon the existing communications service and pedestal to Rest Area 51 during construction in 2025.

Rest Area 52

Brightspeed serves the existing rest area from the distribution network on CTH T with the facility being located underground along the north right-of-way line of IH 43 and enters the existing plaza from the north under the existing truck lot.

Brightspeed plans to abandon the existing communications service and pedestal to Rest Area 52 during construction in 2025.

Efforts by Brightspeed to discontinue service and abandon facilities is anticipated to take one day on each site.

Lumen – Communications has underground fiber optic facilities located along the south right-of-way line of IH 43 and through Rest Area 51.

The facility is not in conflict and no relocations are required.

WPS – Electric has underground facilities at each rest area as described below. Rest Area 51

WPS serves the existing rest area from the distribution network on CTH T with the facility being located underground along the south right-of-way line of IH 43 and enters the existing plaza from the east.

WPS plans to discontinue use of and replace the existing electrical service and transformer to Rest Area 51 in summer/fall of 2024. The new transformer will be placed in consideration of the proposed final infrastructure and the existing transformer will be removed. Electric service will be maintained to the comfort building.

WPS will also install distribution infrastructure between Rest Area 51 and Rest Area 52. The new underground facility will be constructed in fall 2024 and will exit the plaza on Rest Area 51, traversing west behind the truck lot. The facility will cross under IH 43 and extend around the back side of the Rest Area 52 ramps and truck lot to land at the existing transformer location.

Rest Area 52

WPS serves the existing rest area from the distribution network on CTH T with the facility being located underground along the north right-of-way line of IH 43 and enters the existing plaza from the north under the existing truck lot.

WPS replaced the electrical service to Rest Area 52 in fall of 2023. The new transformer was placed in consideration of the proposed final infrastructure and the existing transformer was removed.

WPS will adjust the transformer and place conduit and conductors into the CT cabinet on each rest area comfort building during construction. This installation must occur after building construction allows placement of the CT cabinet.

7. Other Contracts.

Project 1225-10-72, Manitowoc – Green Bay, (Rest Area 51 Maribel and Rest Area 52 Denmark), IH 43, Manitowoc County:

This project includes the roadway/site work project that this project limits are contained within. Extensive coordination with this project will be necessary to complete both projects.

Coordination with Project 1225-10-72 will be required. Project 1225-10-72 involves the removal of the existing rest area ramps, parking areas, and buildings, as well as the construction of the proposed rest area ramps and parking areas for both sites. Coordination with this project will be required for traffic control staging, lighting construction, utility construction, material/equipment delivery and storage, and site access and storage.

Project 1225-10-72 is scheduled to be let on January 14, 2025, and is anticipated to have a completion date contract of June 19, 2026. Project 1225-10-72 will be responsible for all required Traffic Control staging on IH 43 and the rest area ramps.

Coordinate with Project 1225-10-72 to ensure that the proposed utilities are protected from equipment impact loadings until adequate cover can be established as directed by the engineer in the field.

Construction materials and equipment shall be stored within project boundary marked on plans once project 1225-10-72 begins work, unless written permission to store materials or equipment outside of this boundary is received from the engineer and 1225-10-72 contractor.

8. Referenced Construction Specifications.

Building Construction shall conform to the Wisconsin Commercial Building Code, Chapter SPS-362 (based on 2015 International Building Code) and the 2010 ADA Standards for Accessible Design.

If there is a discrepancy or conflict between the referenced specifications and the standard specifications regarding contract administration, part 1 of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, 2025 Edition governs.

9. New Utility Service Connections.

Electrical Service, Rest Area 51: WPS has existing service facilities connecting to the existing rest area facility coming into the site from the east near CTH T. WPS installed new underground services to the proposed building location (single-phase) along the south right-of-way line of the interstate in summer 2024. The transformer existing on site may be used for the new electrical service. WPS will place conduit and conductors from the transformer to the new building CT cabinet. WPS will require two days to

complete the electric service installation from the transformer to the proposed rest area building during construction.

Electrical Service, Rest Area 52: WPS has existing service facilities connecting to the existing rest area facility coming into the site from the east near CTH T. WPS has underground services to the proposed building location (single-phase) coming into the site along the north right-of-way line of the interstate in fall 2023. The transformer existing on site will be used for the new electrical service. WPS will place conduit and conductors from the transformer to the new building CT cabinet. WPS will require two days to complete the electric service installation from the transformer to the proposed rest area building during construction.

Contact Chuck Windus of WPS at (920) 606-1141 (Charles.windus@wisconsinpublicservice.com) a minimum of two weeks in advance of needing WPS onsite to coordinate electrical service installation efforts.

A service request and application have been submitted by the department. Utility installation costs for electric service to the project site transformer location is to be paid for separately by the department.

Coordinate temporary electrical service needs for construction with Chuck Windus. Costs for temporary electrical service and electricity during construction will be the responsibility of the contractor.

Communications Service, Rest Area 51: Communications service will be provided via cellular modem within the completed comfort building.

Communications Service, Rest Area 52: Communications service will be provided via cellular modem within the completed comfort building.

10. Hauling Restrictions.

Access points to the roadways carrying IH 43 traffic for the delivery or hauling of construction materials for this project shall be at the existing ramps.

Equip all vehicles traveling on public roads that are hauling materials or removals that are subject to spillage, either by wind or vibration, with tailgates and adequate sideboards. Use canvas covers and any other protective devices to prevent spillage as determined necessary by the engineer.

11. Information to Bidders, U.S. Army Corps of Engineers Section 404 Permit.

The department has obtained an individual Section 404 Permit from the U.S. Army Corps of Engineers. Comply with the requirements of the permit in addition to requirements of the special provisions.

A copy of the permit is available from the regional office by contacting Joseph Coughlin at (608) 261-8975.

If the contractor requires work outside the proposed slope intercepts, based on their method of operation to construct the project, it is the contractor's responsibility to determine whether a U.S. Army Corps of Engineers Section 404 permit modification is required. If a Section 404 permit modification is necessary, obtain the permit modification prior to beginning construction operations requiring the permit. No time extensions as discussed in standard spec 108.10 will be granted for the time required to apply for and obtain the permit modification. The contractor must be aware that the U.S. Army Corps of Engineers may not grant the permit modification request.

stp-107-054 (20230629)

12. Information to Bidders, WPDES General Construction Storm Water Discharge Permit.

The department has obtained coverage through the Wisconsin Department of Natural Resources to discharge storm water associated with land disturbing construction activities of this contract under the Wisconsin Pollutant Discharge Elimination System General Construction Storm Water Discharge Permit (WPDES Permit No. WI-S066796-1). A certificate of permit coverage is available from the regional office by contacting Joseph Coughlin at (608) 261-8975. Post the permit in a conspicuous place at the construction site.

stp-107-056 (20180628)

13. Information to Bidders, Site Preparation under Project 1225-10-72.

The work performed under Project 1225-10-72 includes preparation of the rough grading in the areas surrounding the proposed building envelopes. This work includes all removal of existing buildings, backfilling and preparation to provide a working platform for this contract and establishing a rough subgrade within 6 inches of the finished floor subgrade elevations for the comfort buildings and maintenance buildings.

14. Information to Bidder, Abatement of Asbestos Containing Material 1225-10-72.

This work is being done by others under Project 1225-10-72.

For Buildings:

Jeffrey S. Carlson and Paul M Garvey, License Number: ALL-3420 and ALL-117079, inspected Structures: Rest Area 51 Comfort Building, Rest Area 52 Comfort Building, Rest Area 51 Maintenance Building, and Rest Area 52 Maintenance Building for asbestos on August 30, 2022. Regulated Asbestos Containing Material (RACM) was found on this structure in the following locations and quantities: electrical component boxes in the comfort buildings and maintenance buildings are presumed to contain ACM, quantities of ACM are unknown. A copy of the inspection report is available from Joseph Coughlin at (608) 261-8975, Joseph.Coughlin@dot.wi.gov.

The RACM must be abated by a licensed abatement contractor. According to NR447 and DHS159, ensure that DNR or DHS receives a completed Notification of Demolition and/or Renovation (DNR Form 4500-113 (R 8/11), or subsequent revision) via U.S. mail, hand- delivery, or using the online notification system at least 10 working days before beginning any demolition or relocation. Pay all associated fees. Provide a copy of the completed 4500-113 form and the abatement report to Joseph Coughlin at (608) 261-8975 Joseph.Coughlin@dot.wi.gov and DOT BTS-ESS attn: Hazardous Materials Specialist, 5 South S.513.12, PO Box 7965, Madison, WI 53707-7965; or via email to dothazmatunit@dot.wi.gov. In addition, comply with all local or municipal asbestos requirements.

15. Erosion Control.

All erosion control will be installed under Project 1225-10-72. Coordinate with the engineer to determine the location of erosion control devices installed under Project 1225-10-72 to allow each project to commence work. Coordinate with the engineer to relocate, adjust, or modify any erosion control measures in place if impacted by operations under Project 1225-10-73. Coordinate with Project 1225-10-72 contractor prior to removing any erosion control devices or if any become damaged.

16. Notice to Contractor – Pre-Bid Meeting.

Supplement standard spec 102.3.1 with the following:

- (3) Prospective bidders are strongly encouraged to attend a pre-bid meeting at 2:00 PM on Tuesday, October 22, 2024.

The meeting agenda will include the following:

- Introductions
- Project Overview
- Highway Construction Contract Information Contractors Checklist
- Prequalification materials (form DT1621) 1130-44-74 10 of 1275
- DBE requirements
- Buy America Requirements
- Contractor Questions/Bid Express
- Q&A

The meeting will be hosted via Microsoft Teams. Join on your computer, mobile app or room device or via telephone. Meeting information is below:

Microsoft Teams [Need help?](#)

[Join the meeting now](#)

Meeting ID: 287 678 543 830

Passcode: 5wThfQ

Dial in by phone

[+1 872-240-1286,,686084815#](#) United States, Chicago [Find a local number](#)

Phone conference ID: 686 084 815#

17. Notice to Contractor – Field Office.

Project 1225-10-73 will not include a Field Office bid item as the engineer will oversee both 1225-10- 72 and 1225-10-73 projects.

18. Removals, General.

All existing site removals will occur under Project 1225-10-72. As-built plans of the existing Rest Areas 51 and 52 are available at the Wisconsin Department of Transportation, Northeast Region Office, 944 Vanderperren Way, Green Bay, WI, for review by prospective bidders prior to the bid letting in order to provide additional information regarding site removal items and buildings. Both sites are open to the public and available for viewing. For access to non-public areas, contact Joseph Coughlin, (608) 261-8975.

19. **Rest Area 51 Building, General Construction, Item SPV.0060.01;
Rest Area 52 Building, General Construction, Item SPV.0060.02;
Rest Area 51 Building, Plumbing, Item SPV.0060.03;
Rest Area 52 Building, Plumbing, Item SPV.0060.04;
Rest Area 51 Building, Heating and Ventilation, Item SPV.0060.05;
Rest Area 52 Building, Heating and Ventilation, Item SPV.0060.06;
Rest Area 51 Building, Electrical, Item SPV.0060.07;
Rest Area 52 Building, Electrical, Item SPV.0060.08;
Rest Area 51 Maintenance Building, Item SPV.0060.09;
Rest Area 52 Maintenance Building, Item SPV.0060.10.**

A Description

This item consists of the general construction, plumbing, heating and ventilation, and electrical work for the Rest Area 51 and 52 Buildings and Maintenance Buildings. The work shall be according to the applicable plans and the following specifications.

B (Vacant)

C (Vacant)

D Measurement

The department will measure the general construction, plumbing, heating and ventilation, and electrical work for the Rest Area 51 and 52 Buildings and Maintenance Buildings as each individual installation, acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.01	Rest Area 51 Building, General Construction	EACH
SPV.0060.02	Rest Area 52 Building, General Construction	EACH
SPV.0060.03	Rest Area 51 Building, Plumbing	EACH
SPV.0060.04	Rest Area 52 Building, Plumbing	EACH
SPV.0060.05	Rest Area 51 Building, Heating and Ventilation	EACH
SPV.0060.06	Rest Area 52 Building, Heating and Ventilation	EACH
SPV.0060.07	Rest Area 51 Building, Electrical	EACH
SPV.0060.08	Rest Area 52 Building, Electrical	EACH
SPV.0060.09	Rest Area 51 Maintenance Building	EACH
SPV.0060.10	Rest Area 52 Maintenance Building	EACH

Payment is full compensation for furnishing all materials and equipment, and for supplying all labor, tools, equipment, and incidentals necessary to complete the work. The contractor can receive prorated payments for this item by submitting a detailed estimate outlining the work completed and the costs associated to the engineer for approval.

SECTION 00 01 10 - TABLE OF CONTENTS

SECTIONS

DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 07 SEALS PAGE

DIVISION 01 — GENERAL REQUIREMENTS

01 10 00 SUMMARY

01 25 13 SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT

01 45 00 QUALITY CONTROL

01 61 00 COMMON PRODUCT REQUIREMENTS

01 71 21 SPECIALTY ENGINEERING REQUIREMENTS

01 77 00 CLOSEOUT PROCEDURES (GC)

01 78 23 OPERATION AND MAINTENANCE DATA

01 78 36 WARRANTIES

DIVISION 03 — CONCRETE

03 08 13 CONCRETE TESTING AND EVALUATION - OWNER

03 11 00 CONCRETE FORMING

03 11 31 VOID FORMS

03 15 19 ANCHORAGE TO CONCRETE

03 15 23 EXPANSION JOINT SEALS IN CONCRETE

03 20 00 CONCRETE REINFORCING

03 31 00 CONCRETE MATERIALS AND PROPORTIONING

03 31 10 CONCRETE MIXING, PLACING, JOINTING, AND CURING

03 35 00 CONCRETE FINISHING

03 45 00 ARCHITECTURAL PRECAST CONCRETE (APC)

DIVISION 04 — MASONRY

04 05 05 COLD AND HOT WEATHER MASONRY PROCEDURES
04 05 10 MASONRY CLEANING
04 05 16 MASONRY GROUTING
04 22 00 CONCRETE UNIT MASONRY (CMU)

DIVISION 05 — METALS

05 50 00 METAL FABRICATIONS

DIVISION 06 — WOOD, PLASTICS, AND COMPOSITES

06 10 00 ROUGH CARPENTRY
06 11 10 WOOD FRAMING AND SHEATHING
06 12 00 STRUCTURAL INSULATED PANELS
06 16 43 GYPSUM SHEATHING
06 17 53 SHOP-FABRICATED WOOD TRUSSES
06 41 00 ARCHITECTURAL WOOD CASEWORK

DIVISION 07 — THERMAL AND MOISTURE PROTECTION

07 21 00 THERMAL INSULATION
07 27 46 VAPOR PERMEABLE AIR BARRIER
07 46 46 FIBER-CEMENT SIDING
07 61 13 STANDING SEAM METAL ROOFING
07 62 00 SHEET METAL FLASHING AND TRIM
07 92 13 EXTERIOR JOINT SEALANTS
07 92 16 INTERIOR JOINT SEALANTS

DIVISION 08 — OPENINGS

08 11 13 HOLLOW METAL (HM) DOORS AND FRAMES
08 14 16 FLUSH WOOD DOORS
08 36 15 SECTIONAL STEEL DOOR (SSD)
08 41 13 LOW-RISE ALUMINUM STOREFRONT
08 71 00 DOOR HARDWARE
08 71 13 AUTOMATIC DOOR OPERATORS
08 81 00 GLASS AND GLAZING
08 91 00 ARCHITECTURAL LOUVERS

DIVISION 09 — FINISHES

09 22 16 NON-STRUCTURAL METAL FRAMING
09 29 00 GYPSUM BOARD
09 30 00 TILING
09 51 00 ACOUSTICAL CEILINGS
09 66 23 THIN-SET EPOXY TERRAZZO
09 67 81 CONCRETE FLOOR SEALER
09 79 11 WOOD INTERIOR WALL AND CEILING PANELS
09 81 13 ACOUSTIC BOARD INSULATION
09 91 13 EXTERIOR PAINTING
09 91 23 INTERIOR PAINTING

DIVISION 10 — SPECIALTIES

10 21 12 METAL TOILET PARTITIONS
10 28 13 TOILET ACCESSORIES
10 51 13 METAL LOCKERS

DIVISION 12 — FURNISHINGS

12 05 01 FURNITURE AND FURNISHINGS - GENERAL REQUIREMENTS
12 36 63 SOLID SURFACE FABRICATIONS (SSF)
12 48 13 ENTRANCE FLOOR MATS AND FRAMES (EM)

DIVISION 22 — PLUMBING

22 11 00 WATER DISTRIBUTION SYSTEM
22 13 00 SANITARY SEWERS
22 31 16 WATER SOFTENER
22 42 00 PLUMBING FIXTURES

DIVISION 23 — HEATING VENTILATING AND AIR CONDITIONING

23 05 00 SPECIAL MECHANICAL REQUIREMENTS
23 05 23 GENERAL-DUTY VALVES FOR HVAC PIPING
23 05 29 PENETRATIONS AND SUPPORTS
23 05 53 MECHANICAL IDENTIFICATION SYSTEMS
23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 00 PIPE, DUCT AND EQUIPMENT INSULATION
23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC SYSTEMS
23 11 00 MECHANICAL PIPE AND FITTINGS
23 21 00 HYDRONIC SPECIALTIES
23 21 14 GEOTHERMAL LOOP HEAT EXCHANGER
23 21 23 HYDRONIC PUMPS
23 25 13 CHEMICAL TREATMENT
23 31 00 HVAC - DUCTWORK
23 80 00 HVAC - EQUIPMENT
23 81 46 UNITARY HEAT PUMP
23 83 16 RADIANT FLOORING SYSTEM

DIVISION 26 — ELECTRICAL

26 00 10 ELECTRICAL GENERAL REQUIREMENTS
26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 33 CONDUITS
26 05 34 BOXES
26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 09 23 LINE VOLTAGE LIGHTING CONTROL DEVICES
26 24 16 PANELBOARDS
26 27 26 WIRING DEVICES
26 28 16 ENCLOSED SAFETY SWITCHES
26 33 23 EMERGENCY LIGHTING INVERTER SYSTEM
26 43 13 SURGE PROTECTIVE DEVICES (SPD)
26 51 13 BUILDING LIGHTING

DIVISION 27 — COMMUNICATIONS

27 10 00 STRUCTURED CABLING

DIVISION 28 — ELECTRONIC SAFETY AND SECURITY

28 23 00 VIDEO SURVEILLANCE (FIXED)

SECTION 00 01 07
SEALS PAGE

I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered architect under the laws of the State of Wisconsin.

Sheppard, David Meade

Digitally signed by Sheppard, David Meade
DN: c=US, o=Sheppard, David Meade, ou=Sheppard, David Meade, ou=Users, ou=St Louis Park-1601 Utica Ave South, ou=Minnesota,
ou=United States, ou=Offices, dc=intrant, dc=ind
Reason: I agree to the terms defined by the placement of my signature on this
document
Date: 2024.08.01 00:05:51 -05'00'

David Sheppard, AIA

Wisconsin License No.: 13899-5 Renewal Date: July 31, 2026

Sections covered by this signature:

03 45 00	ARCHITECTURAL PRECAST CONCRETE
04 05 05	COLD AND HOT WEATHER MASONRY PROCEDURES
04 05 10	MASONRY CLEANING
04 05 16	MASONRY GROUTING
05 50 00	METAL FABRICATIONS
06 10 00	ROUGH CARPENTRY
06 11 10	WOOD FRAMING AND SHEATHING
06 12 00	STRUCTURAL INSULATED PANELS
06 16 43	GYPSUM SHEATHING
06 41 00	ARCHITECTURAL WOOD CASEWORK
07 21 00	THERMAL INSULATION
07 27 46	VAPOR PERMEABLE AIR BARRIER
07 46 46	FIBER-CEMENT SIDING
07 61 13	STANDING SEAM METAL ROOFING
07 62 00	SHEET METAL FLASHING AND TRIM
07 92 13	EXTERIOR JOINT SEALANTS
07 92 16	INTERIOR JOINT SEALANTS
08 06 71	DOOR HARDWARE SCHEDULE
08 11 13	HOLLOW METAL DOORS AND FRAMES
08 14 16	FLUSH WOOD DOORS
08 36 15	SECTIONAL STEEL DOOR
08 41 13	LOW-RISE ALUMINUM STOREFRONT
08 71 00	DOOR HARDWARE
08 71 13	AUTOMATIC DOOR OPERATORS
08 81 00	GLASS AND GLAZING
08 91 00	ARCHITECTURAL LOUVERS
09 22 16	NON-STRUCTURAL METAL FRAMING
09 29 00	GYPSUM BOARD
09 30 00	TILING
09 51 00	ACOUSTICAL CEILINGS
09 66 23	THIN-SET EPOXY TERRAZZO
09 67 81	CONCRETE FLOOR SEALER
09 79 11	WOOD INTERIOR WALL AND CEILING PANELS
09 81 13	ACOUSTIC BOARD INSULATION
09 91 13	EXTERIOR PAINTING
09 91 23	INTERIOR PAINTING
10 21 12	METAL TOILET PARTITIONS
10 28 13	TOILET ACCESSORIES
10 51 13	METAL LOCKERS
12 05 01	FURNITURE AND FURNISHINGS – GENERAL REQUIREMENTS
12 48 13	ENTRANCE FLOOR MATS AND FRAMES
12 36 63	SOLID SURFACE FABRICATIONS

I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered engineer under the laws of the State of Wisconsin.

Mulvihill, Jerome Wayne



Digitally signed by Mulvihill, Jerome Wayne
DN: E=Jerome.Mulvihill@hdrinc.com, CN=Mulvihill, Jerome Wayne, OU=Users, OU=St Louis Park-601 Utica Ave South, OU=Minnesota, OU=United States, OU=Offices, DC=intranet, DC=hdr
Date: 2024.08.01 11:08:27-05'00'

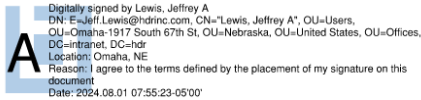
Jerome Mulvihill, PE
Wisconsin License No.: 35085-6 Renewal Date: July 31, 2026

Sections covered by this signature:

03 08 13	CONCRETE TESTING AND EVALUATION - OWNER
03 11 00	CONCRETE FORMING
03 11 31	VOID FORMS
03 15 19	ANCHORAGE TO CONCRETE
03 15 23	EXPANSION JOINT SEALS IN CONCRETE
03 20 00	CONCRETE REINFORCING
03 31 00	CONCRETE MATERIALS AND PROPORTIONING
03 31 10	CONCRETE MIXING, PLACING, JOINTING, AND CURING
03 35 00	CONCRETE FINISHING
04 22 00	CONCRETE UNIT MASONRY

I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered engineer under the laws of the State of Wisconsin

Lewis, Jeffrey A



Digitally signed by Lewis, Jeffrey A
DN: E=Jeff.Lewis@hdrinc.com, CN=Lewis, Jeffrey A, OU=Users, OU=Omaha-1917 South 67th St, OU=Nebraska, OU=United States, OU=Offices, DC=intranet, DC=hdr
Location: Omaha, NE
Reason: I agree to the terms defined by the placement of my signature on this document
Date: 2024.08.01 07:55:23-05'00'

Jeff Lewis, PE

Wisconsin License No.: 42214-6 Renewal Date: July 31, 2026

Sections covered by this seal:

22 11 00	WATER DISTRIBUTION SYSTEM
22 13 00	SANITARY SEWERS
22 31 16	WATER SOFTENER
22 42 00	PLUMBING FIXTURES
23 05 00	SPECIAL MECHANICAL REQUIREMENTS
23 05 23	GENERAL-DUTY VALVES FOR HVAC PIPING
23 05 29	PENETRATIONS AND SUPPORTS
23 05 53	MECHANICAL IDENTIFICATION SYSTEMS
23 05 93	TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 00	PIPE, DUCT AND EQUIPMENT INSULATION
23 09 00	INSTRUMENTATION AND CONTROL FOR HVAC SYSTEMS
23 11 00	MECHANICAL PIPE AND FITTINGS
23 21 00	HYDRONIC SPECIALTIES
23 21 14	GEOHERMAL LOOP HEAT EXCHANGER
23 21 23	HYDRONIC PUMPS
23 25 13	CHEMICAL TREATMENT
23 31 00	HVAC - DUCTWORK
23 80 00	HVAC - EQUIPMENT
23 81 46	UNITARY HEAT PUMP
23 83 16	SNOW MELTING AND RADIANT FLOORING SYSTEM

I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered engineer under the laws of the State of Wisconsin.

Scott Klawitter, PE

Date

Wisconsin License No.: 50143-6

Renewal Date: July 31, 2026

Sections covered by this seal:

26 00 10	ELECTRICAL GENERAL REQUIREMENTS
26 05 19	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 33	CONDUITS
26 05 34	BOXES
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 09 23	LINE VOLTAGE LIGHTING CONTROL DEVICES
26 24 16	PANELBOARDS
26 27 26	WIRING DEVICES
26 28 16	ENCLOSED SAFETY SWITCHES
26 33 23	EMERGENCY LIGHTING INVERTER SYSTEM
26 43 13	SURGE PROTECTIVE DEVICES (SPD)
26 51 13	BUILDING LIGHTING
27 10 00	STRUCTURED CABLING

SECTION 01 10 00 SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Phased construction.
 - 4. Future work.
 - 5. Purchase contracts.
 - 6. Owner-furnished products.
 - 7. Contractor-furnished, Owner-installed products.
 - 8. Specification and Drawing conventions.
 - 9. Miscellaneous provisions.

1.2 PROJECT INFORMATION

- A. Project Identification: WisDOT Project No. 1225-1073, Safety Rest Areas 51 and 52.
 - 1. Project Location:
 - a. Rest Area 51: southbound Interstate 43, mile 168, Maribel, Wisconsin
 - b. Rest Area 52: northbound Interstate 43, mile 168, Denmark, Wisconsin
- B. Owner:

Wisconsin Department of Transportation
Bureau of Highway Maintenance
4822 Madison Yards Way
Madison, WI 53705
- C. Engineer:
 - A. Mead & Hunt
2440 Deming Way
Middleton, WI 53562
Contact: Scott Hasburgh
tel. 608-443-0436
email: scott.hasburgh@meadhunt.com

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Construction of two Safety Rest Areas along with two associated Equipment Garages replacing existing facilities along Interstate 43 in Wisconsin. Rest Area Buildings are each 6,430 GSF facilities of Type II-B construction with insulated precast concrete exterior walls, and the Equipment Garages are each about 650 sf of Type V wood light framing. The Safety Rest Area buildings are conditioned by a new ground-source geothermal system. Work includes HVAC, plumbing, and electrical work in conjunction with building construction, including utility tie-ins at the perimeter of the building. Demolition of existing facilities and all site and civil work shall be performed under separate contract.
- B. Type of Contract:
 - 1. Project will be constructed under two coordinated, concurrent multiple contracts.

2. All site demolition, roadwork, site utility work, earthwork, grading, landscaping, stormwater management, and other civil work shall be performed under a separate contract (WisDOT project number 1225-10-73.) Owner shall coordinate schedules of the Contracts. Contractors shall fully cooperate with each other to maintain project schedule and budget, including coordination of site access and maintenance during construction.

1.4 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products [and making building services connections].
- B. Owner-Furnished Products:
 1. Refrigerator for Break Rooms.
 2. Clothes washers for staff use.
 3. Electric clothes dryers for staff use.

1.5 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and Specifications.

1.6 MISCELLANEOUS PROVISIONS

- PART 2 - PRODUCTS (NOT USED)
- PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 25 13 SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT

PART 1 - GENERAL

1.1 SUMMARY

- A. Manufacturers and Products: See Section 01 61 00.
- B. Products proposed by Contractor that do not meet requirements of Contract Documents, whether in product characteristics, performance, quality, or manufacturer or brand names, is considered a substitution.
- C. Substitutions will be considered for cost, schedule, or constructability impact:
 - 1. In case of non-availability of materials, contact Engineer for review and action.
 - 2. Accepted substitutions may require re-bidding by prior approved bidders.

1.2 PRODUCT SELECTION

- A. Certain types of products are described in Specifications by means of trade names, catalog numbers or manufacturer's names. This is not intended to exclude from consideration other products that may be capable of accomplishing purpose indicated.
- B. Other types of products may be considered acceptable to Owner or Engineer in place of those specified.
- C. Listing of a manufacturer implies acceptance of them only as supplier of a product that complies with specified item.
 - 1. See Section 01 61 00 for definition of "Base" and "Optional" manufacturers.

1.3 SUBSTITUTION REQUESTS

- A. Only written requests with complete data for evaluation will be considered.
 - 1. Submit evaluation data with attached form to Engineer.
 - 2. Submit in timely manner to allow Engineer adequate time for evaluating, making recommendation, and for Owner approval.
- B. Supplier, Subcontractor and Contractor in making substitution request, or in using an approved substitution, represent:
 - 1. they have personally investigated proposed product, system or method, and determined that it is equal or superior in all respects to that specified, and that it will perform intended function.
 - 2. the substitution is in full compliance with applicable codes.
 - 3. the same warranty is provided for substitute item as for product, system or method specified.
 - 4. finish products comply with base specified items in color and pattern.
 - 5. they will coordinate installation of accepted substitution into Work, including building modifications if necessary, and be responsible for such modifications as may be required for Work to be complete and functional in all respects.
 - 6. that cost data presented is complete and includes all related costs, excluding Engineer's review and redesign cost.
 - 7. waive all claims for additional costs or time extensions related to substitution which subsequently become apparent or are caused by substitution.
 - 8. they will pay additional costs to other trades, subcontractors or contracts caused by substitution.
 - 9. they will pay all Engineer's review and redesign cost, special inspections, and other costs caused by substitutions or revisions made necessary by the acts or omissions of Contractor, due to product submittal or product not being ordered in a timely manner, due to ease of construction progress or Work, or which are in interest of or are for convenience of supplier, subcontractor, or Contractor.

10. responsibility of Contractor for substitutions or revisions made necessary by the acts or omissions of Contractor, requested due to product submittal or product not being ordered in a timely manner, requested to ease construction progress or Work, or which are in interest of or requests for convenience of supplier, subcontractor, or Contractor.
 11. they acknowledge acceptance of these provisions.
- C. Contractor sign Substitution Request in space provided on form acknowledging acceptance of terms.

1.4 SUBSTITUTION DATA

- A. Submit complete data substantiating compliance of proposed substitution with Contract Documents.
- B. For products and systems:
 1. Product identification, including manufacturer's name.
 2. Manufacturer's literature, marked to indicate specific model, type, size, and options to be considered:
 - a. Product description.
 - b. Performance and test data.
 - c. Reference standards.
 - d. Difference in power demand, air quantities, etc.
 - e. Dimensional differences from specified unit.
 3. Samples:
 - a. Engineer reserves right to retain sample until physical units are installed on project for comparison purposes.
 - b. Costs of furnishing and return of samples will be paid by the Substitution Requester.
 - c. Owner and Engineer are not responsible for loss of or damage to samples.
 4. Name and address of at least five similar projects that proposed product has been in use for at least four years, and name and phone number of owner's and Engineer's or engineer's representative, which Owner or Engineer can contact to discuss product, installation, and field performance data.
- C. For substitute construction methods:
 1. Detailed description of proposed system or method.
 2. Illustrate with drawings.
- D. Itemized comparison of proposed substitute to specified item; indicate variations.
- E. Warranty comparison with specified product or system.
- F. Effect and changes required on other trades, subcontractors or contracts.
- G. Data relating to change in construction time.
- H. Complete breakdown of costs, of proposed substitution that shall include additional costs or saving generated by proposed substitution and shall indicate amount, if any, to be deducted from Contract Sum if proposed substitution is accepted.
- I. Include life cycle cost savings by product, system or assembly proposed, if applicable.
- J. Availability of maintenance and repair services, and sources of repair or replacement items.

1.5 ENGINEER APPROVAL OF SUBSTITUTION REQUEST

- A. For substitutions which have no cost or time impacts, no verbal or written approvals other than by Owner's signed approval on attached Substitution Request form.

- B. For substitutions which have cost or time impacts, no verbal or written approvals other than by Owner's signed approval of a Change Order.

1.6 REJECTION OF SUBSTITUTION REQUEST

- A. Substitution may be rejected without review if:
 - 1. Submitted after stipulated time period.
 - 2. Not submitted in accord with this section.
 - 3. Acceptance will require substantial revision of Contract Documents, building or systems.
 - 4. Substitution request does not indicate specific item for which request is submitted.
 - 5. Substitution Request form is not properly executed and signed.
 - 6. Substitution request for manufacturer acceptance only.
 - 7. Subcontractor or supplier requested directly.
 - 8. Insufficient information submitted.
 - 9. Substitution color or pattern does not comply with base specified item.
 - 10. Substitution does not appear to comply with requirements of specifications for base product.
 - 11. Owner or Engineer does not want to consider.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SUBSTITUTION REQUEST

PROJECT: _____

PROJECT NUMBER: _____

REQUEST NO.: _____

TO: Office of the Engineer:

HDR Engineering, Inc.

[_____]

[_____]

Attention: [_____]

SPECIFIED PRODUCT:

Substitution request for: _____

Specification Section number: _____

Article(s)/paragraph(s): _____

REASON FOR SUBSTITUTION: Non-availability due to:

☐ Strike	
☐ Lockout	
☐ Bankruptcy	
☐ Discontinuation of Production	
☐ Proven Shortage (Explain)	
☐ Similar Occurrence (Explain)	
☐ Fails to comply with building code requirements	☐ Not available
☐ Unavailable to meet Project schedule	☐ Reduce Project construction time
☐ No qualified installer for specified item	☐ Project cost savings
☐ Supplier refuses to warrant item or installation	☐ Unsuitable for application
☐ Supplier, Subcontractor or Contractor convenience	☐ Constructability issue
☐ Other:	

Explanation in Detail: ☐ See attached: _____

REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS: ☐ See attached:

SUPPORTING DATA:

Attach product description, Specifications, Drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation of the proposed substitution in accord with requirements of Section 01 25 13.

Sample is attached: Yes ☐ No ☐

Sample will be sent if requested: Yes ☐ No ☐

Maintenance Service Available: Yes ☐ No ☐

 If yes, location: _____

 Spare Parts Source: _____

Provide a one-to-one comparison of proposed substitution with ALL specified attributes and qualities of specified item(s)

[illegible]

REFERENCES:

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: _____
Address: _____
Engineer (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

REFERENCES:

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project:	_____
Address:	_____
Engineer (name & phone):	_____
Owner (name & phone):	_____
Contractor:	_____
Date Installed:	_____
Dollar Value this Work:	\$ _____

Project:	_____
Address:	_____
Engineer (name & phone):	_____
Owner (name & phone):	_____
Contractor:	_____
Date Installed:	_____
Dollar Value this Work:	\$ _____

EFFECT OF SUBSTITUTION:

Substitution affects other parts of Work:	No ☐	Yes ☐	(If yes, explain below)
Substitution requires dimensional revision or redesign of structure or mechanical and electrical Work:	No ☐	Yes ☐	(If yes, explain below)
Same warrantee provided as specified base product:	No ☐	Yes ☐	(If no, explain below)
Explanation:	_____		

Cost difference:	\$ _____	(add / deduct).
Total cost implications of substitution on Project:	\$ _____	(add / deduct).
Total time implications:	\$ _____	(add / deduct) calendar days.

STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS:

Supplier, Subcontractor and Contractor in making substitution request or in using an approved substitution represent:

- ☐ Has personally investigated the proposed substitution and determined it is equal or superior in all respects to specified product or system and will perform intended function, except as stated above.
- ☐ Is in full compliance with applicable code requirements.
- ☐ Will provide same warranty for substitute item as for product, system or method specified.
- ☐ Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
- ☐ Waive all claims for additional costs or time extensions related to substitution that subsequently become apparent or are caused by substitution.
- ☐ If a finish product, color wise and pattern wise complies with base specified items.
- ☐ Certifies cost data presented is complete and includes all related costs under this Contract, excluding Engineer's review and redesign cost.
- ☐ Will pay Engineer's review and redesign cost, special inspections, and other costs caused by substitution.
- ☐ Will pay additional costs to other contractors caused by substitution.
- ☐ Will modify other parts of Work as may be needed, to make all parts of Work complete and functioning.
- ☐ Acknowledge acceptance of these provisions.

List of Attachments:

ACKNOWLEDGEMENTS:

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF CONTRACT DOCUMENTS:

Requested by (firm):

Acknowledged by (print & sign):

Date:

Position:

Phone

Subcontractor:

Acknowledged by (print & sign):

Date:

Position:

Phone

Contractor:

Acknowledged by (print & sign):

Date:

Position:

Phone

CONSTRUCTION MANAGER'S ACKNOWLEDGMENT AND RECOMMENDATION:

- ☐ Recommend approval for following reasons:
- ☐ Do not recommend approval for following reasons:
- ☐ Returned to requester - Need more information:

Comments:

Construction Manager:

Acknowledged by (print & sign):

Date:

Position:

Distribution: ☐ Engineer ☐ file

ENGINEER'S ACTION / RECOMMENDATION:

- ☐ Recommend Owner's approval.
- ☐ Submitted to Owner for authorization for Engineer's as Change in service to further evaluate and make recommendation.
- ☐ Do not recommend (see comments below).
- ☐ Rejected:
 - ☐ Submitted after stipulated time period.
 - ☐ Not submitted in accordance with Section 01 25 13.
 - ☐ Acceptance will require substantial revision of Contract Documents, building or systems.
 - ☐ Request does not indicate specific item which is being requested.
 - ☐ Requested for manufacturer acceptance only.
 - ☐ Request form is not properly executed and signed.
 - ☐ Subcontractor or supplier requested directly.
 - ☐ Insufficient information submitted.
 - ☐ Does not comply color wise or pattern wise with base specified items.
 - ☐ Insufficient information submitted to evaluate.
 - ☐ Does not appear to comply with requirements of specifications for base product.
 - ☐ Other:
- ☐ Additional information needed - Returned to CM/Contractor for providing following:

Comments:

Engineer: _____

By (print & sign): _____ Date: _____

Position: _____

Distribution: ☐ Owner ☐ CM/Contractor ☐ file

OWNER ACTION:

- ☐ Reject - Do not want to consider.
- ☐ Approved - Contractor may proceed with request as submitted.
- ☐ Approved – Engineer directed as Change in Services to issue change document to incorporate substitution into contract Documents, adjust Contract Sum and/or Project time.
- ☐ Engineer authorized as Change in Services to further evaluate and make recommendation.
- ☐ Additional information needed - Returned for providing following:

Comments: _____

Owner: _____

By: (print & sign) _____ Date: _____

Position: _____

Distribution: ☐ Engineer ☐ CM/Contractor

ENGINEER FURTHER ACTION / RECOMMENDATION (if needed):

- ☐ Incorporating into change document [_____] as directed by Owner.
- ☐ Recommend Owner's approval.
- ☐ Do not recommend.

Comments: _____

Engineer: _____

By: (print & sign) _____ Date: _____

Position: _____

Distribution: ☐ Owner ☐ CM/Contractor ☐ file

OWNER FURTHER ACTION (if needed):

- ☐ Reject - Do not want to consider.
- ☐ Approved - Contractor may proceed with request as submitted.
- ☐ Approved – Engineer directed as Change in Services to issue change document to incorporate substitution into contract Documents, adjust Contract Sum and/or Project time.
- ☐ Additional information needed - Returned for providing following:

Comments: _____

Owner: _____
By: (print & sign) _____ Date: _____
Position: _____
Distribution: ☐ Engineer ☐ CM/Contractor ☐ file

END OF SUBSTITUTION REQUEST

SECTION 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Quality assurance and control.
 - 2. Regulatory requirements.
 - 3. Tolerances.
 - 4. Mock-ups.
 - 5. Manufacturer's field services.
- B. Provisions followed by an asterisk (*) include some or all provision as obtained from AIA Document A201- General Conditions of the Contract for Construction.

1.2 QUALITY ASSURANCE AND CONTROL

- A. Monitor quality assurance and control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as minimum quality for Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Work to be performed by persons qualified and experienced to produce Work of specified quality.
- F. Verify that field measurements are as indicated on approved shop drawings or as instructed by manufacturer of product.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- H. Materials shall be compatible with one another and with other materials with which they may come in contact.

1.3 SUPERVISION AND CONSTRUCTION PROCEDURES

- A. Contractor shall supervise and direct Work, using Contractor's best skill and attention. *
- B. Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures and for coordinating all portions of Work under the Contract, unless Contract Documents give other specific instructions concerning these matters. *
- C. Whether or not Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall review, substantiate, and comply with current industry execution standards and manufacturer's current execution instructions and evaluate jobsite safety thereof and shall be fully and solely responsible for jobsite safety of such means, methods, techniques, sequences, or procedures. *
 - 1. If Contractor determines that such means, methods, techniques, sequences, or procedures may not be safe, the Contractor shall give timely written notice to Owner and Engineer and shall not proceed with that portion of Work without further written instructions from Engineer. *
 - 2. If Contractor is then instructed to proceed with the required means, methods, techniques, sequences, or procedures without acceptance of changes proposed by Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences, or procedures. *

- D. Contractor shall be responsible to Owner for acts and omissions of Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of Work for, or on behalf of Contractor or any of its Subcontractors. *
- E. Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work. *
- F. Contractor is solely responsible for coordination of scope of Work for its own forces, and of Subcontractors and suppliers, and to complete all Work, whether performed by the Contractor or a Subcontractor.
- G. Contractor shall employ Licensed Surveyor to locate and stake out Work and establish necessary reference and benchmarks.
 - 1. Work from established benchmarks and reference points, layout and correctly establish lines, levels, grades, and locations of all parts of their own Work and be responsible for their accuracy and proper correlation with Work and established data.

1.4 REGULATORY REQUIREMENTS

- A. Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of Work. *
- B. If Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction, including, but not limited to, any penalties, fines or other damages realized. *
- C. When Contract Documents require Contractor, Subcontractor, Vendor, or other supplier to provide selection or design of parts of Work, such selection or design shall meet requirements of Municipal, State or other governmental authorities having jurisdiction.

1.5 TOLERANCES

- A. Monitor fabrication and installation tolerance control of Products to produce approved Work.
 - 1. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances.
 - 1. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.6 MOCK-UPS

- A. Schedule mock-up of items for review and comment by Engineer and Owner sufficiently in advance of scheduled fabrication and/or installation to allow for corrections and/or modifications with no effect on construction schedule.
- B. Tests, if specified, will be performed under provisions of the respective Product Specification Sections.
- C. Except where approved mock-ups are permitted to remain as part of Work, erect mock-ups in a remote area that will not interfere with construction until start of site work.
- D. Mock-up shall not be provided until corresponding product data, shop drawings, samples and other preparatory submittals are approved.
- E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes. Fabricated items which include the work of other sections, such as, but not limited to, mechanical plumbing and electrical fixtures, fittings and accessories shall have those items properly placed without service connections.
- F. Approved mock-ups shall represent quality level required for remaining work. Protect approved mock-ups from damage.

- G. Remove mock-ups not specified to remain part of the work. Do not remove mock-ups until directed to do so.
- H. Surrounding and other construction affected by mock-up construction or removal shall be completed as indicated or, if construction is not indicated, the site shall be restored to the condition existing before mock-up construction.
- I. Submit each request for Mock-up Observation on Mock-up Observation Request form. See sample copy at end of this Section.
- J. After mock-up observation, record observations on Mock-Up Observation Report form. See sample at end of this Section.

1.7 MANUFACTURER'S FIELD SERVICES AND REPORTS

- A. When field services are specified, have material or product suppliers or manufacturers provide technically competent staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, testing, adjusting and balancing of equipment, and supervise installation where specified, and to initiate instructions when necessary.
- B. Report observations, and site decisions or instructions given to applicators or installers which are supplemental or contrary to manufacturer's written instructions.
- C. Submit report in duplicate within 30 days of observation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MATERIALS

- A. Mock-up:
 - 1. Provide materials specified in applicable sections for Work and as approved by submittal reviews used in initial mock-up construction.
 - 2. Materials may be modified only to the extent required for mock-up approval by Engineer.
 - a. Modified materials shall comply with specified requirements but may differ in appearance characteristics, such as color and texture.
 - 3. Materials used in construction of approved mock-up construction shall be used in corresponding permanent construction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
- B. Verify existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual Specification Sections.
- D. Verify that utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 MOCK-UP CONSTRUCTION

- A. Provide initial mock-up construction by methods proposed for the corresponding permanent construction.
 - 1. Comply with installation and application requirements for each component as specified in section applicable for work.

- B. Methods of construction may be modified only to the extent required for mock-up approval by Engineer.
 - 1. Modified methods of construction shall comply with specified requirements as well as approved details of workmanship.
- C. Methods of construction used for approved mock-up construction shall be used in corresponding permanent construction.

END OF SECTION

SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Performance of product, material, or system is result of manufacturing, fabrication, installation procedures, use, and maintenance:
 - 1. Therefore, Engineer endeavors to specify quality levels for products, materials, or systems that are advertised to conceptually meet performance goals and desired attributes for Project.
 - a. For most conceptually equal systems and materials, the Engineer may specify multiple manufactures.
 - b. In some cases, based on quality and attribute goals for Project, number of manufacturers may be limited.
- B. Product, material, or system substitutions after execution of the contract: See Section 01 25 13.

1.2 SPECIFYING METHODS AND PRODUCT OPTIONS

- A. Method 1: Products are specified by naming one or more manufacturers. Substitutions are permitted. Any one of manufacturers named may be used that meet specified requirements. Submit a substitution request for any manufacturer not specifically named.
- B. Method 2: "Base" and "Optional".
 - 1. Base:
 - a. Manufacturer listed as Base in Part 2 of specification section.
 - b. Manufacturer listed as Base is particular manufacturer of a specific product used as basis of design.
 - 1) Products of the Base manufacturer are specific products, assemblies or systems used and identified with model numbers, dimensions, or other identifying features.
 - 2. Optional:
 - a. Manufacturer listed as Optional in Part 2 of specification section.
 - b. More than one manufacturer may be listed as Optional.
 - c. Proposals may be based on any of the manufacturers listed.
 - d. Manufacturers listed as Optional are particular manufacturers of products similar to the specific product used as basis of design.
 - e. Optional products are listed without model numbers, dimensions, or other identifying features.
 - f. Listing manufacturer as Optional indicates acceptance of that manufacturer as supplier of a product to extent product complies with specified descriptive requirements listed in technical specification, including salient qualities provided by Base manufacturer's product.
 - 1) Salient qualities include, but are not necessarily limited to following:
 - a) Purpose and function.
 - b) Material and finish.
 - c) Strength, durability, and other applicable physical properties.
 - d) Compatibility and performance attributes for indicated application.

- e) Capacity and operating characteristics, where applicable.
 - f) Size and configuration to extent required for fit with adjoining and adjacent conditions and within spatial limitations.
 - g) Appearance, including exposed dimensions, profile, texture, pattern, and color, where visible to personnel in finished space, or from exterior.
 - 2) Optional Products that significantly differ in appearance or quality of Base product will not be accepted.
 - g. Contractor is responsible for costs to provide dimensional, operational, structural, utility, or other related adjustments to fit an Optional manufacturer's product into Work.
 - h. Submit Substitution Form with Bid for the Optional product.
 - 3. Refer to specification sections for additional requirements.
 - C. Method 5: Generic: Products are specified by reference standard, by performance, by description or by any combination of these three.
 - 1. Products meeting or exceeding specification requirements may be used.
 - 2. Contractor assumes responsibility for compatibility of products selected.
 - D. Method 6: Visual Matching: Where specifications and drawings require matching existing materials or a sample, the Engineer's decision on whether a proposed product matches is final. Where no product matches or complies with other requirements, comply with specified substitution requests and submittal procedures.
- 1.3 DEFINITIONS
- A. "Product" means material, machinery, components, equipment, fixtures, and systems forming Work. The term does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
 - B. New Products: Items not previously incorporated into another project or facility, [except products consisting of recycled-content materials are allowed, unless explicitly stated otherwise]. Products salvaged or recycled from other projects are not considered new products.
- PART 2 - PRODUCTS (NOT USED)
- PART 3 - EXECUTION (NOT USED)
- END OF SECTION

SECTION 01 71 21 SPECIALTY ENGINEERING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish engineering design, drawings, and calculations for Specialty Engineering Requirements, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 DEFINITIONS

- A. Structural Engineer of Record (SER):
 - 1. Structural engineer legally eligible to seal structural Contract Documents for project.
 - 2. Seal acknowledges SER performed or supervised analysis, design, and document preparation for building structure and has knowledge of requirements for structural system.
 - 3. The SER is responsible for the design of the primary structural system.
- B. Specialty Structural Engineer (SSE):
 - 1. Registered Engineer other than Structural Engineer of Record (SER), licensed to practice structural engineering in the State of Wisconsin.
 - 2. Undertakes engineering calculations, design and drawing preparation of components, systems, or installation methods and equipment for specific temporary portions of Work or special items of permanent Work required to be furnished by Contractor.
 - 3. Provide designs and details for items of permanent Work declared to be minor or non-structural.
 - 4. Employee or officer of Contractor or fabricator, employee or officer of an entity providing components to a fabricator, or an independent consultant.
 - 5. The Contractor is responsible for any structural engineering tasks that are required for construction related services.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SYSTEM DESIGN

- A. Contract Documents show conceptually detailed components describing aesthetic intent and provides a performance-type prescription for the design, fabrication, and installation.
- B. Contractor is responsible for the engineering and design of components and materials as well as fabrication and installation.
- C. Develop conditions not shown in Contract Documents to same level of aesthetics in compliance with performance and aesthetic criteria specified and indicated for detailed areas.
- D. Provide engineering design with drawings and calculations sealed by registered Engineer, licensed to practice structural engineering where the project is located.
- E. Comply with requirements of Contract Documents, codes, regulations, standards, and guidelines including:
 - 1. Nationally published amendments.
 - 2. Local Amendments.
 - 3. Structural criteria provided.
 - 4. Additional requirements indicated in specification sections.

- F. Reference Standards:
 - 1. Refer to technical specification sections for listed standards.
- G. Minor deviations in dimensions and profiles may be considered provided design concept is unchanged or intended performance is not compromised as judged by the Engineer.
- H. Where SSE exercises professional judgment and takes exception to specified criteria or reference standards, disclose exception in writing.

3.2 DOCUMENTATION

- A. Include following items common to project:
 - 1. Project Identification
 - a. Project name
 - b. Project location
 - c. Identifying project numbers
 - d. North arrow
 - e. Scale
 - 2. Governing Codes
 - a. Building code and edition
 - b. Referenced codes and standards
 - c. Design method used for the design
 - 3. Service Loads
 - 4. Strength loads or factors
 - 5. Design Load
 - a. Dead loads
 - b. Live loads
 - c. Snow loads
 - d. Wind loads
 - e. Seismic loads
 - 6. Material Properties
 - a. Design properties
 - b. ASTM designations
 - 7. Computer Submittals
 - a. Documentation of computer programs including the program name and version should be included with any submittal of computer calculations. In the case of custom software or spreadsheet developed in house it may be necessary to provide hand calculation of representative elements to verify the use of the program.
- B. Include maximum design loads at connection points to primary structure.
 - 1. Indicate values consistent with method used for design including service loads or strength loads with factors.
 - 2. Design system to apply loads to the structure through the centerlines of the supporting element.
 - 3. Assume building supports are free to rotate. Torsional or flexural fixed supports shall not be used unless approved by the SER.
 - 4. When fixed or eccentric supports are used, provide additional framing as deemed necessary by the SER at no additional cost.

- C. Include member sizes, required reinforcing, connection details and material specifications.
- D. Include statements where the SSE has exercised professional judgment and takes exception to the specified criteria or referenced standard. Final authority and responsibility for decisions concerning structural design criteria shall belong to the SER. When exceptions are stated as qualifications to the contractor's proposal, the SER shall be notified and respond prior to award.
- E. SSE shall review and approve the shop drawings and special erection drawings prepared by a fabricator or supplier and attest to that review with a signed shop drawing stamp, or other means, prior to submittal of the drawings to the SER. When standardized erection drawings are used, there is no need to provide a shop drawing approval stamp.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES (GC)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout.
- B. Provisions followed by an asterisk (*) include some or all of the provision as obtained from AIA Document A201 - General Conditions of the Contract for Construction.

1.2 SUBMITTALS

- A. Contract Closeout Information:
 - 1. For substantial completion:
 - a. Comprehensive list of all items to be completed or corrected.
 - b. Contractor's Notice of Substantial Completion.
 - c. Certificates of governing authorities.
 - d. Submittals required by other Sections.
 - 2. For final completion:
 - a. Contractor's Certificate of Completion.
 - b. Evidence of payments and release or waiver of liens in triplicate.
 - 1) Contractor's Affidavit of Payments of Debts and Claims: AIA Document G706.
 - 2) Contractor's Affidavit of Release of Liens: AIA Document G706A.
 - 3) Contractor's release or waiver of liens.
 - 4) Separate releases or waivers of liens for subcontractors, suppliers, and others with lien rights against Owner, together with list of all such parties.
 - 5) If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
 - c. Consent of Surety (if any) to Final Payment: AIA Document G707.
 - d. Certificates evidencing that insurance to remain enforce.
 - e. Final application for payment.
 - f. Initialed list(s) of items to be completed or corrected verifying completion of each items.
 - g. List of Subcontractors and equipment suppliers. Include:
 - 1) Name.
 - 2) Address.
 - 3) Telephone number.
 - 4) Representative.
 - h. Letter of site conformance.
 - i. Closeout submittals required by other Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Substantial Completion is the stage in the progress of Work when the Work or designated portion thereof is sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work for its intended use. *

1. Work will not be considered for Substantial Completion until all systems and equipment are operational; all designated or required governing agency inspections and certifications have been made and posted, instruction of designated Owner's personnel in operation of systems and equipment has been completed, operation and maintenance data has been satisfactorily turned over to Owner, and finishes are in place. In general, the only remaining Work shall be minor in nature, such that Owner may occupy or utilize Work or designated portion thereof, and completion or correction of Work by Contractor would not materially interfere or hamper Owner's intended business use or operation.
 2. Contractor shall certify that all remaining Work will be completed within 30 consecutive calendar days following date of Substantial Completion, or as agreed to in writing, and failure to do so shall automatically reinstate provisions for damages due Owner as contained elsewhere in Contract Document or as provided by law for such period of time as may be required by Contractor to fully complete Work whether Owner has occupied Work or not.
- B. Obtain evidence of compliance with requirements of governing authorities:
1. Certificates of inspection of:
 - a. Mechanical.
 - b. Electrical.
 - c. Plumbing.
 - d. Fire protection and life safety systems.
 2. Health Department and other governing authorities as required.
 3. Certificate of Occupancy.
- C. When Contractor considers that Work, or a portion thereof which Owner agrees to accept separately, is substantially complete, Contractor shall thoroughly inspect Work, and prepare and submit to Engineer a comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion (utilize form at end of this Section). *
- D. Contractor certifies that:
1. Work performed under this Contract has been thoroughly inspected and considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work for its intended use.
- E. Failure of Contractor to include an item on such list(s) does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents. *
- F. Contractor shall proceed promptly to complete and correct the items on list.
- G. After receipt of Contractor's comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion, [Engineer] [Inspector of Record] and Owner will, within reasonable period after notification, review list of items to be completed or corrected, or inspect Work, or designated portion thereof, to determine whether Work is Substantially Complete. *
- H. If Engineer or Owner review or inspection discloses any item, whether or not included on Contractor's list, which is not sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work or designated portion thereof for its intended use: *
1. Contractor will be notified stating reasons.
 2. Contractor shall substantially complete or correct Work.
 3. Contractor shall thoroughly re-inspect Work.
 4. Contractor shall submit another Contractor's Notice of Substantial Completion, a revised list of items to be completed or corrected, and a request for another review.

5. Engineer and Owner will again review list of items to be completed or corrected and Work.
- I. If Contractor prematurely submits a Contractor's Notice of Substantial Completion or requests Engineer [or Inspector of Record] review of Work, and Engineer determines that Project or designated portion thereof is not Substantially Complete, Engineer may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.
- J. Engineer will not perform more reviews of sub-projects or phases than number indicated in Contract Documents or Owner – Engineer Agreement, unless otherwise mutually agreed to by Engineer and Owner.
- K. When Work or designated portion thereof is considered Substantially Complete, Engineer will prepare a Certificate of Substantial Completion.
 1. The Certificate of Substantial Completion shall establish date of Substantial Completion, shall establish responsibilities of Owner and Contractor for security, maintenance, heat, utilities, damage to Work and insurance, and shall fix time within which Contractor shall complete and correct Work.
 2. Warranties and guarantees required by Contract Documents shall commence on date of Substantial Completion of Work or designated portion thereof unless otherwise provided in Certificate of Substantial Completion.
 3. The Certificate of Substantial Completion shall be submitted to Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. *
- L. Owner may occupy Project, or designated portion thereof, under provisions agreed to in Certificate of Substantial Completion, and if required, a certificate of occupancy has been issued by governing authorities.
 1. If Owner is going to occupy Project, or designated portion thereof, Contractor shall perform final cleaning immediately.
 2. If Owner or Engineer discovers any Work which is not complete and/or is not in conformance with Contract Documents, during or after occupying or utilizes Work, whether included on a list or not, Owner shall notify Contractor to complete or correct item(s) identified.
- M. Contractor shall proceed expeditiously with adequate forces to complete or correct Work, and to complete all Project closeout requirements within designated time.
- N. Upon completion of Work, employ Licensed Surveyor to make survey of site to assure conformance of elevations, grade and site work to contours shown. Provide letter of site conformance.

1.4 FINAL COMPLETION

- A. After Contractor has completed all Work, and has thoroughly inspected Work to determine that it is sufficiently complete, it is in general accordance with Contract Documents, and Contract is fully performed, Contractor shall submit Contractor's Certificate of Completion to Engineer, and the list(s) of items to be completed or corrected initialed to indicate Contractor has verified completion of each item. * Utilize form at end of this section. Contractor certifies that:
 1. Work has been thoroughly inspected by Contractor for compliance with Contract Documents.
 2. Work has been completed in accordance with Contract Documents.
 3. Equipment and systems have been tested and are operating satisfactorily.
 4. Contract closeout requirements have been completed satisfactorily and submitted.
 5. Contractor knows of no reason that insurance will not be renewable to cover period required by Contract Documents.
 6. Work is ready for final inspection and acceptance.

- B. Contractor submit final closeout submittals required by this and other Sections.
- C. Owner and Engineer will make final walk through within a reasonable time after receipt of Contractor's Certificate of Completion and final Application for Payment. *
 - 1. If Contractor prematurely submits a Contractor's Notice of Final Completion or requests Engineer's final review of Project, and Engineer determines that Project is not satisfactorily complete, Engineer may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.
- D. Contractor shall remedy any remaining deficiencies or incomplete Work, at Contractor's expense.
- E. When Owner [, Inspector of Record,] and Engineer find Work acceptable under Contract Documents and Contract satisfactorily performed, Engineer will promptly issue a final Certificate for Payment. *
- F. Neither final payment nor any remaining retained percentage shall become due until Contractor submits to Engineer the following:
 - 1. an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with Work for which Owner or Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied (AIA Documents G706 and G706A),
 - 2. a certificate evidencing that insurance required by Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to Owner,
 - 3. a written statement that Contractor knows of no substantial reason that insurance will not be renewable to cover period required by Contract Documents,
 - 4. consent of surety, if any, to final payment (AIA Document G707),
 - 5. Contractor's and Subcontractor's final release or waiver of liens,
 - 6. if required by Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of Contract, to extent and in such form as may be designated by Owner, for Owner's review, and
 - 7. if a Subcontractor refuses to furnish a release or waiver required by Owner, Contractor may furnish a bond satisfactory to Owner to indemnify Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to Owner all money that Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees. *
- G. If Substantial Completion or Final Completion is delayed through no fault of Owner [, Inspector of Record,] or Engineer, Engineer may invoice Owner as a change in services for such costs, and associated travel costs. Contractor shall reimburse the Owner for such costs.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION

PROJECT: _____

ENGINEER PROJ. _____ CONTRACT DATE: _____

NO.: _____

CONTRACT FOR: _____

WORK OR DESIGNATED PORTION SHALL INCLUDE: _____

Work performed under this Contract has been thoroughly inspected and is considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work or designated portion thereof for its intended use.

- ☐ Certificates of inspections indicating compliance with requirements of governing authorities, are attached hereto.
- ☐ Certificate of Occupancy have been obtained from governing authorities, are attached hereto.
- ☐ A comprehensive list of items to be completed or corrected, prepared by Contractor is attached, hereto. Failure to include any items on such list does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents.

Contractor will complete or correct Work by: _____

CONTRACTOR: _____

BY: _____ DATE: _____

OWNER (agrees) (does not agree) to accept portion designated above separately from rest of Project.

Owner intends to utilize, occupy or take use on: _____

OWNER: _____

BY: _____ DATE: _____

The Work designated above, has been determined to be:

- ☐ Substantially Complete and a Certificate of Substantial Completion will be issued.
- ☐ Not substantially complete for following reasons: _____

ENGINEER: _____

BY: _____ DATE: _____

DISTRIBUTION: ☐ OWNER ☐ ENGINEER ☐ CONTRACTOR

END OF CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION

CONTRACTOR'S CERTIFICATE OF COMPLETION

PROJECT: _____
ENGR. PROJECT NUMBER: _____
CONTRACT FOR: _____
CONTRACT DATE: _____

This is to certify that I am an authorized official of, and have been properly authorized by said firm or corporation to certify following:

I know of my own personal knowledge, and do hereby certify on behalf of Contractor,
that Work has been reviewed and thoroughly inspected for compliance with Contract Documents,
that Work has been completed, in accordance with Contract Documents and Contract is fully performed,
that all equipment and systems have been tested and are operating satisfactorily,
that all Contract closeout requirements have been completed satisfactorily and submitted,
know of no substantial reason that insurance will not be renewable to cover period required by Contract Documents,
and Work is ready for final inspection and acceptance.

Attached are three (3) copies of following documents, which are required prior to final payment:

- ☐ Final Application for Payment.
- ☐ Contractor's Affidavit of Payments of Debts and Claims: AIA Document G706.
- ☐ Contractor's Affidavit of Release of Liens: AIA Document G706A.
- ☐ Contractor's Final Release or Waiver of Liens.
- ☐ Consent of Surety (if any) to Final Payment: AIA Document G707.
- ☐ Certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to Owner.
- ☐ The list(s) of if items which were to be completed and corrected, with each item initialed to indicate Contractor has verified completion or correction of each.
- ☐ List of subcontractors and equipment suppliers.
- ☐ Certified list of all sales and service taxes paid.
- ☐ Letter of site conformance by licensed surveyor.
- ☐ If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
- ☐ Bond satisfactory to Owner to indemnify Owner against liens from Subcontractors.
- ☐ Transmittal indicating Owner has received Project Record Documents.

I understand that acceptance of final payment by Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at time of final Application for Payment.

CONTRACTOR: _____ BY: _____
TITLE: _____ DATE: _____

Subscribed and sworn to me this _____ day of _____

NOTARY PUBLIC: _____

My commission expires: _____

DISTRIBUTION: ☐ OWNER ☐ ENGINEER

END OF CONTRACTOR'S CERTIFICATE OF COMPLETION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE MANUALS

- A. Assemble data indicated and data required to completely describe operation and maintenance procedures.
- B. Assemble information in form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Index files by specification section, with each item clearly labeled.
 - 2. Identify each volume with Project name and contents.
 - 3. Identify each item in manner consistent with names and identification numbers used in Contract Documents, not with manufacturer's catalog numbers.
 - 4. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- C. Use electronic files prepared by manufacturer where available.
 - 1. Scan paper documents and configure scanned file for minimum readable file size.
- D. Include each item on Table of Contents.

2.2 DATA REQUIRED FOR EQUIPMENT AND SYSTEMS

- A. Sequence of Operation:
 - 1. List valves, switches, etc., used to start, stop and adjust systems.
 - 2. Provide flow diagrams, control sequences and valve directory.
 - 3. Submit valve directory for review prior to inclusion in manual:
 - a. Show valve number, location.
 - b. List equipment controlled.
- B. Lubrication Instructions:
 - 1. Frequency of inspection and lubrication recommended.
 - 2. Type of grease.
 - 3. Amount of lubrication recommended.
- C. Maintenance and Troubleshooting Data:
 - 1. Manufacturer furnished data.
 - 2. Project record wiring diagrams.
 - 3. Name and address of manufacturer.
 - 4. Name and address of local representatives who stock or distribute repair parts.

2.3 DATA REQUIRED FOR FINISH MATERIALS

- A. Maintenance Data:
 - 1. Precautions necessary.
 - 2. Manufacturer's instructions and recommendations.
 - 3. Maintenance materials and tools required.

4. Repair and/or replacement instructions.
5. Name and address of manufacturer.
6. Name and address of local supplier of materials.

PART 3 - EXECUTION

3.1 DELIVERY

- A. Deliver electronic copies to Owner sixty (60) days prior to Owner instruction of systems and equipment, and substantial completion.
- B. Use Operation and Maintenance Data Transmittal form at end of this Section.
- C. Acquire Owner's acceptance of items listed on transmittal form.
- D. Forward copy of transmittal form with Owner's acceptance to Engineer.

END OF SECTION

OPERATION AND MAINTENANCE DATA TRANSMITTAL

Project:

To Owner:

Date:

From C.M./Contractor:

Assemble data required to describe operation and maintenance procedures. Deliver as an indexed electronic PDF file. Include name, address, and phone number of closest supplier for each item.

Section	Description	Quantity

Owner's Verification and Acceptance

Accepted by: _____

Date: _____

Forward copy of this transmittal to the Engineer.

DISTRIBUTION: ☐ OWNER ☐ CONTRACTOR ☐ C. M. ☐ ENGINEER

END OF TRANSMITTAL

SECTION 01 78 36 WARRANTIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Warranties specified in Divisions 02 through 48 Sections shall be in addition to, and run concurrent with other warranties required by Contract Documents.
- 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to the Owner.
- 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for the Owner.
- B. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.
- C. Manufacturer's Warranties:
 - 1. Provide for products, equipment, systems and installations required by Divisions 02 through 48 Sections of Contract Documents for duration indicated.
 - 2. Where manufacturer's standard warranties or guarantees or both expire before duration required by other Sections of Contract Documents, obtain and pay for extensions as part of Contract Price.
- D. Special Warranties:
 - 1. Refer to Divisions 02 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.
 - 2. Provide written Special Warranties for products, equipment, systems, installations, and joint responsibilities as noted and required by Divisions 02 through 48 Sections of Contract Documents for duration indicated.
 - 3. Prepare a written document that contains appropriate terms and identification, ready for execution.
 - a. Modified and properly executed Manufacturer's standard form to include project specific information.
- E. Provide Warranties. Special Warranties and Guarantees prior to final payment.
 - 1. Provide in electronic data format.
 - a. Coordinate format with Owner.
- F. Warranties. Special Warranties and Guarantees required by Contract Documents shall commence on date of Substantial Completion of Work unless otherwise indicated in Certificate of Substantial Completion.

1.2 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Transmittal letter indicating Owner's receipt of electronic data format containing product equipment and system warranties or guarantees or both required by other Sections of Contract Documents.

1.3 JOB CONDITIONS

- A. If for any reason, Contractor cannot warrant or guarantee or both any portion of Work using products or construction methods indicated or required by other Sections of Contract Documents, notify Engineer in writing during bid period, and before contracts are awarded, indicating reasons and names of products and data on substitutions that can be warranted or guaranteed or both.
 - 1. Should Contractor fail to notify Engineer, Contractor will be considered as having agreed to warrant or guarantee the Work indicated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRODUCT, EQUIPMENT AND SYSTEM WARRANTIES AND GUARANTEES

- A. Compile approved warranties and guarantees or both required by other Sections of Contract Documents.
 - 1. Index by Section, with each warranty, guarantee, or both clearly labeled.
 - a. Identify each volume with project name and contents.
 - 2. Identify each warranty or guarantee or both in manner consistent with names and identification numbers used in Contract Documents.
 - 3. Provide transmittal letter containing:
 - a. Date
 - b. Project title
 - c. Contractor's name and address
 - d. Title and number of warranties, guarantees, or both
 - e. Indication of Owner's receipt
 - 4. Deliver to Owner prior to final payment with copy of transmittal letter indicating Owner's receipt.

END OF SECTION

SECTION 03 08 13

CONCRETE TESTING AND EVALUATION - OWNER

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Testing and Evaluation - Owner, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in Field
 - 2. ASTM C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - 3. ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
- B. American Concrete Institute (ACI):
 - 1. ACI 318 Building Code Requirements for Structural Concrete and Commentary
- C. Testing Agency:
 - 1. Acceptable to Engineer.
 - 2. Recent evidence of inspection by Cement and Concrete Reference Laboratory of National Institute of Standards and Technology, with cited deficiencies corrected.
 - 3. Meet requirements of ASTM E329.
 - 4. Agency and its representatives are not authorized to revoke, alter, relax, enlarge or release requirements, nor approve or accept portion of Contract Documents.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Project Information:
 - 1. Testing Agency qualifications.
 - 2. Production sample test reports, when required:
 - a. Include same data as that required for mix designs.
 - 3. Reports of Contractor option tests.
 - 4. Test reports on in-place testing if such testing is performed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DESCRIPTION

- A. Test concrete materials and inspect operations as work progresses.
- B. Failure to detect defective work or material shall not prevent later rejection when such defect is discovered, nor shall it obligate Engineer for final acceptance.
- C. Payment for Testing:
 - 1. Pay for testing services required in paragraph Article 3.2, following.
 - 2. Routine testing of concrete furnished to job site for compliance with Contract Documents will be performed by Owner's testing agency at Owner's expense.

- a. Test for compressive strength, slump, air content, temperature and unit weight.
- b. Perform tests every 75 CU YD or fraction thereof, for each mixture design placed in one day.
- c. Obtain composite samples in accordance with ASTM C172.
 - 1) Obtain each sample from a different batch of concrete on a random basis.
 - 2) Select test batch at random before commencement of concrete placement.
- d. Mold and cure sufficient specimens from each sample in accordance with ASTM C31 and report deviations from requirements, if any.
- e. Coordinate number of specimens with test specification requirements and construction operations.
- f. Test specimens in accordance with ASTM C39.

3.2 RESPONSIBILITIES AND DUTIES OF CONTRACTOR

- A. Provide testing services performed by Testing Agency for qualification of proposed materials and establishment of mix designs.
- B. Submit concrete materials and concrete mix designs.
 - 1. Include results of testing performed to qualify materials and establish mix designs
- C. Place no concrete until Contractor has received approval.
- D. Use of testing service shall not relieve Contractor of responsibility to furnish materials and construction in compliance with Contract Documents.
- E. Testing and Inspection:
 - 1. Furnish labor to assist Owner's Testing Agency in obtaining and handling samples or other materials at site.
 - 2. Advise Owner's Testing Agency in advance of operations.
 - 3. Provide and maintain facilities for storage and curing of concrete compressive strength test specimens on site for first 24 hours or until strength is achieved as required by ASTM C31.
- F. Pay for following additional testing services performed by Owner's testing agency when:
 - 1. When changes in materials or proportions are requested by Contractor Additional testing and inspection.
 - 2. When specimens fail to meet specification requirements, by test or inspection.
 - 3. Testing services needed or required by Contractor.
 - a. Field-cured test specimens as needed for control of stripped, reshored, unshored, post-tensioned concrete work.

3.3 EVALUATION AND ACCEPTANCE OF COMPRESSIVE STRENGTH TEST RESULTS

- A. Evaluate test results for standard molded and cured test cylinders separately for each concrete mix design.
 - 1. Evaluate each mix design for strength and uniformity by a minimum of five tests.
- B. Strength level of concrete shall be considered acceptable when average of three consecutive strength test sets equal or exceed specified strength (f'_c) and no individual strength test result is less than specified strength (f'_c) by more than 500 psi.

3.4 TESTING CONCRETE IN PLACE

- A. Test concrete in place when compressive strength tests indicate potential strength deficiency to evaluate actual strength.

1. Pay for concrete tests and engineering time and analysis required to evaluate in-place concrete strength as result of deficient cylinder strength tests.
 - B. Testing by rebound hammer, ultrasonic, or other non-destructive device.
 1. Tests shall be used to determine relative strengths at various locations in structure to determine areas to be cored.
 2. Calibrated and correlated tests with other test data shall be used as basis for acceptance or rejection.
 - C. Core Tests:
 1. Obtain and test largest practical diameter cores, 2 inches minimum, in accordance with ASTM C42.
 - a. Test dry if concrete in structure will be dry under service conditions,
 - 1) Air dry cores at 60 deg F to 80 deg F, relative humidity less than 60 percent for 7 days before test.
 - b. Test cores after moisture conditioning if concrete in structure is more than superficially wet under service conditions.
 2. Take three cores from area of concrete or member considered deficient in strength.
 - a. Location as selected by Architect.
 - b. Replace cores damaged prior or during removal from structure prior to testing.
 3. Concrete core test shall be considered acceptable if average strength of cores is equal to at least 85 percent of, with no single core less than 75 percent of specified strength (f'_c).
 4. Fill core holes with low slump patching compound per Section 03 35 00.
- 3.5 ACCEPTANCE OR REJECTION OF CAST-IN-PLACE CONCRETE
- A. General:
 1. Completed concrete work which conforms to requirements of Contract Documents will be accepted without qualification.
 2. Concrete work which fails to conform to one or more requirements of Contract Documents shall be rejected and will not be accepted until repaired and proven adequate by concrete testing.
 3. Contractor pays costs incurred in providing remedial work necessary to change rejected work to accepted work.
 4. Remedial work includes, but is not necessarily limited to, applicable repairs, replacement, reinforcement, engineering, and testing.
 5. Repair or replacement of concrete in an approved manner and in conformance with Contract Documents constitutes acceptance.
 - B. Dimensional Tolerances:
 1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances shall be considered potentially deficient in strength and subject to confirmation of safety by structural analysis or load test.
 - a. When deficiencies are confirmed, replace or reinforce structure as directed.
 2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances will be rejected if strength or finish of structure is not acceptable, or function is adversely affected.
 - a. If removal of excess material is permitted, repair of surfaces constitutes acceptance.
 - b. If removal of excess material is not permitted, replacement of surfaces constitute acceptance.

3. Concrete members cast in wrong location will be rejected if: strength or finish is not acceptable, function is adversely affected, and /or interference is encountered with other construction.
 4. Inaccurately formed concrete surfaces exceeding tolerances and exposed to view will be rejected.
- C. Finish:
1. Architectural concrete with surface exceeding limitations will be rejected.
 2. Concrete exposed to view with defects which adversely affect appearance of specified finish may be repaired only by approved methods.
3. Slabs:
- a. Finished slabs exceeding tolerance limits specified in Section 03 35 00 will be rejected if finish is not acceptable and function is adversely affected.
 - 1) If rejected, repair of finished surfaces or replacement of slab in an approved manner and in conformance with Contract Documents will constitute acceptance.
 - b. Repair may involve removing high spots by grinding, filling low spots with patching compound, or remedial measures as permitted.
4. Formed surfaces:
- a. Concrete exposed to view with defects which adversely affect appearance of specified finish will be rejected.
 - 1) Repair surface defects in conformance with Section 03 35 00.
5. Concrete not exposed to view is not subject to rejection for defective finish.
- D. Strength of Structure:
1. Concrete in place which control strength of structure will be rejected if it fails to comply with requirements of Contract Documents, including but not necessarily limited to:
 - a. Deficient concrete strength based on compressive strength tests.
 - b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with requirements on reinforcement.
 - c. Concrete which differs from required dimensions or location.
 - d. Curing less than that specified.
 - e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
 - f. Mechanical injury, construction fires, accidents or premature removal of formwork.
 - g. Substandard workmanship.
 2. When strength of structure is considered potentially deficient, it will not be accepted until one of following is completed and submitted to Architect for approval prior to action by Contractor.
 - a. Confirmation of safety of structure by structural analysis.
 - b. Core tests shall be performed only when safety of structure is not confirmed by structural analysis.
 - c. Confirmation of safety of structure by load tests performed and evaluated in accordance with ACI 318.
 - d. Replacement of structure deficient in strength.

- e. Reinforce structure with supplement supports as directed by Architect and approved by Owner.

END OF SECTION

SECTION 03 11 00
CONCRETE FORMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Formwork, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Design, engineering, and construction of formwork are responsibility of Contractor.
 - 1. Design, engineer, and construct formwork for applicable gravity and lateral loads and pressures as well as other design considerations or applicable requirements of legal local building code.
 - 2. Develop shoring and re-shoring pattern and sequence so as not to exceed safe structural capacity of supporting structural systems. Confer with Architect, if there is any question, regarding the capacity of the structural system.
- B. Design formwork, prepare drawings, and construct formwork in accordance with ACI 347, Guide to Formwork for Concrete.
- C. Layout and measurement of concrete forms and embedment's, required for work, performed by a licensed surveyor employed by the contractor.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.

1.4 DESCRIPTION

- A. Definitions:
 - 1. Formwork: Total system of support for freshly placed concrete including mold or sheathing which contacts concrete as well as supporting members, hardware, and necessary bracing.
 - 2. Exposed construction: Exposed to view.
 - 3. Exposed to view: Concrete surfaces seen by the public from eye level from any walking surface in a public location after completion of building.
 - 4. Public location: Building areas accessible to public and employees not responsible for maintenance. Storerooms, unfinished space, and large mechanical rooms are considered public locations. Equipment closets, elevator and mechanical penthouses are not public space.
- B. Use forms, wherever necessary, to confine concrete and shape it to required dimensions. Use forms of sufficient strength to withstand pressure resulting from placement and vibration of concrete, with sufficient rigidity to maintain specified tolerances.
- C. See concrete finish requirements in Section 03 35 00.
- D. Use earth side forms for spread footings, pile caps and unfinished grade beams where earth can be shaped to a straight and true surface. Do not use earth cuts as forms for other vertical surfaces unless permitted.

PART 2 - MATERIALS

2.1 MATERIALS

- A. Form facing materials: As indicated under description of finishes required.
- B. Form accessories, partially or wholly embedded in concrete, such as ties and hangers: Shall be of a commercially manufactured type. Do not use non-fabricated wire. Use form ties constructed so ends or end fasteners can be removed without causing appreciable spalling of concrete faces. After ends or end fasteners of form ties have been removed, embedded portion of ties shall terminate not less than 2 diameters or twice minimum

dimension of tie from formed faces of concrete to be permanently exposed to view, but in no case less than 3/4 inches. When formed face of concrete is not to be permanently exposed to view, form ties may be cut off flush with formed surfaces. Use ties with 3/4 inches diameter cones on both ends for water retaining structures.

- C. Load-bearing Rigid Board Insulation Fill: See 07 21 00 for high-density rigid board insulation.

2.2 FABRICATION OF FORMS

- A. Make forms sufficiently tight to prevent loss of cement fines. Place chamfer strips in outside corners of forms to produce 45-degree beveled corners on permanently exposed surfaces. Interior corners on such surfaces and edges of formed joints will not require beveling.
- B. To maintain specified finish tolerances, camber formwork to compensate for anticipated formwork deflections prior to hardening of concrete.
- C. Provide positive means of adjustment (wedges or jacks) of shores and struts and take up settlement during concrete placing operation. Securely brace forms against lateral deflection.
- D. Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.
- E. At construction joints, contact surface of form sheathing for flush surfaces exposed to view shall overlap hardened concrete in previous placement minimum 1 inch. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface.
- F. Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling.
- G. Fasten wedges (used for final adjustment of forms prior to concrete placement) in position after final check.
- H. Anchor formwork to shores or other supporting surfaces or members so upward or lateral movement of any part of formwork system is prevented during concrete placement.
- I. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.

2.3 TOLERANCES

- A. Construct formwork so concrete surfaces will conform to tolerance limits listed: Tolerances non-cumulative. Most restrictive tolerance governs. Tolerance limits noted are maximum deviations (plus or minus) on each side of intended line.
 - 1. Deviation from plumb:
 - a. In lines and surfaces of columns, piers, walls, and in arrises:
 - 1) In any length: 1 inch 500 but not less than 1/8 inches.
 - 2) In any story: 3/8 inches.
 - 3) Maximum for entire length: 3/4 inches.
 - b. For exposed corner columns, control-joint grooves, and other conspicuous vertical lines:
 - 1) In any length: 1-inch 1000 but not less than 1/8 inches.
 - 2) In any story: 3/16 inches.
 - 3) Maximum for entire length: 1/2 inches.
 - 2. Deviation from level or from grades specified:
 - a. In slab soffits, ceilings, beam soffits and in arrises, measured before removal of supporting shores:
 - 1) In any length: 1 inch 750 but not less than 1/8 inches.
 - 2) In any bay: 3/8 inches.

- 3) Maximum for entire length: 1/2 inches.
 - b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous horizontal lines:
 - 1) In any length: 1-inch 1000, but not less than 1/8 inches.
 - 2) In any bay: 1/4 inches.
 - 3) Maximum for entire length: 1/2 inches.
 3. Deviations from true plane of concrete surface exposed to view caused by bulging of form facing material between supports:
 - a. 3/16 inches or l/300 of span between supports whichever is smaller.
 4. Deviation from established position in plan of linear building lines, columns, walls:
 - a. In any length: 1 inch 500, but not less than 1/8 inches.
 - b. In any bay: 1/2 inches.
 - c. Maximum for entire length: 3/4 inches.
 5. Deviation in sizes and location of sleeves, floor openings, and wall openings: 1/4 inches.
 6. Deviation in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:
 - a. Minus: 1/4 inches.
 - b. Plus: 1/2 inches.
 7. Footings:
 - a. Deviations in dimensions in plan:
 - 1) Minus: 1/2 inches.
 - 2) Plus: 2 inches.
 - b. Misplacement or eccentricity:
 - 1) 2 percent of footing width in direction of misplacement but not more than 2 inches.
 - c. Thickness:
 - 1) Decrease in specified thickness: 5 percent.
 - 2) Increase in specified thickness: No limit (except that which may interfere with other construction).
- B. Formwork Classifications:
1. Concrete formwork shall meet the following classification requirements:
 - a. Concrete noted as "Architectural Exposed Concrete: Class A."
 - b. Concrete exposed to view or to receive membrane waterproofing: Class B.
 - c. Footings: Class D.
 - d. All other concrete: Class C.
- C. Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items, except where specifically noted otherwise.
- D. Establish and maintain in undisturbed condition and until final completion of project, sufficient control points and benchmarks to be used for reference purposes to check tolerances.
- E. Regardless of tolerances listed allow no portion of building to extend beyond setback line of project.

PART 3 - EXECUTION

3.1 PREPARATION OF FORM SURFACES

- A. Clean form surfaces and embedded materials of mortar, grout and foreign material before concrete is placed.
- B. Before placing of reinforcing steel or concrete, treat surfaces of forms as follows:
 - 1. Unless otherwise noted, cover surfaces of forms with non-staining, biodegradable, form release agent to prevent absorption of moisture and prevent bond with concrete,
 - 2. Form release agent VOC content no greater than 250 g/L.
 - a. Bio-Nox by Nox-Crete Products Group, or equal.
 - 3. Do not allow excess release agent to collect in forms or contact hardened concrete against which fresh concrete is placed.
 - 4. Factory applied non-absorptive liner may be used.

3.2 REMOVAL OF FORMS

- A. When repair of surface defects or finishing is required at early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations.
- B. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Perform needed repairs or treatment required on such sloping surfaces at once, followed by specified curing.
- C. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete.
- D. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.
- E. Where no re-shoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs, and other concrete members in place until concrete has attained its specified strength. Where re-shoring is planned, supporting formwork may be removed when concrete has reached 75 percent of specified strength, provided re-shoring is installed immediately.
- F. When shores and other vertical supports are arranged so non-load-carrying form-facing material may be removed without loosening or disturbing shores and supports, facing material may be removed at earlier age as permitted.

3.3 RE-SHORING

- A. When re-shoring is permitted or required, plan operations in advance. Follow sequence indicated on formwork drawings as directed by forming system design engineer. While re-shoring is underway, allow no live load on new construction.
- B. During re-shoring do not subject concrete in beam, slab, column, or other structural member to combined dead and construction loads in excess of loads permitted by forming system design engineer for developed concrete strength at time of re-shoring. Place re-shores as soon as practicable after stripping operations are complete but in no case later than end of working day on which stripping occurs. Tighten re-shores to carry required loads without overstressing construction. Leave re-shores in place until:
 - 1. Tests representative of concrete being supported have reached specified strength.
 - 2. In-place concrete is at least 7 days old and/or meets the strength required by the forming system design engineer.
 - 3. Loads imposed by construction operations do not exceed design loads.
- C. For floors supporting shores under newly placed concrete leave original supporting shores in place or re-shore. Re-shoring system shall have capacity sufficient to resist anticipated loads and equal to at least one half of capacity of shoring system above. Locate re-shores directly under shore position above unless otherwise permitted.

3.4 REMOVAL STRENGTH

- A. When removal of formwork or re-shoring is based on concrete reaching specified strength, concrete shall be presumed to have reached this strength when either of following conditions has been met.
 - 1. When test cylinders, field cured along with concrete they represent, have reached specified strength.
 - 2. When concrete has been cured as specified for same length of time as age at test date of laboratory-cured cylinders which reached specified strength. Determine length of time concrete has been cured in structure by cumulative number of days or fractions thereof, not necessarily consecutive, during which temperature of air in contact with concrete is above 50 deg F and concrete has been damp or sealed from evaporation and loss of moisture.

END OF SECTION

SECTION 03 11 31

VOID FORMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Void Forms, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Design, place, and maintain void forms or carton forms for cast-in-place concrete work in compliance with ACI 347 Guide to Form Work, for Concrete, unless otherwise shown or specified.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Project Information:
 - 1. Name of listed manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Void Forms:
 - 1. Base:
 - a. VoidForm Products, Inc.
 - 2. Optional:
 - a. Savway Carton Forms.
 - 3. Other manufactures desiring approval comply with Section 01 61 00.
- B. Other Manufacturers desiring approval shall comply with section 01 61 00.

2.2 MATERIALS

- A. Void Forms:
 - 1. Natural kraft corrugated fiberboard with liners impregnated with polyethylene-wax blend, and laminated with waterproof adhesive, or asphalt impregnated corrugated fiber material, approximately 30% asphalt by weight.
 - 2. Design and maintain void forms to maintain vertical and lateral loads applied until such loads can be supported by concrete structure. This includes, but is not limited to, live load, dead load, and weight of moving equipment, height of concrete drop, vibrator frequency, ambient temperature, soil pressures, and lateral stability.
 - 3. Provide depth as indicated in Drawings.
 - 4. Place 0.25 inches protective hardboard or plywood cover on top of slab void forms.
 - 5. Design form material to lose its strength upon prolonged contact with moisture.
 - 6. Sufficient deterioration to cushion uplift forces in soil shall take place within a maximum of 8 weeks after placement of concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Place Void Forms under grade beams and first floor slabs as detailed on Contract Drawings, and leave in place after concrete placement.

- B. Assemble forms, place and tape joints in accordance with manufacturer's directions.
- C. Provide end closures where required.
- D. Prefabricate fill pieces around stub columns, piers, or other openings.
- E. Vent closures to prevent cracking of concrete.

END OF SECTION

SECTION 03 15 19
ANCHORAGE TO CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for anchorages in concrete, including: cast-in-place anchor bolts, anchor rods, reinforcing anchorage adhesive, and post-installed concrete anchors required for the Project but not specified elsewhere in the Contract Documents.
2. Delegated design requirements for concrete anchors not expressly shown or indicated on the Drawings or elsewhere in the Contract Documents, including, but not limited to, anchorages in concrete for the following structural and nonstructural components:
 - a. Structural members and accessories.
 - b. Metal, wood, and plastic fabrications.
 - c. Architectural Work, including building components, finishes, specials, facility equipment and conveying equipment, furnishings, and special construction Work.
 - d. Mechanical and electrical Work, including process-mechanical Work, site and infrastructure Work, electrical Work, communications Work, electronic safety and security systems Work, and others.
 - e. Fire suppression, plumbing, and HVAC Work.
 - f. Other components requiring anchorages to concrete.

B. Related Requirements: Include but are not necessarily limited to:

1. Section 03 08 13 - Concrete Testing and Evaluation - Owner.

1.2 REFERENCES

A. Definitions and Terminology:

1. This provision presents definitions and terminology, which have the meanings indicated in this provision, applied to the singular or plural thereof, and without regard to use of initial capital letters.
 - a. Adhesive Anchors:
 - 1) Post-installed anchors developing their strength primarily from chemical bond between the concrete and the anchor.
 - 2) Includes anchors using acrylics, epoxy and other similar adhesives.
 - b. Anchor Bolt: Any cast-in-place anchorage that is made of a headed (i.e. bolt) material.
 - c. Anchor Rod: Any cast-in-place or post-installed anchorage made from unheaded, threaded, rod or deformed bar material.
 - d. Concrete Anchor: Generic term for either an anchor bolt or an anchor rod.
 - e. Galvanizing: Hot-dip galvanizing in accordance with ASTM A123, ASTM A153 or ASTM F2329 with minimum coating of 2.0 ounces of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by reference standard.
 - f. Hardware: As defined in ASTM A153 and ASTM F2329.
 - g. MPIL: Manufacturer's printed installation instructions.

- h. Mechanical Anchors:
 - 1) Post-installed anchors developing their strength from attachment other than thru adhesives or chemical bond to concrete.
 - 2) Includes expansion anchors, expansion sleeve, screw anchors, undercut anchors, specialty inserts and other similar types of anchorages.
 - 3) Drop-in anchors and other similar non-ICC ES approved anchors are unacceptable.
 - i. Post-Installed Anchor: Adhesive or mechanical anchor installed into previously placed and adequately cured concrete.
- B. Reference Standards:
- 1. American Concrete Institute (ACI):
 - a. 318, Building Code Requirements for Structural Concrete and Commentary.
 - 2. American Concrete Institute/Concrete Reinforcing Steel Institute (ACI-CRSI):
 - a. Adhesive Anchor Installation Certification Program: Adhesive Anchor Installer.
 - 3. American Institute of Steel Construction (AISC):
 - a. 303, Code of Standard Practice for Steel Buildings and Bridges.
 - b. 355.2, Seismic Testing of Post-Installed Concrete and Masonry Anchors in Cracked Concrete.
 - c. 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete.
 - 4. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - c. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - d. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - e. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - f. A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 - g. A563, Standard Specification for Carbon and Alloy Steel Nuts.
 - h. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - i. F436, Standard Specification for Hardened Steel Washers.
 - j. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - k. F594, Standard Specification for Stainless Steel Nuts.
 - l. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
 - m. F2329, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

5. International Code Council Evaluation Service (ICC-ES):
 - a. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
 - b. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Design Conference:
 1. Pre-design conference for anchorages to concrete (where such anchorages are delegated design Work) is not required.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Code-required Special Instructions:
 - a. Special Inspection is required in accordance with the building code for all concrete anchorages.
 - b. Notify the Special Inspector that an inspection is required prior to concrete placement (or during post-installed anchorage installation).
 - c. See the "Field Quality Control" Article in "Part 3 – Execution" of this Section for additional requirements.
- B. Qualifications:
 1. Installer:
 - a. Installer for post-installed anchors shall be trained by the manufacturer or certified by a training program approved by the Engineer.
 - b. Installer for adhesive anchors installed in horizontal, upward incline, or overhead applications shall be certified by ACI-CRSI Adhesive Anchor Installation Certification Program.

1.5 SUBMITTALS

- A. Action Submittals: Submit the following:
 1. Shop Drawings:
 - a. Submit schedule (table or listing) of types, sizes (diameter, length, embedment length), material, finish, and proposed manufacturers of anchorages to concrete to be provided. Apportion by Project-specific application (for example, "Anchorage for cooling water pumps in basement") and indicate where anchorages are fully-designed by Engineer and those for which final design was prepared by delegated design professional.
 - b. Engineer's approval of such Shop Drawing will be only for anchorages fully designed by Engineer. For anchorages for which final design is by delegated design professional, include on such Shop Drawing delegated design professional's approval stamp.
 2. Product Data: Submit as Action Submittals product data for anchorages to concrete fully designed by Engineer. For anchorages to concrete for which final design is by delegated design professional, submit as Informational Submittals bearing approval stamp of delegated design professional.
 - a. Manufacturer's express, written acknowledgement that proposed items comply with referenced standards indicated in this Section and, as applicable, by delegated design professional.
 - b. Manufacturer published data and information for each anchor.
 - 1) Clearly indicate items that are proposed for the Work. Neatly strike out or obscure materials and products not proposed.

- c. Manufacturer's published installation instructions and instructions for code-required special inspections and tests.
 - d. Post-Installed Anchors: In addition, submit for each post-installed anchor system current ICC-ES report , indicating the following:
 - 1) Manufacturer's certification that anchors comply with requirements indicated in the Contract Documents.
 - 2) Performance data indicating that anchor is approved by its manufacturer for use in cracked concrete.
 - 3) Seismic design categories for which anchor system is approved by ICC-ES report.
 - e. Anchorage layout drawings and details:
 - 1) Drawings showing location, configuration, spacing and edge distance.
- 3. Delegated Design Professional's Instruments of Service Submittals: Submit, in accordance with this Section, for each anchorage to concrete for which final design is by delegated design professional:
 - a. Certification of compliance. Indicate design tension and shear loads used for anchor design.
 - b. Delegated design professional's drawings.
 - c. Delegated design professional's specifications, if any, when prepared by delegated design professional.
 - d. Post-Installed Anchors (for which final design is by delegated design professional): Submittal shall also include the following for post-installed anchors for which final design was by delegated design professional:
 - 1) Show diameter, embedment depth and edge distance of each anchor.
 - 2) Indicate compliance with ACI 318 Chapter 17, ACI 350-06 Appendix D.
 - 3) Type of post-installed anchor system used.
 - a) Provide manufacturer's ICC-ES report for the following:
 - (1) Mechanical anchorage per ICC-ES AC193.
 - (2) Adhesive anchorage per ICC-ES AC308.
- 4. Samples:
 - a. Submit representative Samples of anchorages to concrete, when requested by Engineer. Engineer's approval of Samples will be for type and finish only.
- B. Informational Submittals: Submit the following:
 - 1. Shop Drawings and Product Data Approved by Delegated Design Professional:
 - a. Submit with delegated design professional's approval stamp those Shop Drawings and product data Submittals indicated in this Article but for which final design was performed by delegated design professional.
 - 2. Calculations by Delegated Design Professional:
 - a. Submit sealed and signed calculations for sizing and determining embedment length of anchorages to concrete not fully designed by Engineer.

- b. Post-Installed Anchors Designed by Delegated Design Professional: In addition, also submit design calculations:
 - 1) Indicate design load to each anchor.
 - 2) When design load is not indicated on the Drawings, include calculations to develop anchor forces based on performance and design criteria indicated in this Section.
 - 3. Supplier's Instructions:
 - a. Submit manufacturer's published instructions for installation.
 - 4. Field Quality Control Submittals:
 - a. Submit written results of required field quality control activities indicated in this Section.
 - 5. Reports of Supplier's Visits to Site:
 - a. Submit each written report of visit to the Site by Supplier's factory trained representative and delegated design professional. For each, indicate date and time of visit, purpose of visit, observations made, decisions made, problems encountered, and other pertinent information.
 - 6. Qualifications Statements:
 - a. Delegated design professional.
 - b. Each installer.

PART 2 - PRODUCTS

2.1 MATERIALS – ALL ANCHORAGES

- A. Materials – General:
 - 1. This Article applies to all anchorages to concrete, regardless of whether fully designed by Engineer or delegated design professional. Requirements for delegated designs are in the following Article.
 - 2. Additional requirements for anchorages fully designed by Engineer are indicated in the Article following requirements for delegated design anchorages.
 - 3. For structural applications, do not use powder actuated fasteners and other types of bolts or fasteners not specified in this Section unless approved by Engineer or otherwise required by the Contract Documents.
- B. Description:
 - 1. Provide anchorages to concrete, of the types shown or indicated, to secure to concrete materials, equipment, and appurtenances installed as part of the Work.
 - 2. Locations where anchorages are required are generally shown or indicated on the Drawings. Where not shown or indicated on the Drawings provide anchorages or the types required for materials, equipment, and systems where such materials, equipment, and systems are shown on the Drawings.
 - 3. Anchorages required include those for materials, equipment, and systems shown on the structural Drawings and Drawing other than the structural Drawings.
 - 4. Design loads for concrete anchorages are shown or indicated on the Drawings for anchorages where design responsibility is delegated to Contractor's delegated design professional. For such anchorages, embedment depths are not shown or indicated.
- C. Cast-in-place Concrete Anchors:
 - 1. Buildings, non-building structures, and equipment, unless otherwise specified:
 - a. ASTM F1554, Grade 36 or Grade 55 with weldability supplement S1 for galvanized threaded rods.
 - b. ASTM A307, Grade A for galvanized headed bolts.

2. All other cast-in-place concrete anchors:
 - a. Stainless steel with matching nut and washer.
 - b. Non-submerged application: ASTM F593, Type 304 or Type 316, minimum yield strength of 45,000 psi.
- D. Post-Installed Mechanical and Adhesive Concrete Anchors:
 1. Submerged application: ASTM F593, Type 316, minimum yield strength of 45,000 psi with matching nut and washer.
 2. Non-submerged application: ASTM F593, Type 304 or Type 316, minimum yield strength of 45,000 psi with matching nut and washer.
 3. Post-installed anchors and related materials shall be listed by ICC-ES or Engineer-approved equivalent.
- E. Reinforcing: Comply with Section 03 20 00 – Concrete Reinforcing.
- F. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.
- G. Deformed Bar Anchors: ASTM A496 with minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.
- H. Washers:
 1. ASTM F436 unless indicated otherwise, finish to match bolt.
 2. When stainless steel anchorage is provided for cast-in-place anchorages, provide washers of the same material and alloy as in the associated anchorage.
 3. Plate washers: Minimum 1/2inch thick fabricated ASTM A36 square plates as required.
 4. Comply with manufacturer's written instructions for all post-installed anchorages.
- I. Nuts:
 1. ASTM A563 for cast-in-place anchorages.
 2. When stainless steel anchorages are provided for cast-in-place anchorages, nuts shall comply with ASTM F594 and shall match material and alloy of the associated anchorage.
 3. Follow manufacturer's requirements if using post-installed anchorage.
- J. Galvanizing Repair Paint:
 1. High zinc dust content paint for regalvanizing welds and abrasions.
 2. ASTM A780.
 3. Zinc content: Minimum 92 percent in dry film.
 4. Products and Manufacturers: "ZRC Cold Galvanizing", by ZRC; or "High Performance Zinc Spray", by Clearco; or equal.

2.2 DELEGATED DESIGN ANCHORAGES TO CONCRETE

- A. Manufacturers:
 1. Post-installed anchor systems for indicated manufacturers are acceptable only when a current ICC-ES evaluation report is furnished as a Submittal and the subject anchorage system is approved by delegated design professional.
 - a. Hilti.
 - b. DeWalt.
 - c. Simpson Strong-Tie.
 - d. Or equal.

- B. Description: Perform delegated design for anchorages when one or more of the following applies:
1. Design load for concrete anchorage is shown or indicated on the Drawings and anchorage embedment depth is not shown or indicated.
 2. When specifically required by the Contract Documents.
 3. When an anchorage is necessary but is not shown or indicated on the Drawings.
 4. Anchorages shown on the Drawings other than the structural Drawings.
- C. Performance and Design Criteria for Delegated Design Anchorages:
1. Determine design loads, including wind and seismic loads, in accordance with applicable building code and other Laws and Regulations.
 2. For anchorage of equipment and non-structural components, use actual dead load and operating loads obtained by Contractor or delegated design professional from manufacturer. Design loads shall include operating conditions when equipment or element of the Work is in operation, dynamic loads, and other loads as appropriate or required by the building code or other Laws or Regulations.
 3. Design assuming cracked concrete.

2.3 ANCHORAGES FULLY DESIGNED BY ENGINEER

- A. When size, length, and details of anchorage are shown or indicated on the structural Drawings, such anchorages are considered as fully designed by Engineer and delegated design of such anchorage is not required.
- B. Manufacturers:
1. For post-installed anchor systems regardless of whether proposed manufacturer is indicated below, furnish as Submittal current evaluation agency report and anchor system is certified by ICC-ES for cracked concrete conditions.
 2. Mechanical Anchors:
 - a. Hilti:
 - 1) Kwik Bolt TZ (ICC-ES ESR-1917).
 - b. DeWalt:
 - 1) Power-Stud+ SD1 (ICC-ES ESR-2818).
 - c. Simpson Strong-Tie:
 - 1) Strong-Bolt 2 (ICC-ES ESR-3037).
 - d. Or equal.
 3. Adhesive Anchors for Concrete:
 - a. Hilti:
 - 1) HIT RE 500 V3 (ICC ESR-3814).
 - b. DeWalt:
 - 1) PURE110+ (ICC-ES ESR-3298).
 - c. Simpson Strong-Tie:
 - 1) SET-3G (ICC ES 4057)
 - d. Or equal.
 4. Screw Anchors for Concrete:
 - a. Hilti:
 - 1) Kwik HUS-EZ Screw (ICC-ES ESR-3027).

- b. DeWalt:
 - 1) Screw-Bolt+ (ICC-ES ESR-3889).
 - c. Simpson Strong-Tie:
 - 1) Titen HD (ICC-ES ESR-2713).
 - d. Or equal.
5. Requests, if any, for Engineer's approval of "or-equals" or substitutes shall indicate proposed anchor has at least the same tension and shear strength as the associated anchorage products indicated by name in this Article.

PART 3 - EXECUTION

3.1 PREPARATION

- A. For cast-in-place concrete anchorages, allow adequate time for proper installation, inspection, and observation prior to placing concrete.
- B. Prior to installation, inspect and verify areas and conditions under which concrete anchorages will be installed.
 - 1. Notify Engineer of conditions detrimental to proper and timely completion of the Work.
 - 2. Do not proceed with the Work until unsatisfactory conditions are properly remedied.

3.2 INSTALLATION

- A. Installation Requirements - General:
 - 1. Install items in accordance with the Contract Documents, manufacturer's written instructions, and Laws and Regulations. Where such requirements conflict, obtain interpretation or clarification from Engineer prior to commencing the associated Work.
 - 2. Perform the following unless shown or indicated otherwise:
 - a. Provide stainless steel anchorages for connecting aluminum and steel members to concrete and masonry.
 - b. Provide washers for all anchorages.
 - c. Where exposed, extend threaded anchorage a minimum of 0.5 inch above top of fully-engaged nut. If anchorage is cut off to required maximum height, dress the threads to allow nuts to be removed without damage to nuts.
 - 3. Tightening of nuts: Do the following after nuts are snug-tightened down:
 - a. Upset anchorage threads to prevent nuts from backing off. Provide double nut or lock nut in lieu of upset threads for items that may require future removal.
 - b. For cast-in-place anchorages (excluding post-installed anchorages), tighten nuts an additional 1/8 turn beyond snug tight to prevent nuts from backing off.
 - c. When two nuts are used per concrete anchor above the base plate, tighten top nut an additional 1/8 turn to "lock" the two nuts together.
 - d. For post-installed anchorages, comply with MPII.
 - 4. Secure architectural components to avoid aesthetic distortion and to avoid overstressing fasteners from expansion, contraction, or installation.
- B. Cast-in-Place Anchorages:
 - 1. Provide where anchor rods or anchor bolts are indicated on the Drawings, unless another anchor type is approved by Engineer.

2. Provide concrete anchorages as shown on the Drawings or as required to secure the Work to concrete.
 3. Tie cast-in-place anchorage in position to embedded reinforcing steel using wire.
 4. Tack welding of anchorage is prohibited.
 5. Chase threads as required and coat projected portion of carbon steel anchors and nut threads with a heavy coat of clean grease after concrete has cured.
 6. Anchorage location Tolerance: in accordance with AISC 303.
 7. Provide steel or durable wood templates for all column and equipment anchorages. Place templates above top of concrete; do not impede proper concrete placement and consolidation.
- C. Mechanical Anchorages:
1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
 2. Do not use where subjected to vibration.
 3. May be used in overhead applications.
 4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.
- D. Post-installed Anchorages:
1. For post-installed anchors, comply with MPII regarding hole diameter and depth required to fully develop the tensile strength of anchor or reinforcing bar.
 2. Use hammer drills to create holes.
 3. Properly clean out holes in accordance with the associated ICC-ES report using non-metallic, fiber bristle brush and compressed air, or as otherwise necessary to remove all loose material from each hole prior to installing anchor in the presence of Special Inspector.
 4. Adhesive Anchorages:
 - a. Provide only where specifically indicated on the Drawings or when approved for use by Engineer.
 - b. May be provided where subjected to vibration or at buried or submerged locations.
 - c. Do not install for overhead applications or sustained tension loading conditions such as utility hangers.
 - d. Install adhesive anchors in concrete aged not less than 21 days.
- E. Finishes:
1. Repair of damaged galvanized surfaces:
 - a. Prepare damaged surfaces by abrasive blasting or power sanding.
 - b. Repair damaged galvanized surfaces in accordance with ASTM A780.
 - c. Apply galvanizing repair paint to not less than 6 mils dry film thickness in accordance with galvanizing repair material manufacturer's instructions and ASTM A780.
- F. Ensure that embedded items are protected from damage and are not filled in with concrete or related materials.

3.3 FIELD QUALITY CONTROL

- A. Field Tests and Inspections:
1. Comply with Section 03 08 13 - Concrete Testing and Evaluation - Owner.
 2. Tests and inspections of anchorages shall comply with ACI 355.2 and/or ACI 355.4 as applicable.

3. Owner reserves the right to inspect and test completed anchorages at a minimum of 25 to 50 percent of provided anchorages.
 - B. Supplier's services:
 1. Post-installed anchor manufacturer's representative shall demonstrate and observe the proper installation procedures for the post-installed anchors.
 - C. Defective Work:
 1. Anchorages that do not successfully pass required field tests and inspections or that are otherwise deemed defective by Engineer shall be remedied, in accordance with the Contract Documents, at no cost to Owner.
- 3.4 CLEANING
- A. After concrete has been placed, remove protection and clean all anchorage of all concrete, dirt, and other foreign matter.

END OF SECTION

SECTION 03 15 23
EXPANSION JOINT SEALS IN CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Expansion Joint Seals in Concrete, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Install Expansion Joints in weather-tight, water-tight fashion.
- B. Extruded Neoprene:
 - 1. Comply with ASTM D3542, and following properties:

Minimum Physical Properties		
Property	Test Method	Required Value
Tensile strength, min.	ASTM D412	2000 psi
Elongation at break, min.	ASTM D412	250%
Hardness, Type A durometer	ASTM D2240	55 ±5
Oven aging (70 hours at 212 degrees F: Tensile strength, max. Elongation, max. Hardness, Type A durometer	ASTM D573	20% loss 20% loss 0 to +10 pts
Max Weight Change due to Oil swell; (#3 Oil for 70 hours at 212 degrees F)	ASTM D471	45%
Ozone resistance, 20% strain 70 hours aging, ASTM D 573, 3 ppm in air	ASTM D1149	No cracks

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Project Information:
 - 1. Manufacturer of listed products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Expansion joint seals:
 - 1. Base:
 - a. D.S. Brown.
 - 2. Optional:
 - a. Watson Bowman Acme Corp
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. General:
 - 1. Size material for joint width indicated and in accord with current published recommendations of manufacturer.
 - 2. Use maximum available lengths.
 - 3. Use factory fabricated joints.
 - 4. Use types described below where indicated.
- B. Expansion Joint Seal – Type A:
 - 1. Elastomeric, neoprene profiles as indicated.
 - 2. Base Product:
 - a. JP-Series by D.S. Brown.
- C. Expansion Joint Seals – Type B:
 - 1. Dense neoprene, supported by rolled stainless steel frame rails.
 - 2. Frame rails to include 1/2 inches 13 mm diameter embed studs.
 - 3. Base Product:
 - a. PG-Series by D.S. Brown.
- D. Expansion Joint Seals – Type C:
 - 1. Heavy-duty Compression Type.
 - 2. Elastomeric, neoprene profiles as indicated.
 - 3. Base Product:
 - a. Delastic CV-Series by D.S. Brown.
- E. Expansion Joint Seals – Type D:
 - 1. Normal-duty Compression Type.
 - 2. Elastomeric, neoprene honeycomb profiles as indicated.
 - 3. Width: As indicated
 - 4. Base Product:
 - a. CS-Series by D.S. Brown.
- F. Lubricant/Adhesive:
 - 1. High-strength, 2-part Epoxy Manufacturer's standard.
 - 2. Use where required.

2.3 EXPANSION JOINTS TYPES SPECIFIED ELSEWHERE

- A. Expansion Joints at Roofing:
 - 1. See Sections 07 62 00 and 07 61 13.
- B. Expansion Joints in Exterior Walls:
 - 1. Compressible Sealants: See Section 07 92 13.
- C. Expansion Joints in Interior locations:
 - 1. See Section 07 92 16.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Confirm that joints to receive seal are free from defects with sides straight and parallel to proper width and depth indicated.

1. Temperature at time of joint construction determines width of working joint.
2. Form joints allowing for design temperature variations.
3. Ensure that concrete is cured per manufacturer's recommendations, prior to installing joint.

3.2 PREPARATION

- A. Clean surfaces to receive seal of material which may be detrimental to effective joint sealing.
- B. Do not apply adhesives at temperatures below 40 degrees F.
- C. Do not install seals at temperatures above 85 degrees F.
- D. Keep adhesives and solvents away from heat or flame.
- E. Apply in well-ventilated area.

3.3 INSTALLATION

- A. General:
 1. Utilize ADA compliant material where pedestrian traffic is anticipated.
 2. Miter and splice seal at corners where space does not permit a smooth bend.
 3. Splice seal using adhesive to provide a permanent, watertight joint.
 4. Remove misapplied adhesive immediately, using methylethylketone (MEK) or toluene.
- B. Installation – Joint Type A, C, and D:
 1. Decompress seals using vacuum suction.
 2. Apply continuous coat of adhesive to both joint interfaces.
 3. Insert into joint void.
 4. Release suction, allowing material to expand and apply necessary bonding pressure.
 - a. Exception: Use pressurized air, in lieu of suction, where so recommended by manufacturer.
 5. Install with top recessed 1/8 inches.
- C. Installation – Joint Type B:
 1. Embed stainless steel frame rails into concrete.
 2. Coordinate joint void width with drawings and according to manufacturer's recommendations.
 3. Install substantially flush with adjacent slab surfaces.
 4. Seal frame rails to concrete after slabs have cured.

3.4 FIELD TESTING

- A. Flood test installed joints for 24 hours.
 1. Minimum depth of water: 2 inches.
- B. Visually inspect area below for signs of water leakage.
- C. Repair areas which permit passage of water and re-test.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Reinforcing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM A36 Standard Specification for Carbon Structural Steel.
 - 2. ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 3. ASTM A663 Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
 - 4. ASTM A675 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
 - 5. ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - 6. ASTM A775 Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - 7. ASTM A884 Standard Specification for Epoxy-Coated Wire and Welded Wire Reinforcement.
 - 8. ASTM A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- B. American Concrete Institute (ACI):
 - 1. ACI SP 66, ACI Detailing Manual
 - 2. ACI 117, Specification for Tolerances for Concrete Construction Materials.
 - 3. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
 - 4. ACI 318, Building Code Requirements for Structural Concrete.
- C. American National Standards Institute (ANSI) /American Welding Society (AWS):
 - 1. ANSI/AWS-D1.4 Structural Welding Code- Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute (CRSI)
 - 1. Manual of Standard Practice.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
 - 2. Mill certificates for all reinforcing.
- B. Shop Drawings:
 - 1. Shop drawings indicating size, number, dimensions and locations of reinforcing steel and accessories, spacing, lap splice lengths and locations, concrete cover, and reinforcing support, in sufficient detail to permit installation of reinforcing without reference to Contract drawings.
 - a. Details of concrete reinforcement and accessories not indicated on Contract Documents shall be in accordance with ACI SP 66 and ACI 315.

2. Shop drawings shall not be prepared by reproducing the plans and details indicated on the Contract Drawings, but shall consist of completely redrawn plans and details as necessary to indicate complete fabrication and installation of all reinforcing steel.

C. Project Information:

1. Certification that reinforcing to be welded conforms to ASTM A706.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Support and store all reinforcing above ground,
- B. Ship to jobsite with attached plastic or metal tags with permanent mark numbers which match the Shop Drawing mark numbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. End Bearing Splice Couplers:
 1. Base:
 - a. Erico Products.
- B. Tension Splice Couplers:
 1. Base:
 - a. Erico Products.
 - b. Dayton Metal Products.
 - c. Dextra America Inc.
- C. Epoxy Adhesive for Anchoring Reinforcing:
 1. Base:
 - a. HIT System by Hilti.
- D. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. General Reinforcing:
 1. Conform to ASTM A615, Grade-60, deformed.
- B. Welded Reinforcing:
 1. Conform to ASTM A706, deformed.
- C. Welded Wire Reinforcement:
 1. Smooth wire flat sheets.
 2. Conforming to ASTM A1064 and to wire size and spacing as indicated on Drawings.
- D. Smooth Dowel Bars for Construction Joints:
 1. Conform to ASTM A663 or ASTM A675, Grade-60.
 2. Where indicated, provide a metal dowel cap at one end of dowel to permit longitudinal movement of dowel within concrete section.
 3. Provide for movement which equals joint width plus 1/2 inches.
- E. Slab on Grade Plate Dowels:
 1. ASTM A36 steel.
 2. May be used as an equal substitute for smooth dowel bars at construction joints.
 3. Diamond Dowel System, by PNA Construction Technologies, size 1/4 inches x 4-1/2 inches dowels or equal.

4. Locate plate dowels per smooth dowel bar requirements.
 5. Do not shear plates.
 6. Remove burrs at edges of plates.
- F. End Bearing Splice Couplers:
1. Erico Speed-Sleeve Splice by Erico Products.
- G. Tension Splice Couplers:
1. Minimum 125% yield strength of bar.
 2. Where drawings indicate tension splice couplers, provide one of following:
 - a. Lenton threaded tension coupler by Erico Products.
 - b. Bar-Grip tension coupler by Dayton Metal Products.
 - c. Cadweld tension splice by Erico Products.
 - d. Bar-Lock lockshear bolt coupling sleeves by Dayton Superior
 - e. Barte Mechanical Couplers by Dextra America, Inc.
- H. Epoxy Coating for Reinforcing:
1. Conform to ASTM A775.
 2. Coat reinforcing specifically noted on Drawings in addition to splice couplers.
 3. Touch up damaged coating areas in field.
- I. Epoxy Anchored Reinforcing:
1. Install reinforcing anchored in concrete with epoxy adhesive, in accordance with epoxy manufacturer's instructions.

2.3 FABRICATION

- A. Bars for Concrete Reinforcement:
1. Sheared length: Plus or minus 1 inch.
 2. Depth of truss bars: Plus 0, minus 1/2 inches.
 3. Overall dimensions of stirrups, ties, and spirals: Plus or minus 1/2 inches.
 4. Other bends: Plus or minus 1 inch.
- B. Bars with End Bearing Splice Couplers:
1. Terminate bar ends in flat surfaces within 1-1/2 degrees of right angle to axis of bars.
 2. Fit within 3 degrees of full bearing after assembly.
- C. Tolerances
1. Conforms to ACI 117, except as modified herein.
 2. Sheared lengths: ± 1 inch.
 3. Overall dimensions of stirrups and ties: $\pm 1/2$ inch.
 4. All other bends: 0 inch, -1/2 inch.
- D. Minimum diameter of bends measured on the inside of the reinforcing bar to be as indicated in ACI 318, Paragraph 7.2.

2.4 ACCESSORIES

- A. Chairs, Runners, Bolsters, Spacers, Hangers, and Other Reinforcing Supports:
1. Metal fabrications with plastic-coated tips in contact with forms.
 - a. Plastic coating meeting requirements of CRSI Manual of Standard Practice.

2. All plastic construction meeting the requirements of CRSI Manual of Standard Practice.
 - a. 100% non-metallic, non-corrosive.

PART 3 - EXECUTION

3.1 WELDING

- A. Welding of reinforcing is not permitted unless previously approved by the Engineer-of-Record.
- B. Perform welding of reinforcing steel in conformance with AWS-D1.4.
- C. Use E70 electrodes.
- D. Each welder shall place an approved identifying mark near each completed weld.
- E. Cut out welds determined to be defective.
 1. Weld and retest at Contractor's expense.

3.2 PLACING REINFORCEMENT

- A. Provide minimum concrete covering for reinforcement as follows:
 1. Concrete deposited against earth: 3 inches.
 2. Formed surfaces exposed to weather or in contact with earth:
 - a. 2 inches for reinforcing bars No.6 or larger.
 - b. 1-1/2 inches for reinforcing bars less than No.6.
 3. Interior surfaces:
 - a. 1-1/2 inches for beams, girders, and columns.
 - b. 3/4 inches for slabs, walls and joists with No.11 bars or smaller, and 1-1/2 inches with No.14 and No.18 bars.
- B. Place bars to following tolerances:
 1. Conform to ACI 117, except as modified herein.
 2. Clear distance to formed surfaces: Plus or minus 1/4 inches.
 3. Minimum spacing between bars: Minus 1/4 inches.
 4. Top bars in slabs and beams:
 - a. Members 8 inches deep or less: Plus or minus 1/4 inches.
 - b. Members between 8 and 24 inches deep: Plus/minus 1/2 inches.
 - c. Members more than 2 feet deep: Plus or minus 1 inch.
 5. Crosswise of members: Spaced evenly within 2 inches.
 6. Lengthwise of members: Plus or minus 2 inches.
- C. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.
 1. If moved more than one bar diameter, or enough to exceed above tolerances, resulting arrangement of bars subject to approval.
- D. Assure that reinforcement, at time concrete is placed, is free of materials that may adversely affect or reduce bond.
 1. Reinforcement with rust, mill scale or a combination of both is acceptable provided dimensions and weights, including heights of deformations, of a cleaned sample is not less than required by ASTM.
- E. Support reinforcement and fasten together to prevent displacement by construction loads or placing of concrete beyond tolerances indicated.

1. On ground, provide supporting concrete blocks or other approved method.
 2. Over formwork, use concrete, metal, plastic or other approved bar chairs and spacers.
 3. Where concrete surface will be exposed to weather in finished structure, furnish accessories within 1/2 inches of concrete surface of non-corrosive material or protect against corrosion.
- F. Overlap welded wire reinforcement not less than spacing of cross wires plus 2 inches.
1. Unless shown otherwise, support welded wire reinforcement by methods of Paragraph E, above.
- G. Offset vertical bars in columns at least one bar diameter at lapped splices to ensure proper placement, furnish templates for column vertical bars and dowels.
- H. Splices not specifically indicated shall be subject to approval.
- I. Unless permitted by Engineer-of Record, do not bend reinforcement after embedding in hardened concrete.
- J. Unless permitted by Engineer-of-Record, do not tack weld reinforcing.
- K. Unless indicated otherwise on Drawings, provide splice lengths for reinforcing as follows:
1. For reinforcing: Class B splice meeting the requirements of ACI 318.
 2. Provide splices of reinforcing not specifically indicated of specified subject to approval of Engineer.
 - a. Mechanical proprietary splice connectors may only be used when approved by Engineer-of-Record.

3.3 FIELD QUALITY CONTROL

- A. Reinforcement Congestion and Interferences:
1. Notify Engineer-of-Record whenever the specified clearances between bars cannot be met.
 2. Do not place any concrete until the Engineer-of-Record submits a solution to reinforcing congestion problem.
 3. No cutting of reinforcing shall be done without written approval of Engineer-of-Record.

END OF SECTION

SECTION 03 31 00
CONCRETE MATERIALS AND PROPORTIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Materials and Proportioning, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Section Includes:
 - 1. Requirements for concrete materials, including:
 - a. Materials, including various types of grout, admixtures, cement, sand, aggregate, and other materials.
 - b. Concrete strength and proportioning, including design mixes for:
 - 1) Normal-weight concrete.
 - 2) Grout.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C33, Standard Specification for Concrete Aggregates.
 - 2. ASTM C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 3. ASTM C94, Standard Specification for Ready-Mixed Concrete.
 - 4. ASTM 125, Terminology Relating to Concrete and Concrete Accessories.
 - 5. ASTM C138, Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - 6. ASTM C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - 7. ASTM C150, Standard Specification for Portland Cement.
 - 8. ASTM C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
 - 9. ASTM C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - 10. ASTM C192, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
 - 11. ASTM C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 12. ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - 13. ASTM C311, Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.
 - 14. ASTM C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
 - 15. ASTM C494, Standard Specification for Chemical Admixtures for Concrete.
 - 16. ASTM C496, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
 - 17. ASTM C595, Standard Specification for Blended Hydraulic Cements.
 - 18. ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - 19. ASTM C989, Standard Specification for Slag Cement for Use in Concrete and Mortars

20. ASTM C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
 21. ASTM C1399, Standard Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete.
 22. ASTM C1602, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
 23. ASTM C1609, Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading).
- B. American Concrete Institute (ACI):
1. Comply with applicable provisions of following ACI publications, latest edition, except as otherwise indicated:
 - a. ACI CT-13, Concrete Terminology
 - b. ACI 117, Specification for Tolerances for Concrete Construction and Materials.
 - c. ACI 211.1, Standard Practice for Selecting Proportions for Normal Concrete.
 - d. ACI 212.3R, Chemical Admixtures for Concrete.
 - e. ACI 232.2R, Use of Fly Ash in Concrete.
 - f. ACI 301 Specifications for Structural Concrete for Buildings.
- C. Concrete Mixture Proportioning:
1. Employ and pay for testing agency acceptable to Engineer and Owner to perform materials evaluation, testing and design of concrete mixes.
 2. Certificates, signed by material producer and Contractor, may be submitted in lieu of material testing when approved by Engineer.
- D. Concrete Testing:
1. Specified in Section 03 08 13.
 2. Contractor to assist with related communication and temporary storage of test cylinders at jobsite.
- E. Preinstallation Conference:
1. Minimum thirty-five (35) days prior to start of concrete construction schedule, conduct meeting to discuss approved mix designs and required methods and procedures to achieve required concrete construction.
 2. Send a Pre Installation Conference agenda to attendees twenty (20) days prior to scheduled date of the conference.
 3. Invite responsible representatives, in addition to those listed in Section 01 31 19, including but not limited to following:
 - a. Ready mix concrete producer.
 - b. Admixture manufacturer.
 - c. Concrete pumping equipment manufacturer
 - d. Laboratory responsible for the concrete design mix.
 - e. Owners Testing Agency responsible for field quality control.
 4. Record minutes of the meeting and distribute to attendees within five (5) days of conference.
 - a. Include statement by concrete contractor indicating proposed mix design, and placing, finishing, and curing procedures produce concrete quality required by specifications.

1.3 SUBMITTALS

A. Product Data:

1. Concrete Mix Designs:

- a. Submit each Mix Design individually.
- b. Do not combine multiple mix designs into a single submittal.
- c. Submit following data for each concrete mix proposed:
 - 1) Intended use.
 - 2) Proportions of materials.
 - 3) Slump.
 - 4) Air content.
 - 5) 7-day and 28-day compression test results of trial mixes or those used for standard deviation analysis of an established mix.
 - a) Test records for use in standard deviation analysis must have been made within 24 months of the date of the submittal and represent a time span of production of not less than 45 days.
- d. Submit source and certification or proof of quality (and compatibility of admixtures) for each of the constituents of the proposed concrete mixes. Compatibility of admixture must be certified.
 - 1) Cement - Mill certificate.
 - 2) Aggregate:
 - a) Certificate that class of coarse aggregate complies with ASTM C33 for type and location of concrete work.
 - b) Certification of aggregate gradation.
 - c) Certification of aggregate impurities relative to alkali-aggregate reactivity in accordance with ASTM C1778.
 - 3) Water – Clean potable.
 - 4) Admixtures:
 - a) Air Entraining Admixture.
 - b) High-Range Water Reducer.
 - c) Fly Ash.
 - d) Other.
- e. Submit concrete mix designs using the mix design submittal form included at the end of this specification:

PART 2 - PRODUCTS

2.1 MATERIALS

A. Under-slab Vapor Retarder:

1. Specified in Section 03 31 10.

B. Cement:

1. Portland cement conforming to ASTM C150 or blended cements conforming to ASTM C595.
2. Color: Natural gray.

- C. CSM:
 - 1. Fly Ash
 - a. ASTM C618, Class F.
 - b. Non-staining.
 - c. Appropriate for providing hardened concrete of uniform, light-gray color.
 - d. Compatible with all other concrete ingredients. Fly Ash shall have no deleterious effect on hardened concrete Work.
 - e. Produced by a source approved by the same jurisdiction as the Site, for use in concrete for highway construction.
 - f. Evaluate and use in accordance with ACI 232.2R.
- D. Aggregates:
 - 1. General:
 - a. Regard fine and coarse aggregates as separate ingredients.
 - b. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of applicable ASTM specifications.
 - 2. Normal Weight Concrete:
 - a. ASTM C33, also aggregate shall be obtained from a source approved by the State Highway Department for use in concrete for State bridges.
- E. Potable Water:
 - 1. Conforming to ASTM C1602.
- F. Admixtures:
 - 1. Use only when specifically required or permitted by Contract Documents, otherwise must be approved by Engineer.
 - 2. Trial mixes and tests shall be prepared with job materials, including admixture, to demonstrate that there will be no subsequent reduction in strength or durability of hardened concrete.
 - 3. Provide admixtures certified by manufacture to be compatible with other admixtures. Calcium chloride, thiocyanates, and admixtures containing more than 0.05 percent chloride ions are not permitted.
 - 4. Air-entraining Admixtures: ASTM C260.
 - 5. Mid-Range Water Reducer: ASTM C494, Type A.
 - 6. High-Range Water Reducer:
 - a. ASTM C494, Type F or G. Subject to complying with these specifications, the following manufacturers of High Range Water Reducing Admixtures are approved:
 - 1) Daracem – 100 or Adva Flow Series by Grace Construction Products.
 - 2) MasterRheobuild 1000, MasterGlenium Series or PS 1466 by Master Builders Solutions.
 - 3) Eucon 37, Eucon SPJ or Plastol Series by Euclid Chemical.
 - 4) PSP-N, PSP-N2, PSP-R, and PSP-L by Procrete Industries.
 - 7. Water-reducing, Retarding, and Accelerating Admixtures: ASTM C494.

8. Viscosity Modifying Admixture (VMA):
 - a. Specialty admixture to reduce bleed and segregation in concrete
 - 1) Euclid Chemical Company (The); Viscrol.
 - 2) Boral Materials Technologies; Boral SL.
 - 3) Master Builders Solutions; MasterMatrix VMA Series
9. Calcium-nitrite Corrosion Inhibitor:
 - a. Base Products: DCI and DCI S by Grace Construction Products.
 - b. Rheocrete CNI by Master Builders Solutions.
 - c. Eucon CIA by the Euclid Chemical Company
 - d. Incorporate at a rate recommended by manufacturer.
10. Supplementary Cementitious Materials (SCM):
 - a. Fly ash - ASTM C618, Class C or Class F.
 - 1) Samples shall be obtained, prepared, and tested in accordance with ASTM C311.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
11. Synthetic Macro Fibers:
 - a. ASTM C1116 Type III
 - b. Where permitted, fiber reinforced concrete shall replace and provide equivalent reinforcing to that indicated in both direct tension and bending capacity for concrete thickness indicated.
 - c. Testing per ASTM C1018 and/or ASTM C1399 shall indicate a minimum residual strength of 170 psi. Establish dosage rate required to meet performance specified.
 - 1) Submit manufacturers data verifying conformance.
 - d. Minimum Dosage rate 4 pounds/CU YD.
 - e. Acceptable manufacturers:
 - 1) Euclid Chemical Company Tuf-Strand SF.
- G. Sand Cement Grout (termed "Grout" on the Drawings):
 1. Performance Criteria:
 - a. Minimum 28-day compressive strength: 3000 psi
 - b. Strength shall not be less than strength of adjacent concrete to which grout is applied.
 2. Materials:
 - a. Provide sand cement grout as approximately:
 - 1) (3) parts sand to (1) part Portland cement
 - 2) 4.5% - 7.5% entrained air
 - 3) Water to provide slump allowing grout to completely fill required spaces and surround adjacent reinforcing.
- H. Non-shrink Grout:
 1. Manufacturers and Products: Subject to compliance with the contract Documents, the following are acceptable:
 - a. Master Builder Solutions: Masterflow 713
 - b. Euclid Chemical Company: NS Grout

- c. Sika Corporation: Sika Grout 212
 - d. Or approved equal.
- 2. Description:
 - a. This provision requires non-shrink, non-metallic grout. Unless otherwise shown of indicated on Contract Documents.
- 3. Performance Criteria:
 - a. Non-shrink grout shall produce a positive but controlled expansion.
 - b. Mass expansion shall not be created by gas liberation or by other means.
 - c. Minimum 28-day compressive strength: 7,000 psi.
- 4. Material:
 - a. Provide material that is non-shrink, non-metallic, non-corrosive, and non-staining.
 - b. Comply with ASTM C1107, Grade B.
 - c. Premixed with water only. Add water in accordance with manufacturer's written instructions.

2.2 PROPORTIONING CONCRETE MIXES

- A. General:
 - 1. Contractor and concrete supplier are responsible to provide concrete, in-place, which satisfies requirements listed in following table.
 - 2. Contractor and concrete supplier are responsible to adjust the concrete mixes, as needed, to:
 - a. Correct for non-conformance.
 - b. Correct for a variation in the quality of a constituent.
 - c. Compensate for extreme conditions in the field.
- B. Establish concrete material proportions by any of the proportioning methods described in AC1-301 guidelines.

Concrete Properties Table – IP Units							
Use	28-day Compressive Strength (KSI)	Dry Unit Weight (PCF)	Max Aggregate Size (IN)	Air percent	Max. W/C Ratio	Slump (IN)	Cement type
Footings	4.0	145-150	3/4	4.5 to 7.5	0.45	1-5	I/II
Walls	4.0	145-150	3/4	4.5	0.45	1-5	I/II
Slabs-on-grade	4.0	145-150	3/4	4.5	0.45	1-5	I/II
Structural floors	4.0	145-150	3/4		0.45	1-5	I/II

C. Instructions for use of Table:

1. Provide concrete mixes with properties indicated in locations identified in Use column.
2. 28-day Strength:
 - a. Installed concrete must meet or exceed the minimum 28-day compressive strength indicated.
 - b. Laboratory mix design strengths must exceed this strength by the appropriate amount per AC1-301.
 - c. Determine strength in accordance with ASTM C192 and ASTM C39.
3. Dry Unit Weight:
 - a. If no value is listed, assume normal weight.
 - b. Dry unit weight of light weight mixes shall be maximum air dry unit weight permitted.
 - c. Correlate fresh weight with air dry weight of same mix to use as basis of acceptance on job site. Test in accordance with ASTM C567 and ASTM C138.
 - d. Dry unit weight for concrete for Radiation Shielding shall be minimum air dry unit weight permitted. Use heavy aggregate if necessary.
4. Maximum Aggregate Size:
 - a. Maximum size of coarse aggregate determined in accordance with:
 - 1) ASTM C33 for normal weight concrete.
5. Air Content:
 - a. Required percentage of entrained and entrapped air as measured by ASTM C231, ASTM C173, or ASTM C138, as appropriate.
 - b. Tolerance of air content as delivered is +/- 1-1/2 percent for normal weight and +/- 2 percent for lightweight concrete.
 - c. When left blank, the required air content is not specified. All concrete exposed to freezing and thawing shall have air content between 4.5 percent and 7.5 percent. All interior slabs and all slabs to receive dry shake shall have a maximum air content of 3 percent.
6. Water Reducer:
 - a. Mid-Range Water Reducer or High Range Water Reducer complying with ASTM C494 shall be provided as necessary to achieve slump indicated.
 - b. Contractor, as option, may elect to use Water Reducers to improve workability or permit pumping.
7. Maximum W/C Ratio:
 - a. Maximum ratio of pounds of water allowed to pounds of cementitious material used in the concrete mix.
8. Slump:
 - a. Mixes without Water Reducers:
 - 1) Slump tolerance: Up to 1 inch above maximum indicated is allowed, provided the average of 5 consecutive batches does not exceed the indicated amount by more than a 1/2 inches.
 - b. Mixes with Water Reducers:
 - 1) Maximum slump after dosing shall not exceed 8 inches.
 - 2) Slump tolerance after dosing: +1-1/2 inches and -1 inches is permitted for each batch.

- c. Determine slump in accordance with ASTM C143.
 - d. Where slump is not specified, provide concrete with slump in accordance with approved mix designs.
 - e. No water is allowed to be added on Site.
9. Cement:
- a. Type: Provide cement type indicated.
 - b. As option, the contractor/supplier may use Fly Ash or Ground Blast Furnace Slag for partial replacement of cement.
 - 1) For each unit of cement that is removed, replace with two units of Class F Fly Ash.
 - 2) For each unit of cement that is removed, replace with one unit of Ground Blast Furnace Slag.
 - 3) Maximum amount of cement replaced shall not exceed that specified in table 4.2.2.7.b.2 of ACI 301.
 - 4) W/C ratio shall be based on total cementitious material content.
- D. Admixtures:
- 1. Use admixtures in accordance with manufacturer's instructions.
 - 2. Use only approved admixtures.

PART 3 - EXECUTION

3.1 STORAGE OF MATERIALS

- A. Store cement in weather tight buildings, bins, or silos which will exclude moisture and contaminants.
- B. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
 - 1. Perform tests for determining conformance to requirements for cleanliness and grading on samples secured from aggregates at point of batching.
 - 2. Do not use frozen or partially frozen aggregates.
- C. Allow sand to drain until it has reached relatively uniform moisture content before use.
- D. Store admixtures in manner to avoid contamination, evaporation, or damage.
 - 1. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure uniform distribution of ingredients.
 - 2. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics.

3.2 MIXING AND DELIVERY

- A. Batch, mix and transport concrete in accordance with ASTM C94.
- B. Batch and mix admixtures in accordance with manufacturer's instructions.
- C. Water added to concrete at the job site:
 - 1. Water additions at job site shall be limited to comply with W/C Ratio requirements.
 - 2. Do not allow water to be added to the mix unless the amount allowed is clearly indicated on the truck delivery ticket.
- D. Following addition of High Range Water Reducer, mix for a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.

E. Reduction of required average strength:

1. During construction, and after sufficient data becomes available, laboratory strength of mixes may be reduced in accordance with Section 3.11 of AC1-301, subject to approval by the Engineer.

END OF SECTION

SECTION 03 31 10
CONCRETE MIXING, PLACING, JOINTING, AND CURING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Mixing, Placing, Jointing and Curing as indicated, in accordance with provisions of Contract Documents.
- B. Sustainable Design Requirements:
 - 1. Section 03 08 13 – Concrete Testing and Evaluation.
 - 2. Section 03 11 00 – Concrete Forming.
 - 3. Section 03 20 00 – Concrete Reinforcing.
 - 4. Section 03 31 00 – Concrete, Materials, and Proportioning.
 - 5. Section 03 35 00 – Concrete Finishing.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C94 Standard Specification for Ready-mixed Concrete.
 - 2. ASTM C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - 3. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete.
 - 4. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 5. ASTM C567 Standard Test Method for Determining the Density of Structural Lightweight Concrete.
 - 6. ASTM D1751 Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
 - 7. ASTM D1752 Standard Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - 8. ASTM E1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
 - 9. ASTM E1745 Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- B. American Concrete Institute (ACI):
 - 1. ACI CT-13 Concrete Terminology
 - 2. ACI 117 Specification for Tolerances for Concrete Construction and Materials
 - 3. ACI 302.1R Guide for Concrete Floor and Slab Construction
 - 4. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete
 - 5. ACI 305.1 Hot Weather Concreting.
 - 6. ACI 306.1 Cold Weather Concreting.
 - 7. ACI 308 Standard Specification for Curing Concrete.
 - 8. ACI 309 Recommended Practice for Consolidation of Concrete.
 - 9. ACI 318 Building Code Requirements for Structural Concrete and Commentary
 - 10. ACI 360R Guide to Design of Slabs-on-Ground

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Placement plans: Indicate proposed locations of construction joints, control joints, expansion joints (as applicable), joint profile dimensions, and placement sequence.
 - 2. Screeding and finishing plan.
- B. Product Data:
 - 1. Vapor Retarder.
 - 2. Joint Fillers.
 - 3. Curing Agents.
 - 4. Construction Joint Bonding Adhesive.
- C. Project Information:
 - 1. Joint filler technical data.
 - 2. Strippable Curing compound technical data.
 - a. Interior slabs:
 - 1) Include floor covering manufacturer's written approval for use.
 - 2) Include procedures to be used for removing compound

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Evaporation Retarder:
 - 1. Base:
 - a. Euclid Chemical Company; Eucobar.
 - 2. Optional:
 - a. Master Builders Solutions; MasterKure ER50.
- B. Strippable Curing Compound:
 - 1. Base:
 - a. Kurez DR VOX or Kurez W VOX by Euclid Chemical Company.
 - b. L&M Cure R by L&M Construction Chemicals
 - c. Clear Resin Cure J11W by Dayton Superior
 - d. 1150 Clear by WR Meadows
 - e. SpecRez by SpecChem, LLC
 - 2. Strippable curing compound shall have a VOC content no greater than 100 g/L.
- C. Curing Sheet Material:
 - 1. Base
 - a. Hydracure M5 by PNA Construction Technologies, Inc.
 - 2. Optional:
 - a. Transguard 4000 by Reef Industries, Incorporated
- D. Vapor Retarders: As noted.
- E. Fiber Expansion Joint Fillers:
 - 1. Materials: ASTM D1751.
- F. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Concrete Materials and Proportioning: See Section 03 31 00.
- B. Premolded Expansion Joint Filler: Type required, conforming to ASTM D1751 or ASTM D1752.
- C. Evaporation Retarder
 - 1. Waterborne, monomolecular film forming, manufactured for application to fresh concrete designed to inhibit the loss of moisture before and during the finishing process.
- D. Curing Sheet Material:
 - 1. Provide where concrete is scheduled to be stained per section 09 67 75.
 - 2. Moisture Retaining Cover Conforming to ASTM C171: Naturally colored, non woven polypropylene fabric with a 4 mil non perforated reflective (white) polyethylene coating.
 - 3. Fabric shall exhibit low permeability and high moisture retention.
- E. Strippable Curing Compound:
 - 1. Conform to ASTM C309 with VOC no greater than 350 g/l.
 - 2. Where used on slabs receiving subsequent applied finishes, compound must be removed completely after curing.
 - 3. Install in accordance with manufacturer's recommendation and supervision.
- F. Granular Fill.
- G. Underslab Vapor Retarder:
 - 1. Meet ASTM E1745 Class A.
 - 2. Maximum Water Vapor Permeance: 0.03 Perms.
 - 3. Minimum Tensile Strength, ASTM E154: 55 feet-LB/IN.
 - 4. Minimum Puncture resistance: 2,200 grams, minimum.
 - 5. Base Product:
 - a. Perminator - 15 mil by WR Meadows.
 - 6. Optional Products:
 - a. Barrier-Bac VB350 - 16 mil by Inteplast.
 - b. Moistop Ultra - 15 mil by Fortifiber.
 - c. Florprufe 120 – 21 mil by GCP Applied Technologies.
 - d. Stego Wrap - 15 mil by Stego Industries.
 - e. Vapor Block Plus - 20 mil by Raven Engineered Films.
 - f. Viper VaporCheck II - 15 mil by ISI Building Products.
 - g. Yellow Guard – 15 mil by Poly-America.
 - 7. Tape as recommended by vapor retarder manufacturer.
 - 8. Other manufacturers desiring approval comply with requirements of Section 00 26 00.

PART 3 - EXECUTION

3.1 MIXING AND PRODUCTION OF CONCRETE

- A. Batch, mix and transport ready-mixed concrete in accordance with ASTM C94.
 - 1. Plant equipment and facilities shall conform to Check List for Certification of Ready Mixed Concrete Production Facilities of National Ready Mixed Concrete Association.

- B. Site batched and mixed concrete will be permitted only after ability to control quality has been demonstrated to satisfaction of Engineer.

3.2 MIXING - CONTROL OF ADMIXTURES

- A. Incorporate admixtures in accordance with Manufacturers' recommendations.
- B. Verify compatibility with manufacturers when more than one admixture is used.

3.3 MIXING - NORMALWEIGHT CONCRETE

A. Concrete Mixing – General

1. Provide concrete materials from one ready-mix batch plant qualified in accordance with this section's "Quality Assurance" Article.
2. Batch, mix, and transport in accordance with ASTM C94/C94M.

B. Control of Admixtures:

1. Control at ready-mix plant:

- a. Admixtures shall be introduced at the ready-mix plant in accordance with manufacturer's recommendations.
- b. Charge admixtures into mixer as solutions.
 - 1) Measure by means of an appropriate mechanical dispensing device.
 - 2) Liquid considered a part of mixing water.
 - 3) Admixtures that cannot be added in solution may be weighed or measured by volume if so recommended by manufacturer.
- c. Add separately, when two or more admixtures are used in concrete, to avoid possible interaction that might interfere with efficiency of either admixture, or adversely affect concrete.
- d. Complete performing addition of retarding admixtures within one minute after addition of water to cement has been completed, or prior to beginning of last three quarters of required mixing, whichever occurs first.

2. Control Admixtures at the Site:

- a. Additional quantities of admixtures (with exception of retarders) may be added at the Site provided:
 - 1) Addition of admixtures shall be under the supervision of the ready-mix plant's quality control representative.
 - 2) Addition of each admixture shall be documented on the delivery ticket.
 - 3) Provide additional mixing in accordance with ASTM C94.

3.4 MIXING - TEMPERING AND CONTROL OF MIXING WATER

- A. Mix concrete only in quantities for immediate use. Discard concrete which has set.
- B. When concrete arrives at project with slump below that suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded.
 1. Incorporate water by additional mixing equal to at least half of total mixing required.
 2. Do not add water after discharge commences

3.5 MIXING - WEATHER CONDITIONS

A. Cold Weather:

1. Comply with ACI 306.
2. In cold weather, temperature of concrete when delivered at site shall conform to following limitations:
3. For sections with least dimension greater than 36 inches, comply with table 3.1 of ACI 306R.

Minimum Concrete Temperature Required at Time of Pour		
Air Temperature at time of pour	For sections with least dimension less than 12 inches	For sections with least dimension 12 inches to 36 inches
Above 30 degrees F	60 degrees F	55 degrees F
0 to 30 degrees F	65 degrees F	60 degrees F
Below 0 degrees F	70 degrees F	65 degrees F

Minimum Concrete Temperature Required within 24 Hours of Pour		
Air Temp within 24 Hours of pour	For sections with least dimension less than 12 inches	For sections with least dimension 12 inches or greater
Below 32	60 degrees F	50 degrees F

4. If water or aggregate is heated above 100 degrees F, combine water with aggregate in mixer before cement is added.
 - a. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 100 degrees F.
 - b. Final temperature of combined mix shall not exceed 90 degrees F or be high enough to cause flash set or loss of slump or workability.

B. Hot Weather:

1. Comply with ACI 305 when high temperature, low slump, flash set, or cold joints are encountered.
2. Cool ingredients before mixing or add flake ice or well-crushed ice of a size that will melt completely during mixing for all or part of mixing water. Account for water contribution by ice when calculating the quantity if mixing water and insure that specified W/C ratio is not exceeded.

3.6 PREPARATION BEFORE PLACING

A. Equipment:

1. Remove hardened concrete and foreign material from inner surfaces of conveying equipment.
2. Provide spare vibrator on job site during concrete placing operations.
3. In cold weather, have protective blankets ready and heaters operational and in-place before placing concrete.

B. Forms:

1. Complete formwork: Remove frost, snow, ice, water, and foreign material; secure reinforcement in place, position expansion joint material, anchors, and other embedded items, and have entire preparation inspected prior to concrete placement.

2. In hot weather when temperature of reinforcing or forms is greater than 120 degrees F spray forms and reinforcement with water just prior to placing concrete.
- C. Screeds and Scream Rails:
1. Develop a screed system to accurately strike off fresh concrete to the surfaces and elevations defined on drawings.
 2. Anticipate deflection of formwork and support systems.
 - a. Provide and place extra concrete as necessary to produce finish surfaces with specified tolerances at designated elevations and contours at no additional cost to the Owner.
 3. When form work is cambered whether shored or un-shored and screeding is performed perpendicular (i.e., up and over) to crown of camber set screed rails to follow camber and provide a slab of uniform thickness.
 - a. When screeding parallel with the camber, set one screed at midspan along crown of camber and one along girder or support.
 - b. Two passes of the screed are necessary to cover one full bay.
 4. Other screeding methods may be used provided deflection of un-shored formwork is taken into consideration.
 5. On un-shored steel framing systems, accurately strike off concrete using a laser to produce a level surface after steel supporting system has deflected due to dead weight of fresh concrete. Anticipate steel framing deflection to be 0 inch at columns, and up to 1 1/2 inches at mid-point of bays, with an approximately parabolic profile.
 6. Slab thickness on cambered steel shall not be less than that indicated on plan.
 7. If not required in documents and subjected to approval of Engineer, Contractor as option may camber formwork.
 8. Concrete shall be struck off with a vibrating screed.
 9. Use of a wet screed system will not be permitted unless:
 - a. Concrete is struck with a pneumatically vibrated floater screed.
 - b. A highway straight edge is used to true the surface perpendicular to direction of screeding.
 - c. A satisfactory finish is produced on a trial slab.
 10. Submit a screeding and finishing plan for approval.
 - a. A representative trial slab pour shall be provided to demonstrate that the specified tolerances and a satisfactory surface can be provided by the proposed method of screeding and finishing.
- D. Subgrade for Slabs on Grade:
1. Subgrade shall be well drained and of adequate and uniform load bearing nature.
 - a. Keep in-place density of subgrade soils at least to minimum indicated.
 2. Keep subgrade free of frost before concrete placing begins.
 - a. If temperature inside a building where concrete is to be placed is below freezing, raise temperature and maintain above 50 degrees F long enough to remove frost from subgrade and reinforcing.
 3. Keep subgrade moist at time of concreting.
 - a. If necessary, dampen with water in advance of concreting.
 - b. Allow no free water standing on subgrade nor muddy or soft spots when concrete is placed.

3.7 UNDER-SLAB VAPOR RETARDER

- A. Place continuous vapor retarder over granular fill.
 - 1. See standard spec.
 - 2. Installation as recommended by manufacturer.
- B. Comply with ASTM E1643 Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - 1. Lap vapor retarder at ends and edges of sheets and seal with vapor retarder tape.
 - 2. Extend to extremities of area.
 - 3. Turn up at perimeter walls to form bond breaker and tape in place.
 - 4. Terminate at top of foundation or grade beam for slabs on grade.
 - 5. Detail sleeved or drilled penetrations as recommended by manufacturer.
 - a. Coordinate detailing at penetrations with subcontractors responsible for penetrations.
- C. Protect vapor retarder. Repair punctures, tears and other damage using vapor retarder tape.
- D. Trim excess material after slab is placed.
- E. Inspect and approve vapor retarder installation prior to concrete placement.
 - 1. See Section 01 45 23.

3.8 PROTECTION

- A. Unless adequate protection is provided and approval is obtained, do not place concrete when temperature is below freezing or during rain, sleet, or snow.
- B. Do not allow rainwater to increase mixing water nor to damage surface finish.
- C. Concrete damaged by rain or weather and judged defective by Engineer shall be removed and replaced by Contractor at no additional cost to Owner or corrected by procedures listed in Section 03 08 13.

3.9 CONVEYING

- A. Handle concrete from mixer to place of final deposit as rapidly as practicable by methods which prevent segregation or loss of ingredients and assure that quality is maintained.
- B. Use equipment conforming to ASTM C94.
- C. Use horizontal belt conveyors or mount at a slope which will not cause excessive segregation or loss of ingredients.
 - 1. Protect concrete against undue drying or rise in temperature.
 - 2. Handle to prevent segregation.
 - 3. Do not allow mortar to adhere to belt.
 - 4. Discharge long runs into a hopper or through a baffle.
- D. Use metal or metal-lined chutes with slope between 1 vertical and 2-3 horizontal.
 - 1. Chutes more than 20 feet long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.
- E. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity.
 - 1. Control pneumatic placement so that segregation is not apparent in discharged concrete.

2. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 inches.
3. Do not convey concrete through pipe made of aluminum or aluminum alloy.

3.10 DEPOSITING IN FORMS

A. Work Includes:

1. Deposit concrete continuously or in layers of such thickness that no concrete is deposited on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section.
2. Place at such a rate that concrete which is being integrated with fresh concrete is still plastic.
3. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
4. Remove temporary spreaders in forms when concrete placing has reached an elevation rendering their service unnecessary.
5. Temporary spreaders may remain embedded in concrete only if made of metal or concrete and if prior approval has been obtained.

B. Do not start placing concrete in supported elements until concrete previously placed in columns and walls is no longer plastic and has been in place at least two hours.

C. Deposit concrete as nearly as practicable in its final position to avoid segregation due to re-handling or flowing.

1. Do not subject concrete to procedure which will cause segregation.
2. Concrete shall not drop more than 6 feet unless approved by the Engineer. For greater heights, provide special mix design, chute, spout, tremie, or other approved method.

D. Concrete buckets shall be equipped with rubber discharge tubes.

1. Tube size shall be effective in directing flow of concrete directly downward between reinforcing.
2. Unless it can be demonstrated, no segregation will occur with greater distances, maximum free fall distance of concrete below flexible tube is limited to 4 feet.

E. Consolidation:

1. Consolidate concrete by vibration, so that concrete is thoroughly worked around reinforcement, around embedded items and into corners of forms eliminating air or stone pockets which may cause honeycombing, pitting, or planes of weakness.
2. Use internal vibrators having a minimum frequency of 8000 vibrations per minute to consolidate concrete effectively.
3. Do not use vibrators to transport concrete within forms.
4. Insert vibrators and withdraw at points approximately 18 inches apart.
5. At each insertion allow duration sufficient to consolidate concrete but not sufficient to cause segregation; generally, from 5 to 15 sec.
6. Where concrete is to have an as-cast finish, bring a full surface of mortar against form by vibration process, spading, or both to work coarse aggregate back from formed surface.

3.11 SLAB PLACEMENT

A. Coordinate mixing and placing with finishing.

1. Do not place concrete on subgrade or forms more rapidly than it can be spread, straight edged, and darbied or bull floated.
2. Perform these operations before bleed water has an opportunity to collect on surface.

- B. Plan size of finishing crews to achieve good surfaces and avoid cold joints caused by temperature and atmospheric conditions.
 - 1. If construction joints become necessary, construct as required under joints and embedded items.
- C. Consolidation:
 - 1. Thoroughly consolidate concrete in slabs.
 - 2. Use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade.
 - 3. Obtain consolidation of slabs with vibrating screeds, roller pipe screeds, internal vibrators, or other approved means.

3.12 JOINTS AND EMBEDDED ITEMS

- A. Construction Joints - Other than Slab on Grade:
 - 1. Locate joints not indicated to least impair strength of structure.
 - a. Place joints in locations approved by Engineer.
 - 2. In general, locate near middle of spans of slabs, beams, and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice width of beam.
 - a. Locate joints in walls and columns at underside of floors, slabs, beams, or girders and at tops of footings or floor slabs.
 - b. Place beams, girders, brackets, column capitals, haunches, and drop panels at same time as slabs.
 - c. Make joints perpendicular to main reinforcement.
 - 3. Continue reinforcement across joints.
 - 4. Clean surface of concrete at joints thoroughly and remove laitance.
 - a. Prior to placing adjoining concrete, dampen, but do not saturate, hardened concrete of construction joints.
- B. Joints – Slabs on Grade:
 - 1. Construction joints:
 - a. Place keyed dowelled or diamond plate construction joints as indicated on plans and at locations where a slab placement is terminated or interrupted.
 - b. Size of placements and sequence of slab placement is Contractor's option, except construction joints shall be located at a control joint location.
 - c. Construction joints act as control joints.
 - 2. Control joints:
 - a. Provide contraction (control) joints as indicated.
 - b. If not shown, provide along column centerlines.
 - c. Where column centerline spacing or spacing between column centerlines and walls exceeds 20 feet, provide an intermediate joint at intervals not exceeding 20 feet.
 - d. Locate joints to produce panels that are as square as possible with length not exceeding 1.5 times width.
 - e. Also provide joints where change in slab width occurs, such as at block-outs, pits, etc.

- f. If saw cut joints are required or permitted, time cutting properly with set of concrete by one of the following methods:
 - 1) A conventional saw, cutting as soon as possible after final finishing when cutting action will not tear, ravel, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Cut to a depth of 1/4 slab thickness or 1/3 slab thickness if steel-fiber or structural synthetic macro fiber reinforcement is used.
 - 2) An early entry saw beginning immediately after final finishing when cutting action will not tear, ravel, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 - a) Remove debris in path of cut and under skid plate before cutting. Skid plate must remain flat on surface.
 - b) Use early entry saw blades and skid plates.
 - c) Install early entry joint protector at sawcut intersection prior to cross-cutting.
 - d) Remove dry powder without disturbing finish.
 - e) Avoid traffic across saw cut until sufficient strength is gained to protect joint edges.
3. Complete before shrinkage stresses become sufficient to produce cracking.
4. Isolation joints:
 - a. Provide isolation joints around columns, and between slab on grade and walls.
 - b. Also provide isolation joints around equipment or machinery isolation pads, pits, pipes, etc., unless detailed otherwise.
- C. Expansion Joints:
 1. Do not permit reinforcement or other embedded metal items bonded to concrete, except dowels in floors bonded on only one side of joints, to extend continuously through expansion joint.
 2. Locate expansion joints as indicated.
- D. Acoustic Isolation Joint:
 1. Do not permit any reinforcing or other bonded items to extend through joint.
 2. Remove forming material and clean joint thoroughly prior to cover installation. Locate as indicated.
- E. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to placement of concrete.
 1. Give Contractors whose work is related to concrete or supported by it ample notice and opportunity to introduce and/or furnish embedded items before concrete placement.
 2. Position expansion joint material, waterstops, and other embedded items accurately and support against displacement.
 3. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete.

3.13 BONDED JOINTS

- A. At construction joints indicated as bonded, obtain bond by one of following methods:
 1. Roughen surface of concrete in an approved manner which will expose aggregate uniformly and not leave laitance, loosened particles of aggregate or damaged concrete at surface.

- a. Dampen (but do not saturate) hardened concrete of joints in exposed work; joints in middle of beams, girders, joists, and slabs; and joints in work designed to contain liquids.
 - b. Thoroughly cover with a coat of cement grout of similar proportions to mortar in concrete.
 - c. Use grout as thick as possible on vertical surfaces and at least 1/2 inches thick on horizontal surfaces.
 - d. Place fresh concrete before grout has attained its initial set.
2. Prepare joints receiving an adhesive and apply adhesive in accordance with manufacturer's recommendations prior to placing of fresh concrete.
 3. Prepare surfaces of joints which have been treated with a chemical retarder in accordance with manufacturer's recommendations prior to placing of fresh concrete.

3.14 SLAB FINISHING

- A. See Section 03 35 00.

3.15 CURING AND PROTECTION

- A. Work Includes:

1. Beginning immediately after placement, protect concrete from premature drying, hot or cold temperatures, and mechanical injury, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration and hardening of concrete.
2. Materials and methods of curing subject to approval.

- B. Preservation of Moisture:

1. Preserve moisture in slab before and during finishing until slab is ready for application of final curing.
2. When conditions warrant, apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 pound/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions one or more times after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Final curing:

1. Interior slabs:
 - a. Application of sheet curing materials.
 - b. Application of strippable curing compound.
 - 1) Submit written approval from floor covering manufacturer prior to use.
 - 2) Apply in accord with recommendations of manufacturer immediately after water sheen, which may develop after finishing, has disappeared.
 - 3) Apply continuous film at manufacturer's specified rate.
 - 4) Completely remove prior to application of floor covering material.
2. Other concrete surfaces not in contact with forms apply one of following procedures immediately after completion of placement and finishing:
 - a. Ponding or continuous sprinkling.
 - b. Application of absorptive mats or fabric kept continuously wet.
 - c. Application of sand kept continuously wet.
 - d. Continuous application of mist spray, not exceeding 150 degrees F.
 - e. Application of sheet curing materials.

- f. Application of other moisture-retaining covering as approved.
 - g. Application of strippable curing compound.
 - 1) Apply in accordance with recommendations of manufacturer immediately after water sheen has disappeared.
 - 2) Apply continuous film at manufacturer's specified rate.
 - 3) Remove after curing where cured surface is against which additional concrete or other material is to be bonded, unless it is proven that curing compound will not prevent bond.
- 3. Minimize moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by sun by keeping forms wet until they can be safely removed.
 - a. After form removal cure concrete until end of time prescribed.
- 4. Continue curing in accordance with ACI 301 and ACI 302. Seven days for most concrete.
 - a. If tests made of cylinders, kept adjacent to structure, and cured by same methods, indicate average compressive strength has reached 70% of specified strength, (f'c), moisture retention methods may be terminated.
 - b. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is one day old, provided concrete is not permitted to become surface dry during transition.
- D. Temperature, Wind and Humidity:
 - 1. Cold weather:
 - a. When mean daily outdoor temperature is less than 40 degrees F maintain temperature of concrete between 50 and 70 degrees F for required curing period.
 - b. Make provisions for heating, covering, insulating, or housing concrete work adequately to maintain required temperature without injury.
 - c. Do not use combustion heaters during first 24 hours unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
 - 2. Hot weather:
 - a. Make provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light-colored material.
 - b. Take such protective measures as quickly as concrete hardening and finishing operations will allow.
 - 3. Rate of temperature change:
 - a. Keep changes in temperature of air immediately adjacent to concrete during and immediately following curing period as uniform as possible.
 - b. Do not exceed 5 degrees F in any 1 hour or 50 degrees F in any 24-hour period.
- E. Protection from Mechanical Injury:
 - 1. During curing period, protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.
 - 2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
 - 3. Do not load self-supporting structures in such a way as to overstress concrete.

F. Protection of Slabs on Grade from Frost:

1. Interior slabs exposed to freezing temperatures shall be adequately protected so that frost does not develop in supporting subgrade.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Finishing and Repair of Surface Defects, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Section Includes:
 - 1. Concrete finishing and repair of surface defects.
 - 2. Resurfacing mortar.
- D. Related specification sections include, but are not necessarily limited to:
 - 1. 03 11 00 – Concrete Forming
 - 2. 03 31 00 – Concrete Materials and Proportioning
 - 3. 03 31 10 – Concrete Mixing, Placing, Jointing, and Curing

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. ACI CT-13 – Concrete Terminology.
 - 2. ACI 117 – Specification for Tolerances for Concrete Construction and Materials.
 - 3. ACI 303R – Guide to Cast-in-Place Architectural Concrete Practice.
 - 4. ACI 308 – Standard Practice for Curing Concrete.
 - 5. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in Cube Specimens).
 - 6. ASTM C150 – Standard Specification for Portland Cement.
 - 7. ASTM C157 – Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
 - 8. ASTM C666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
 - 9. ASTM D4258 – Standard Practice for Surface Cleaning Concrete for Coating.
 - 10. ASTM E1155 Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers
- B. Floor Finish Tolerances:
 - 1. Follow F-Number System as defined in ASTM E1155.
 - a. Floor Flatness F-Number: FF defines maximum floor curvature allowed over 24 inches computed on basis of successive 12 inches elevation differentials.
 - b. Floor Levelness F-Number: FL defines relative conformity of floor surface to a horizontal plane measured over a 10 feet distance.
 - c. Above number pair to be stated in form: FF/FL.
 - d. Specified Overall Value (SOV) is enumerated and is based on composite of measured values in a placement.
 - e. Minimum Local Value (MLV) describes flatness or levelness below which repair or replacement is required. MLV is based on individual placement and applies to minimum local area not crossing construction or control joints.

1.3 DEFINITIONS

A. Vertical Surface Defects:

1. Any void in the face of the concrete deeper than 1/8 inches, such as:
 - a. Tie holes
 - b. Air pockets (bug holes)
 - c. Honeycombs
 - d. Rock holes
2. Scabbing:
 - a. Scabbing is defect in which parts of the form face, including release agent, adhere to concrete.
 - b. Foreign material embedded in face of concrete.
 - c. Fins 1/16 inches or more in height.

B. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project Site.
2. Installer and applicator are synonymous.

C. Other words and terms used in this Specification Section are defined in ACI CT-13.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements or standards referenced.
 - b. Manufacturer's installation instructions.
2. Certifications:
 - a. Certification of aggregate gradation.
 - b. Certification of manufacturer experience qualifications and performance history.
 - c. Certification of applicator's qualifications:
 - 1) Refer to Qualifications paragraph.
 - 2) Provide manufacturer's written approval of applicators.
 - 3) Provide references substantiating specialty experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Bonding Agents:
 - a. Master Builder Solutions.
 - b. Euclid Chemical Co.
 - c. L&M Construction Chemicals.
2. Patching Mortar:
 - a. Master Builder Solutions.
 - b. Euclid Chemical Co.

- c. L&M Construction Chemicals.
- d. Sika Corporation.

2.2 MATERIALS

A. Bonding Agent:

- 1. Approximately 1 part Portland cement to 1 part fine sand passing a No.30 mesh sieve.
- 2. Mix to consistency of thick cream.

B. Patching Mortar:

- 1. Same materials and approximately same proportions as used for concrete, except omit coarse aggregate.
- 2. Shall consist of not more than 1 part Portland cement to 2-1/2 parts sand by loose volume.
- 3. For exposed concrete, part of Portland cement shall be white to produce a color matching color of surrounding concrete, as determined by a trial patch.
- 4. Add no more water than necessary for handling and placing.
- 5. Mix compound in advance and allow to stand with frequent manipulation, without addition of water, until it has reached stiffest consistency that will permit placing.

C. Grout Mix:

- 1. Cleaned rubbed finish:
 - a. Mix 1 part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout with a consistency of thick paint.
- 2. Cork floated rubbed finish:
 - a. Mix 1 part Portland cement and 1 part fine sand with sufficient water to produce a stiff grout.

D. Proprietary Materials:

- 1. Contractor's option: Proprietary compounds for adhesion, patching, or finishing may be used in lieu of or in addition to foregoing grouts.
- 2. Use such compounds in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 FINISHING

- A. After removal of forms, repair and give surfaces of concrete finishes indicated.
 - 1. Top surface of slabs not included.
- B. Unspecified finish: If finish is not designated, use following finishes as applicable:
 - 1. Unpainted concrete surfaces not exposed to public view: Rough form finish.
 - 2. Unpainted concrete surfaces exposed to public view: Smooth form finish.
 - 3. Concrete surfaces to receive paint: Grout cleaned rubbed finish.
 - 4. Unformed surfaces (except slabs): As indicated.

3.2 REPAIR OF SURFACE DEFECTS

- A. Repair surface defects immediately after form removal.
- B. Remove honeycombed and other defective concrete down to sound concrete.
- C. Chip if necessary to make edges perpendicular to surface or slightly undercut.
- D. No feather edges will be permitted.
- E. Dampen area to be patched and an area at least 6 inches wide surrounding it to prevent absorption of water from patching compound.

- F. After surface water has evaporated from area to be patched, brush bonding agent into surface.
- G. When bonding agent begins to lose water sheen, apply patching compound.
- H. Thoroughly consolidate compound into place and strike off so as to leave patch slightly higher than surrounding surface.
- I. To permit initial shrinkage, leave undisturbed for at least 1 hour before final finish. Keep patched area damp for 7 days.
- J. Do not use metal tools in finishing a patch which will be exposed.
- K. Tie holes:
 - 1. Unless stainless steel, non-corrosive, or acceptably coated ties are used, tie holes shall be filled.
 - 2. Clean and thoroughly dampen tie holes; fill solid with patching compound.

3.3 AS-CAST FINISHES

- A. Rough Form Finish:
 - 1. No selected form facing materials are specified for rough form finish surfaces.
 - 2. Concrete surfaces shall conform to tolerances in f 03 11 00 Concrete Formwork.
 - 3. Patch defects and tie holes.
 - 4. Chip or rub off fins exceeding 1/4 inches in height.
 - 5. Leave surfaces with texture imparted by forms.
- B. Smooth Form Finish:
 - 1. Use form facing material to produce a smooth, hard, uniform texture on concrete.
 - 2. Arrange facing material orderly and symmetrical, with number of seams kept to practical minimum.
 - 3. Support by studs or other backing capable of preventing excessive deflection.
 - 4. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surface.
 - 5. Patch tie holes and defects.
 - 6. Remove fins completely.
 - 7. When surface textures are impaired and form joints misaligned by more than 1/8 inches grind bush hammer, or otherwise correct affected concrete.
 - 8. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.
 - 9. Repair major mortar leakage as a defective area.
- C. Unformed Surface Finish:
 - 1. Strike smooth tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces after concrete is placed.
 - 2. Float to a texture reasonably consistent with that of formed surfaces.
 - 3. Continue final treatment on formed surfaces uniformly across unformed surfaces.
 - 4. Not intended for slabs.

3.4 RUBBED FINISHES

- A. General:
 - 1. Form and repair concrete surfaces to receive rubbed finishes, in accordance with requirements for smooth form finish.
 - 2. Remove forms and perform necessary patching as soon after placement as possible without jeopardizing structure.

- B. Smooth:
1. Produce smooth rubbed finish on newly hardened concrete no later than day following form removal.
 2. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.
 3. Use no cement grout other than cement paste drawn from concrete itself by rubbing process.
- C. Grout Cleaned:
1. Undertake no cleaning operations until contiguous surfaces are completed and accessible.
 2. Wet surface of concrete sufficiently to prevent absorption of water from grout and apply grout uniformly.
 3. Immediately after applying grout, scrub surface vigorously with a cork float or stone to coat surface and fill air bubbles and holes.
 4. While grout is still plastic, remove excess grout by working surface with a rubber float, sack, or other means.
 5. After surface whitens from drying, rub vigorously with clean burlap.
 6. Keep finish damp for at least 36 hours after final rubbing.
- D. Cork Floated:
1. Remove forms at an early stage, within 2 to 3 days of placement where possible.
 2. Remove ties.
 3. Remove burrs and fins.
 4. Dampen wall surface.
 5. Apply grout with firm rubber float or with trowel, filling surface voids.
 6. Compress grout into voids.
 7. If grout surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with a fog sprayer.
 8. Produce final texture with a cork float using a swirling motion.

3.5 SLAB FINISHING

- A. General:
1. Place slabs to finish tolerances specified.
 2. Slab finish: Use following finishes at building locations noted.
 - a. Troweled finish:
 - 1) Floors intended as walking surfaces or to receive floor coverings.
 - b. Non-slip finish (interior and exterior): Where indicated on drawings.
- B. Finishing tolerances:
1. For shored construction, measurements for conformance with finishing tolerances shall be made as soon as slab can tolerate foot traffic, and before shores are removed.
 2. The FL levelness tolerance is not applicable to unshored form work such as cast in place topping on prestressed tees, slabs on unshored steel and metal deck, or unshored, post-tensioned slabs on steel beams.
 3. Horizontal finishes will be accepted provided:
 - a. Applicable specification requirements are satisfied.
 - b. Water does not pond in areas sloped to drain.

- c. Floor finish tolerances FF/ FL conforms to that specified for particular finish and Minimum Local Values are not less than 75 percent of the floor finish tolerance specified.
 - 4. Accumulated deviation from intended true plane of finished surface does not exceed 1 inch.
 - 5. Accuracy of floor finish does not adversely affect installation and operation of movable equipment, floor supported items or items fitted to floor.
- C. Finishes:
- 1. Troweled finish:
 - a. Sequence:
 - 1) Float finish
 - 2) Power trowel
 - 3) Hand trowel
 - b. First troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still indicate some trowel marks.
 - c. Final trowel when a ringing sound is produced as trowel is moved over surface.
 - d. Thoroughly consolidate surface by hand troweling.
 - e. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to FF25/ FL20 tolerance.
 - f. On surfaces intended to receive floor coverings, grind off defects which would indicate through floor covering.
 - g. On surfaces intended to receive waterproofing membranes grind off defects that might tear or otherwise damage membrane.
 - 2. Non-slip slab finish:
 - a. Aggregate: Crushed, ceramic bonded aluminum oxide particles. Apply at 25 pound per 100 square feet.
 - b. Blend aggregate with Portland cement in proportions recommended by manufacturer of aggregate.
 - c. Give surface a float finish.
 - d. Apply approximately two-thirds of blended material for required coverage to surface by a method that ensures even coverage without segregation.
 - 1) Begin floating immediately.
 - e. After material has been embedded by floating, apply remainder of blended material to surface at right angles to previous application.
 - f. Make second application heavier in areas not sufficiently covered by first application. Follow with second floating immediately.
 - g. After selected material has been embedded by two floatings, complete operation with a broomed finish.

END OF SECTION

SECTION 03 45 00
ARCHITECTURAL PRECAST CONCRETE (APC)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Architectural Precast Concrete (APC) in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Fabricator Qualifications:
 - 1. Firm experienced in producing architectural precast concrete units similar to those indicated and with a record of successful performance.
 - 2. PCI Certified for Group A, Category A1-Architectural Cladding and Load Bearing Units or designated as an APA certified plant for production of architectural precast concrete products.
 - 3. Capacity to produce required units without delaying Work.
 - 4. Assume responsibility for engineering of APC units to comply with Building Code requirements as locally adopted.
- B. Engineer Qualifications:
 - 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
- C. Erector Qualifications:
 - 1. Certificate of Compliance furnished by PCI designating qualification in Category A (Architectural Systems) for non-loadbearing members.
 - 2. Certify welders according to AWS D1.1: Structural Welding Code – Steel and AWS D1.4: Structural Welding Code – Reinforcing Steel.
- D. Testing Agency Qualifications:
 - 1. An independent testing agency, acceptable to authorities having jurisdiction and qualified to conduct the testing indicated.
- E. Reference Standards:
 - 1. ACI 318 Building Code Requirements for Structural Concrete
 - 2. PCI MNL117 Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products
 - 3. ASTM A27/A27M Steel Castings, Carbon for General Application
 - 4. ASTM A36/A36M Carbon Structural Steel
 - 5. ASTM A47/A47M Ferritic Malleable Iron Castings
 - 6. ASTM A108 Steel Bar, Carbon and Alloy, Cold Finished
 - 7. ASTM A123/A123M Zinc (Hot-Dipped Galvanized) Coatings of Iron and Steel Products
 - 8. ASTM A185 Steel Welded Wire Fabric, Plain for Concrete Reinforcement.
 - 9. ASTM A283/A283M Low and Intermediate Tensile Strength Carbon Steel Plates
 - 10. ASTM A307 Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength
 - 11. ASTM A500/A500M Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - 12. ASTM A563 Carbon and Alloy Steel Nuts
 - 13. ASTM A572/A572M High-Strength Low-Alloy Columbium-Vanadium Structural Steel

14. ASTM A615/A615M Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
15. ASTM A1064/A1064M Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
16. ASTM C33/C33M Concrete Aggregates
17. ASTM C39/C39M Compressive Strength of Cylindrical Concrete Specimens
18. ASTM C231/C231M Test for Air Content of Freshly Mixed Concrete by the Pressure Method
19. ASTM C260/C260M Specifications for Air-Entraining Admixtures for Concrete
20. ASTM C494/C494M Specifications for Chemical Admixtures for Concrete
21. ASTM C578 Rigid, Cellular Polystyrene Thermal Insulation
22. ASTM C642 Test for Density, Absorption, and Voids in Hardened Concrete
23. ASTM C979/C979M Pigments for Integrally Colored Concrete
24. ASTM C1088 Standard Specifications for Thin Veneer Brick Units Made From Clay or Shale
25. ASTM C1107/C110M Standard Specification for Packaged Dry, Hydraulic Cement Grout (non-shrink)

F. Testing:

1. Test one set of cylinders for each 50 cubic yards 38 cubic meters of concrete, but not less than one set for each day's pour.
 - a. Test for air content each time cylinders are made, in accordance with ASTM C231.
 - b. Test for water absorption in accordance with ASTM C642 or PCI MNL 117.
 - c. Test cylinders in accordance with ASTM C39. One at 7 days and two at 28 days.

G. Fabrication Tolerances:

1. Refer to Part 2.

H. Erection Tolerances:

1. Refer to Part 3.

1.3 SUBMITTALS

A. Product Data:

1. For each type of material and accessory.

B. Shop Drawings:

1. Detail fabrication and installation of architectural precast concrete units including:
 - a. Member locations, plans, elevations, dimensions, shapes and cross sections.
 - b. Details at joints, reveals, and surface finish.
 - c. Loose and cast-in hardware, connections and anchorage devices.
 - d. Locations of dry joints if two-stage casting is proposed.
 - e. Sequence of erection for special conditions.
 - f. Identification mark on each panel.

- g. Relationship of architectural precast concrete units to adjacent materials.
- h. Indicate locations and details of brick units and joint treatment.
- i. Indicate locations and details of stone facings, stone anchors, and joint widths.

C. Samples:

- 1. Three, 12 x 12 x 2 inches 300 x 300 x 50 mm, samples, replicating each of the colors and textures indicated, approval of appearance.
 - a. Provide samples for each color/texture combination.
 - b. Label samples to indicate name of project; fabricator; finish; type, color and source of cement and aggregate.
- 2. Mock-up Panel on-site: As described herein.
- 3. Samples for Brick units showing the full range of color and texture.
 - a. Sample of each corner or standard special shape.
 - b. Sketch of each nonstandard special shape with dimensions.
 - c. Sample showing color and texture of joint treatment.

D. Project Information:

- 1. Test reports signed by certified testing agency.
- 2. Design Mixes: For each concrete mix including compressive strength and water absorption tests.
- 3. Design Calculations:
 - a. Submit calculations signed and sealed by Specialty Structural Engineer, as described in Quality Assurance, Design Requirements.
 - b. Submit concurrent with shop drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Architectural Precast Concrete (APC):

- 1. Base:
 - a. Wells.
- 2. Optional:
 - a. Spancrete.
 - b. Gage Brothers.

B. Thin Brick Facings:

- 1. Base:
 - a. Belden.
- 2. Optional:
 - a. Glengarry.
 - b. Endicott.

C. Rigid Board Insulation:

- 1. Base:
 - a. DuPont.
- 2. Optional:
 - a. Kingspan.
 - b. Owens Corning.

- D. Galvanize Repair Paint:
 - 1. Base:
 - a. Tnemec.
 - b. ZRC Worldwide.
- E. Other materials listed:
 - 1. Base:
 - a. As indicated.
- F. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

- A. Comply with ACI 318 and the design recommendations of PCI MNL 120: PCI Design Handbook – Precast and Prestressed Concrete, applicable to types of architectural precast concrete units indicated.
- B. Design units and connections to satisfy requirements of building codes.
- C. Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Include effect from adjacent attached construction.
 - 2. Wind pressure, and/or earthquake lateral forces.
 - 3. Live Loads.
 - 4. Dead load of unit plus superimposed loads.
 - 5. Handling, transportation, and erection forces.
 - 6. Temperature stresses appropriate for project site and conditions.
 - 7. Shrinkage stresses.
- D. Design framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
 - 1. Upward and downward movement of $L/300$ for floors and $L/200$ for roofs.
- E. Show, by engineering calculations, embedded connections can adequately support anticipated loads.
 - 1. When approved by Engineer, load tests may be substituted for calculations.
- F. Design, detail and provide internal reinforcing and embedded connection hardware.
- G. Reinforce units with welded wire fabric or reinforcing bars as needed to satisfy design criteria or provide following minimum reinforcing, whichever is greater:
 - 1. Unit thickness up to 4 inches 100 mm: One layer 4 x 4 - W4.0 x W4.0 102x102 - MW9.1/MW9.1.
 - 2. Unit thickness over 4 inches 100 mm: Two layers 4 x 4 - W4.0 x W4.0 102x102 - MW9.1/MW9.1.
- H. When unit is supported from rigid base, design connections to permit reasonable amount of independent vertical movement of structural frame.
- I. Attach connections placing lateral loads on structural members to elements capable of resisting forces without reinforcing, unless such reinforcing is provided by erector at no additional cost to Owner and in manner acceptable to Engineer, unless detailed and accommodated otherwise.
- J. Design, detail and provide connection hardware and anchors to be set in CIP Concrete and for Structural Steel frames associated with precast unit connections.

2.3 FORM MATERIALS

- A. Forms:
 - 1. Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated.
 - 2. Non-reactive with concrete and suitable for producing required finishes.
- B. Form Liners:
 - 1. Units of face design, texture, arrangement, and configuration indicated or to match precast Design Reference Sample.
 - 2. Provide solid backing and form supports to ensure that form liners remain in place during concrete placement.
- C. Release Agents:
 - 1. Commercially produced liquid release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.4 REINFORCING MATERIALS

- A. Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and wire in place.
- B. Use products with Corrosion Resistant Coatings of type indicated below when concrete cover on exterior face is less than 1-1/2 inches 38 mm or interior face is less than 3/4 inches 19 mm. Otherwise, uncoated reinforcing may be used.
- C. Reinforcing Bars:
 - 1. Welded bars: ASTM A706.
 - 2. Non-welded: ASTM A615 Grade 60, deformed.
- D. Welded Wire Reinforcement:
 - 1. Galvanized and chromate wash treated.
 - 2. Plain: ASTM A185, flat sheet.
- E. Corrosion Resistant Coatings:
 - 1. Hot dip Galvanizing (HDG) Coating:
 - a. Reinforcing bars and wire mesh: ASTM A123 applied after welding/fabrication.
 - b. ASTM A767, Class II zinc coated, hot dip galvanized (HDG) and chromate wash treated after fabrication and bending.

2.5 CONCRETE MATERIALS

- A. Design Reference Sample:
 - 1. Sample Number 313 as illustrated in Architectural Precast Concrete – Color and Texture Selection Guide, published by PCI.
- B. Portland Cement:
 - 1. ASTM C150, Type I or III.
 - 2. Same type, brand, and mill source throughout production.
 - 3. Cement Color:
 - a. Face Mixes (portions of units exposed to view):
 - 1) As necessary to reproduce coloration of Design Reference Sample.

- b. Backup mixes (portions of units not exposed to view):
 - 1) Contractor's option.
- C. Normal Weight Aggregates:
 - 1. Comply with ASTM C33 except as modified by PCI MNL 117:
 - a. Employ coarse aggregates complying with Class 5S.
 - 2. Stockpile fine and coarse aggregates for each type of exposed finish from a single source for entire project.
 - 3. Face Mix Coarse Aggregates:
 - a. Selected, hard, and durable; free of material that reacts with cement or causes staining.
 - b. Color: To match selected Design Reference Sample.
 - c. Gradation:
 - 1) To match selected Design Reference Sample.
 - 4. Face Mix Fine Aggregates:
 - a. Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Engineer.
 - b. Color: To match selected Design Reference Sample.
- D. Coloring Admixture:
 - 1. Pigment: As required by Design Reference Sample.
 - 2. ASTM C979, synthetic or natural mineral oxide pigments or colored water reducing admixtures, temperature stable and non-fading.
 - 3. Lime and alkali resistant.
 - 4. Limit type and amount used so as not to reduce quality of concrete.
- E. Water:
 - 1. Potable, clean, fresh, free from oil, acid, organic matter or other deleterious substances that may affect color, stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- F. Air Entraining Admixture:
 - 1. ASTM C260, certified by manufacturer to be compatible with other required admixtures.
- G. Water Reducing Admixture: ASTM C494, Type A.
- H. Retarding Admixture: ASTM C494, Type B.
- I. Water Reducing and Retarding Admixture: ASTM C494, Type D
- J. Water Reducing and Accelerating Admixture: ASTM C494, Type E.
- K. High Range, Water Reducing Admixture: ASTM C494, Type F.
- L. High Range, Water Reducing and Retarding Admixture: ASTM C494, Type G.
- M. Plasticizing Admixture for Flowable Concrete: ASTM C1017.
- N. Admixtures containing calcium chloride, or more than 0.15% chloride ions or other salts by weight of admixture are not permitted.

2.6 CARBON STEEL CONNECTION MATERIALS

- A. Carbon Steel Shapes and Plates:
 - 1. ASTM A36 except silicon content in the range of 0 to 0.03%.
 - a. 0.15 to 0.25% for materials to be galvanized.
 - b. Steel with chemistry conforming to the formula $Si + 2.5P$ less than or equal to 0.09 is also acceptable.
 - 2. ASTM A283 for Carbon Steel Plate.
- B. Carbon Steel Headed Studs:
 - 1. ASTM A108, Grades 1018 through 1020, cold finished and bearing the minimum mechanical properties for studs as indicated under MNL 117, Table 3.2.3.; AWS D1.1, Type A or B, with arc shields.
- C. Malleable Iron Castings: ASTM A47, Grade 32510 or 35028.
- D. Carbon Steel Castings: ASTM A27, Grade U-60-30.
- E. High Strength, Low Alloy Structural Steel:
 - 1. ASTM A572 except silicon content in the range of 0 to 0.03%.
 - a. 0.15 to 0.25% for materials to be galvanized.
 - b. Steel with chemistry conforming to the formula $Si + 2.5P$ less than or equal to 0.09 is also acceptable.
- F. Carbon Steel Structural Tubing: ASTM A500, Grade B.
- G. Wrought Carbon Steel Bars: ASTM A675, Grade 65.
- H. Deformed Steel Wire or Bar Anchors: ASTM A1064/A1064M or ASTM A706.
- I. Carbon Steel Bolts and Studs:
 - 1. Hex head bolts and studs: ASTM A307, Grade A.
 - 2. Nuts: ASTM A563, Grade A.
 - 3. Flat, unhardened steel washers: ASTM F844.
 - 4. Headed studs or deformed bar anchors:
 - a. Headed studs having minimum tensile strength of 60,000 psi 415 MPa, minimum yield strength of 52,000 psi 360 MPa, ASTM A108.
 - b. Deformed bar anchors having minimum tensile strength of 80,000 psi 550 MPa, minimum yield strength of 70,000 psi 485 MPa, ASTM A1064/A1064M.
- J. High Strength Bolts and Nuts:
 - 1. Heavy structural steel hex bolts: ASTM A325 or ASTM A490, Type 1,
 - 2. Heavy carbon steel hex nuts: ASTM A563.
 - 3. Hardened carbon steel washers: ASTM F436.
- K. Protective Coating:
 - 1. Exterior steel items and items indicated for galvanizing:
 - a. Apply zinc coating by hot dip process according to ASTM A123 after fabrication or ASTM A153 as applicable.

2.7 BEARING PADS AND OTHER ACCESSORIES

- A. Provide bearing pads for architectural precast concrete units as follows:
 - 1. Elastomeric Pads:
 - a. AASHTO M 251, plain, vulcanized, 100% neoprene.
 - b. Surface hardness: 50 to 70 Shore A durometer according to ASTM D2240.
 - c. Minimum tensile strength: 2250 psi 15.5 MPa per ASTM D412.
 - 2. Fiber Reinforced Elastomeric Pads:
 - a. Preformed, randomly oriented synthetic fibers set in elastomer.
 - b. Surface hardness: 70 to 90 Shore A durometer according to ASTM D2240.
 - c. Capable of supporting a compressive stress of 3300 psi 27.7 MPa with no cracking, splitting or delaminating in the internal portions of the pad.
 - d. Test one specimen for each 200 pads used in the project.
 - 3. Fabric Reinforced Elastomeric Pads:
 - a. Preformed, horizontally layered cotton duck fabric bonded to an elastomer.
 - b. Surface hardness: 80 to 100 Shore A durometer according to ASTM D2240.
 - c. Conforming to Division II, Section 18.10.2 of AASHTO LRFD Bridge Design Specifications, or Military Specification, MIL-C-882D.
 - 4. Frictionless Pads:
 - a. Teflon, glass fiber reinforced; bonded to stainless or mild steel plates, of type required for in-service stress.
 - 5. High-Density Plastic:
 - a. Multimonomer, non-leaching, plastic strip
- B. Reglets and Counterflashing:
 - 1. Specified in Section 07 62 00.
 - 2. Fabricator to obtain reglet material specified and cast reglets into APC pieces.
- C. Accessories:
 - 1. Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.8 THIN BRICK UNITS AND ACCESSORIES

- A. Thin Brick Units:
 - 1. Comply with PCI Standard for Thin Brick.
 - 2. Minimum Thickness, plus or minus 1/16 inches 1.5 mm:
 - 3. Face Dimensions, actual:
 - a. Norman: 11-5/8 inches long x 2-1/4 inches tall 295 mm long x 57 mm tall
 - 1) Pattern: As indicated on Drawings..
 - 4. Special Shapes: Include corners, edge corners, and end edge corners.
 - 5. Bond Strength to concrete:
 - a. Shear bond strength of 150 psi 1034 kPa when tested per ASTM C482.
 - b. Tensile bond strength of 150 psi when tested per ASTM E488.

6. Initial Rate of Absorption:
 - a. Less than 30g/30 inches² per minute when tested per ASTM C67.
 - b. Units with higher IRA should be wetted before placement to improve bond.
 7. Back Surface Texture: Scored, combed, wire roughened, ribbed, key-backed or dovetailed.
 8. Base Product: "Admiral Full Range Velour" by Belden Brick Company.
- B. Pointing Grout:
1. Latex Portland Cement complying with ANSI A118.6 and as follows:
 - a. Dry grout mixture:
 - 1) Factory prepared consisting of Portland cement, graded aggregate, and dry, re-dispersible, ethylene-vinyl-acetate additive for mixing with water; uniformly colored.
 - b. Commercial Portland Cement grout:
 - 1) Factory prepared, with liquid styrene-butadiene rubber or acrylic resin latex additive; uniformly colored.
 - c. Colors: Basis of Design: "SM600 Dark Brown" by Spec Mix, Inc.
 - 1) Or alternate as approved by Engineer. Design intent is to tint mortar to a shade as dark or darker than darkest bricks in selected range.

2.9 INSULATED PANEL ACCESSORIES

- A. Extruded Polystyrene (XPS) Board Insulation:
1. Rigid cellular polystyrene thermal insulation complying with ASTM C578, Type IV.
 2. Edges:
 - a. Square edges.
 3. Minimum aged thermal value per unit thickness: 5.0 R per IN 0.88 R per 25 mm.
 4. Required Thickness: 3 inches.
- B. Wythe Connectors:
1. Devices specifically manufactured to connect wythes of precast concrete panels:
 - a. Bent galvanized reinforcing bars or welded wire trusses.
 - b. Glass-fiber and vinyl-ester polymer connectors.

2.10 CONCRETE MIX DESIGN

- A. Maximum Water Absorption:
1. 6% by weight, equal to 14% by volume, tested according to PCI MNL 117.
- B. Air-Entrainment:
1. Provide concrete containing air-entraining admixture producing air content between 6 and 8% including entrapped air.
- C. Normal Weight Concrete Face and Backup Mixes:
1. Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on project, to provide normal weight concrete with the following properties:
 - a. Minimum Compressive Strength (28 Days): 5000 psi 34.5 MPa.
 - b. Maximum Water-Cementitious Materials Ratio: 0.45.

2.11 MOLD FABRICATION

- A. Molds:
 - 1. Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete placement and vibration operations and temperature changes and for prestressing and de-tensioning operations.
 - 2. Coat contact surfaces of molds with release agent before reinforcement is placed.
 - 3. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Form Liners:
 - 1. Place form liners accurately to provide finished surface texture indicated.
 - 2. Provide solid backing and supports to maintain stability of liners during placing of concrete.
 - 3. Coat form liner with form-release agent.
- C. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
- D. Form joints are not permitted on faces exposed to view in the finished work.

2.12 PANEL FABRICATION

- A. Mark each unit for identification and date of casting.
- B. Locate holes, inserts and other lifting mechanisms in non-finished surfaces.
- C. APC Panel-to-Panel Joints:
 - 1. Typical:
 - a. Unless otherwise shown provide for uniform joint widths of 3/4 inches 19 mm.
 - 2. Corners:
 - a. 3/4 inches 19 mm wide butt joints where indicated.
- D. Panel Edge and Corner Treatment:
 - 1. Uniformly chamfered or as otherwise indicated.
- E. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware:
 - 1. Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements.
 - 2. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
- F. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on drawings.
 - 1. Cast-in openings larger than 10 inches 250 mm in any dimension.
 - 2. Do not drill or cut prestressing strand.
- G. Reinforcement:
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 - a. When damage to epoxy coated reinforcing exceeds limits specified ASTM A775 repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - 2. Accurately position, support and secure reinforcement during concrete placement and consolidation operations.
 - a. Completely conceal support devices to prevent exposure on finished surfaces.

3. Install welded wire reinforcement in lengths as long as practicable.
 - a. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design.
 - b. Offset laps of adjoining widths to prevent continuous laps in either direction.
 - H. Prestress tendons for architectural precast concrete units by either pre-tensioning or post-tensioning methods.
 1. De-tension or post-tension prestressed architectural precast concrete units after concrete has reached its indicated minimum design release compressive strength as established by test cylinders.
 2. Protect strand ends and anchorages to prevent corrosion and rust spots.
 - I. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
 - J. Comply with ACI 305R recommendations for hot weather concrete placement.
 - K. Comply with ACI 306.1 procedures for cold weather concrete placement.
 - L. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings as indicated on erection drawings.
 - M. Repair damaged architectural precast concrete units to meet acceptability requirements of PCI MNL 117.
- 2.13 PANEL FABRICATION - THIN BRICK FACED UNITS
- A. Place form liner templates accurately to provide grid for brick facings.
 - B. Provide solid backing and supports to maintain stability of liners while placing bricks and during placing of concrete.
 - C. Bond Pattern: Running Bond with nominal 3/8 inches 9.5 mm joints.
 - D. Clean faces and joints of brick facing after stripped from forms.
- 2.14 FABRICATION - INSULATED PANELS
- A. Cast and screed supported wythe over mold.
 - B. Place insulation boards, abutting edges and ends of adjacent boards.
 1. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.
 2. Extend insulation from edge to edge of panel with no reduction in insulation thickness unless noted or shown otherwise.
 - C. Cast and screed top wythe to meet required finish.
- 2.15 FABRICATION TOLERANCES
- A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with the following product tolerances.
 1. Overall Height and Width of Units, measured at the Face Exposed to View:
 - a. 10 feet 3 M or under: Plus or minus 1/8 inches 3 mm.
 - b. 10 feet 3 M to 20 feet 6 M: Plus 1/8 inches 3 mm, minus 3/16 inches 4.5 mm.
 - c. 20 feet 6 M to 40 feet 12 M: Plus 1/8 inches 3 mm, minus 1/4 inches 6 mm.
 - d. Each additional 10 feet 3 M: Plus or minus (1 inches 2000) to maximum 1/16 inches per 10 feet 1.5 mm per 3 M.

2. Overall Height and Width of Units, measured at the Face Not Exposed to View:
As follows:
 - a. 10 feet 3 M or under: Plus or minus 1/4 inches 6 mm.
 - b. 10 feet 3 M to 20 feet 6 m: Plus 1/4 inches, minus 3/8 inches 9.5 mm.
 - c. 20 feet 6 M to 30 feet 9 m: Plus or minus 3/8 inches 9.5 mm.
 - d. Each additional 10 feet: Plus or minus 1/8 inches 3 mm.
 3. Total Thickness or Flange Thickness: Plus 1/4 inches 6 mm, minus 1/8 inches 3mm.
 4. Rib Thickness: Plus or Minus 1/8 inches 3 mm.
 5. Rib to Edge of Flange: Plus or Minus 1/8 inches 3 mm.
 6. Distance between Ribs: Plus or Minus 1/8 inches 3 mm.
 7. Alignment of ribbed members:
 - a. 3/16 inches 4.5 mm up to 40 feet 12 m.
 - b. 1/4 inches 6 mm in 40 feet 12 M or more.
 8. Variation from Square: Plus or Minus 1/8 inches per 72 inches 3 mm per 1800 mm up to 1/4 inches 6 mm.
 9. Length and Width of Block outs and Openings within One Unit: Plus/minus 1/4 inches 6 mm.
 10. Location and Dimension of Block outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or Minus Plus/minus 3/4 inches 19 mm.
 11. Dimensions of Haunches: Plus or Minus 1/4 inches 6 mm.
 12. Haunch Bearing Surface Deviation from Specified Plane: Plus or Minus 1/8 inches 3 mm.
 13. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or Minus 1/4 inches 6 mm.
 14. Bowing: Plus or Minus L/360, maximum 3/4 inches 19 mm.
 - a. Differential bowing between adjacent members: 1/4 inches 6 mm.
 15. Angular deviation of plane of side mold: (1 inches 100) to maximum 1/16 inches 1.5 mm.
 16. Jog in alignment of edge: 1/4 inches 6 mm.
 17. Local Smoothness: 1/4 inches 6 mm per 10 feet 3 m.
 18. Maximum Warp (One corner out of plane of other three): (1 inches 200) 1/16 inches per foot 1 mm per 200 mm from nearest adjacent corner.
 19. Tipping and Flushness of Plates: Plus or Minus 1/4 inches 6 mm.
 20. Dimensions of Architectural Features and Rustications: Plus or Minus 1/8 inches 3 mm.
 21. Dimensions not listed above: In any length: (1 inches 2000) to maximum 1/8 inches 3 mm.
- B. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
1. Weld Plates: Plus or Minus 1 inch 25 mm.
 2. Inserts: Plus or Minus 1/2 inches 13 mm.
 3. Handling Devices: Plus or Minus 3 inches 75 mm.
 4. Reinforcing Steel and Welded Wire Reinforcement: Plus or Minus 1/4 inches 6 mm where position has structural implications or affects concrete cover; otherwise, Plus or Minus 1/2 inches 13 mm.

5. Reinforcing Steel Extending out of Member: Plus or Minus 1/2 inches 13 mm of plan dimensions.
6. Tendons: Plus or Minus 1/4 inches 6 mm, vertical; Plus or Minus 1 inch 25 mm horizontal.
7. Location of Rustication Joints: Plus or Minus 1/8 inches 3 mm.
8. Location of Opening within Panel: Plus or Minus 1/4 inches 6 mm.
9. Location of Flashing Reglets: Plus or Minus 1/4 inches 6 mm.
10. Location of Flashing Reglets at Edge of Panel: Plus or Minus 1/8 inches 3 mm.
11. Reglets for Glazing Gaskets: Plus or Minus 1/8 inches 3 mm.
12. Electrical Outlets, Hose Bibs: Plus or Minus 1/2 inches 13 mm.
13. Location of Bearing surface from End of Member: Plus or Minus 1/4 inches 6 mm.
14. Allowable Rotation of Plate, Channel Inserts, Electrical Boxes: 2-degree rotation or 1/4 inches 6 mm maximum over the full dimension of the unit.
15. Position of Sleeve: Plus or Minus 1/2 inches 13 mm.
16. Location of Window Washer Track or Buttons: Plus or Minus 1/8 inches 3 mm.

2.16 FABRICATION TOLERANCES – BRICK FACED UNITS

- A. The number of bricks allowed these misalignments is limited to 2% of the total bricks within a single panel.
 1. Alignment of mortar joints:
 - a. Jog in Alignment: 1/8 inches 3 mm.
 - b. Alignment with Panel Centerline: Plus or Minus 1/8 inches 3 mm.
 2. Variation in Width of Exposed Mortar Joints: Plus or Minus 1/8 inches 3 mm.
 3. Tipping of Individual Bricks from the Panel Plane of Exposed Brick Surface: Plus 1/16 inches 1.5 mm; Minus 1/4 inches 6 mm < depth of form liner joint.
 4. Exposed Brick Surface Parallel to Primary Control Surface of Panel: Plus 1/4 inches 6 mm; Minus 1/8 inches 3 mm.
 5. Individual Brick Step in Face from Panel Plane of Exposed Brick Surface: Plus 1/16 inches 1.5 mm; Minus 1/4 inches 6 mm < depth of form liner joint.

2.17 FINISHES

- A. Panel faces shall be free of joint marks, grain, and other obvious defects.
- B. Corners, including false joints shall be uniform, straight and sharp.
- C. Exposed Face and Edge Surfaces:
 1. Match colors and textures of Design Reference Sample
 2. Acid Etched Finish:
 - a. Use acid and hot water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 - b. Protect hardware, connections and insulation from acid attack.
- D. Finishes of other Exposed Surfaces:
 1. Panel Tops Returns (i.e. parapet and sill): Finish to match face surface finish.
 2. Panel Bottom Returns (i.e. soffits): Finish to match face surface finish.
 3. Back of Panel (i.e. interior): Finish to be steel trowel with light sandblast.

E. Unexposed surfaces:

1. Float finish.

2.18 SOURCE QUALITY CONTROL

A. Quality Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.

1. If using self-consolidating concrete: Also test and inspect according to PCI Guidelines for the Use of Self-Consolidating Concrete.

B. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 requirements for concrete strength.

C. Testing:

1. If there is evidence that the concrete strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, APC Fabricator will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42.

2. Procedural Requirements:

- a. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Engineer.
- b. Cores will be tested in an air dry condition.
- c. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85% of the 28 day design compressive strength and no single core is less than 75% of the 28 day design compressive strength.
- d. Test results will be made in writing on the same day that tests are performed, with copies to Engineer, Contractor, and precast concrete fabricator.

3. Reports:

- a. Test reports will include the following:
 - 1) Project identification name and number.
 - 2) Date when tests were performed.
 - 3) Name of precast concrete fabricator.
 - 4) Name of concrete testing agency.
 - 5) Identification letter, name, and type of precast concrete units or units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length/diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

4. Patching:

- a. If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

D. Defective Work:

1. Architectural precast concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range are unacceptable.
2. Chipped, spalled or cracked units may be repaired, if repaired units match the visual mock-up.

3. The Engineer reserves the right to reject any unit if it does not match the accepted samples and visual mock-up.
4. Replace unacceptable units with precast concrete units that comply with requirements.

2.19 RELATED ITEMS SPECIFIED ELSEWHERE

- A. Cast-in-Place Concrete: Specified in elsewhere in Division 03.
- B. Structural Steel for connection attachment to structural steel framing: Specified in Section 05 12 00.
- C. Sheet Metal Flashing and Trim: Specified in Section 07 62 00.
- D. Backer Rod and Sealants: As specified in Section 07 92 13.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.
 2. Start of installation constitutes acceptance of surfaces and conditions.
- B. Do not install precast concrete units until supporting cast-in place concrete building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is structurally ready to receive loads from precast.

3.2 ERECTION

- A. Perform erection under supervision of qualified superintendent.
- B. Employ only skilled and experienced personnel and equipment capable of properly installing units.
- C. Erect architectural precast concrete level, plumb and square within the specified allowable tolerances.
- D. Connect APC units in position by bolting, welding, grouting, or as otherwise indicated on approved erection drawings.
 1. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.
 2. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.
- E. Welding:
 1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
 2. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS.
 3. Protective Coating Repair:
 - a. Clean weld affected metal surfaces with chipping hammer followed by brushing then apply a minimum 0.004 inches 0.1 mm thick coat of Galvanize Repair Paint to galvanized surfaces in conformance with ASTM A780.
- F. Bolted Connections:
 1. At bolted connections, use lock washers, tack welding, or other acceptable means to prevent loosening of nuts after final adjustment.

- G. Grouting Connections:
1. Grout connections where required or indicated.
 2. Retain grout in place until hard enough to support itself.
 3. Pack spaces with stiff grout material, tamping until voids are completely filled.
 4. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces.
 5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and true, without exceeding the following non-cumulative erection tolerances:
1. Total deviation equal to maximum allowance specified for the structural frame.
 2. Plan Location from Building Grid Datum: Plus or Minus 1/2 inches 13 mm.
 3. Plan Location from Centerline of Steel: Plus or Minus 1/2 inches 13 mm.
 4. Top Elevation from Nominal Top Elevation:
 - a. Exposed Individual Panel: Plus or Minus 1/4 inches 6 mm.
 - b. Non-exposed Individual Panel: Plus or Minus 1/2 inches 13 mm.
 - c. Exposed Panel Relative to Adjacent Panel: 1/4 inches 6 mm.
 - d. Non-exposed Panel Relative to Adjacent Panel: 1/2 inches 13 mm.
 5. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: 1/2 inches 13 mm.
 - b. Maximum High: 1/4 inches 6 mm.
 6. Maximum Plumb Variation:
 - a. Over the Lesser of Height of Structure or 100 feet 30 m: 1 inch 25 mm.
 - b. Plumb in Any 10 feet 3 M of Element Height: 1/4 inches 6 mm.
 7. Maximum Jog in Alignment of Matching Edges: 1/4 inches 6 mm.
 8. Joint Face Width (governs over Joint Taper):
 - a. Maximum deviation from Specified Width: Plus or Minus 3/16 inches 4.5 mm.
 - b. Step in face: 1/4 inches 6 mm.
 9. Maximum Joint Taper:
 - a. Total: 3/8 inches 9.5 mm.
 - b. In 10 feet 3 m: 1/4 inches 6 mm.
 10. Maximum Jog in Alignment of Matching Faces: 1/4 inches 6 mm.
 11. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inches 6 mm.
 12. Opening Height between Spandrels: Plus or Minus 1/4 inches 6 mm.

3.4 JOINT SEALANTS

- A. Seal architectural precast concrete work as specified in Section 07 92 13.

3.5 FIELD QUALITY CONTROL

- A. Field Testing:
1. Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.

2. Testing agency will report test results promptly and in writing to Contractor and Engineer.
 3. Repair or remove and replace work that does not comply with specified requirements.
 4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.
- B. Field Welds:
1. Subject to visual inspections and non-destructive testing in accordance with ASTM E165 or ASTM E709.

3.6 REPAIRS

- A. Repairs will be permitted provided structural adequacy of units and appearance are not impaired.
- B. Replace units which exhibit damage to surfaces, finish, corners or edges which will be exposed to view after setting in place, or which is broken or cracked due to shrinkage, temperature, transportation, handling or erection.
 1. When approved in writing by Engineer, unit may be repaired in place.
 2. Perform such work at no additional expense to Owner.
- C. Acceptance of units, repaired pursuant to written approval, is contingent upon repairs being skillfully done so as to be sound, permanent, flush with adjacent surfaces and of color and texture matching similar adjoining surfaces and indicating no apparent line of demarcation between original and repaired work, when viewed from a distance of 20 feet 6 mm.
- D. Remove and replace other work damaged by removal of defective precast members, at no additional cost to Owner.
- E. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780.
- F. Remove and replace damaged APC units when repairs do not meet requirements.

3.7 CLEANING

- A. Clean surfaces of precast concrete to be exposed to view prior to shipping.
- B. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 1. Protect other work from staining or damage due to cleaning operations.
 2. Coordinate cleaning of precast units with cleaning of glass and other work.
 3. Pre-clean soiled surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water.
 4. Perform cleaning procedures using product specified in Section 04 05 10 or as otherwise recommended by precast concrete fabricator.
 - a. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.
 5. Start at top of building and proceed downward.
 6. Leave precast units clean, free of traces of cleaning compound and with joints watertight.

END OF SECTION

SECTION 04 05 05
COLD AND HOT WEATHER MASONRY PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Cold and Hot Weather Masonry Procedures, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. International Building Code, Chapter 21: Masonry.
- B. Local Building Code.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. As required to achieve desired results.

PART 3 - EXECUTION

3.1 PROCEDURES

- A. ACI 530.1/ASCE 6/TMS 602: Specification for Masonry Structures.
- B. Brick Industry Association (BIA), Technical Note 1: Hot and Cold Weather Construction
- C. National Concrete Masonry Association (NCMA), TEK 03-01C: All Weather Concrete Masonry Construction.

3.2 GENERAL

- A. At end of each day or at shutdown, cover tops of walls not enclosed or sheltered.
- B. Do not use frozen or ice coated materials.
- C. Remove and replace frozen or damaged masonry to satisfaction of Engineer.

3.3 TEMPORARY FACILITIES

- A. Construct and maintain temporary protection required to permit continuous and orderly progress of work.
- B. Provide temperature conditioning sufficient for indicated temperatures.
- C. Provide sufficient temporary lighting to permit work to be correctly performed.

END OF SECTION

SECTION 04 05 10
MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Masonry Cleaning in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Project Information:
 - 1. Name of proposed product and manufacturer.
 - 2. Certification that the proposed products are compatible with materials on subject project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Cleaners:
 - 1. Base:
 - a. ProSoCo.
 - 2. Optional:
 - a. EaCo Chem.
- B. Diedrich. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Use only products which are recommended by manufacturer of material to be cleaned.
- B. Brick Masonry Cleaner:
 - 1. Verify compatibility with brick manufacturer.
 - 2. Brick:
 - a. Base Product: Sure Klean Lime Solvent 101 by ProSoCo.
- C. Concrete Masonry (CMU) Cleaners:
 - 1. Clean CMU which will remain exposed to view (including CMU walls which are scheduled for painting).
 - 2. Lightweight and Normal Weight CMU:
 - a. Base Product: Sure Klean Custom Masonry Cleaner by ProSoCo.
- D. Cast-in-Place Concrete Cleaner:
 - 1. Clean Cast-in-Place concrete walls which will remain exposed to view (including CIP walls which are scheduled for painting).
 - 2. Clean with most effective products which are appropriate for texture and color specified.
 - 3. Smooth Textures:
 - a. Base Product: Sure Klean Light Duty Concrete Cleaner by ProSoCo.
 - 4. Abrasive blasted, Etched, and Exposed-aggregate Textures:
 - a. Base Product: Sure Klean Custom Masonry Cleaner or Heavy-duty Concrete Cleaner both by ProSoCo.

- E. Architectural Precast Concrete (APC) Cleaner:
 - 1. Clean with most effective products which are appropriate for texture and color specified.
 - 2. Base Product: Sure Klean Light Duty Concrete Cleaner by ProSoCo.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cleaned.
 - 1. If necessary, point with mortar.
- B. Waiting Time before cleaning:
 - 1. Mortar Type N: Allow mortar to cure for 14 to 28 days prior to cleaning.
 - 2. Mortar Types M and S: Allow mortar to cure for 7 to 14 days prior to cleaning.
 - 3. Colored Mortar: Allow mortar to cure for 28 days prior to cleaning.
- C. Remove excess mortar using wooden paddles and scrapers.
- D. Do not proceed with cleaning until unsatisfactory conditions have been corrected.
- E. Test 4 x 4 feet 1.2 x 1.2 M area of each surface type for compatibility with cleaner, using recommended dilutions, prior to full scale cleaning operations.
- F. Cleaning indicates acceptance of surfaces and responsibility for performance.

3.2 PREPARATION

- A. Protect adjacent surfaces, not scheduled for cleaning.
- B. Prepare surfaces as recommended by manufacturer.

3.3 CLEANING

- A. Clean surfaces as recommended by manufacturer.
- B. Do not use wire brushes.
- C. Thoroughly rinse and pre-soak walls.
- D. Flush loose mortar and dirt from surface.
- E. Wet to prevent runoff streaking.
- F. Apply solution using fibered wall washing brush or low-pressure spray.
 - 1. Maximum Pressure: not to exceed 400 psi 2,750 kPa.
 - 2. Tip spray angle: Not less than 25 degrees.
 - 3. Maximum rate of flow: 4 to 6 gpm 15 to 23 LPM.
 - 4. Tip shall be held at least 12 inches 300 mm from surface of masonry.
 - 5. Comply with manufacturer's recommendations, where more restrictive.
- G. Scrape off mortar and re-apply cleaning solution.
- H. After scrubbing, clean thoroughly with low pressure water.
 - 1. Comply with low-pressure spray criteria listed above.

END OF SECTION

SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Portland Cement - Lime Mortars and Grout, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Definitions:
 - 1. PCL Mortar: Portland Cement-Lime Mortar.
 - 2. PCL Grout: Portland Cement-Lime Grout.
 - 3. Pre-Blended: Factory blended mortar mix of dry ingredients including sand, cement, lime, pigments, and approved additives.
- B. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. ASTM C143 Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - b. ASTM C144 Standard Specification for Aggregate for Masonry Mortar.
 - c. ASTM C150 Standard Specification for Portland Cement.
 - d. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purposes.
 - e. ASTM C270 Specification for Unit Masonry.
 - f. ASTM C404 Standard Specification for Aggregates for Masonry Grout.
 - g. ASTM C476 Standard Specification for Grout for Masonry.
 - h. ASTM C780 Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - 2. American Concrete Institute (ACI):
 - a. ACI 530.1 Building Code Requirements and Specification for Masonry Structures.
 - 3. Brick Industry Association (BIA):
 - a. Technical Notes.
- C. Use of masonry cement alone, or in combination with PCL mixes, is prohibited.
- D. The use of blended hydraulic cements, including Portland blast-furnace slag cement, Portland-pozzolan cement, slag cement, and natural cement is not permitted.
- E. Cold Weather Procedures:
 - 1. Specified in Section 04 05 05.
- F. Hot Weather Procedures:
 - 1. When ambient temperature is over 100 degrees F 38 degrees C, or over 90 degrees F 32 degrees C with a wind over 8 mph 13 kph:
 - a. Monitor mortar temperature and maintain it between 70 to 120 degrees F 21 to 49 degrees C.
 - b. Limit spreading of bed mortar to 4 feet 1.2 M, maximum, and place masonry units within 1 minute of spreading.

1.3 SUBMITTALS

A. Product Data:

1. Material certificates for each material used in proposed mix designs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Factory Pre-blended PCL Mortar:

1. Base:
 - a. Spec Mix
2. Optional:
 - a. Amerimix (Bonsal)
 - b. Ash Grove Cement Company
 - c. U-Mix
 - d. US Mix Company

B. Site Mixed PCL Grout:

1. Base:
 - a. Products as indicated.

C. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

A. Factory Pre-blended Mortar Mix:

1. Use approved mix designs which comply with ASTM C270, Property Method.
2. Blend cementitious materials, aggregate and admixtures in factory under controlled conditions, which requires only addition of water at project site.
3. Oven-dry aggregates prior to measuring and include in pre-blended mix.

B. Portland Cement: ASTM C150, Type I, II or III.

1. Air-entraining cement is not permitted.
2. Portland Cement Color: As indicated below for each application.
3. Maximum percent of alkalis: 0.60.

C. Hydrated Lime:

1. ASTM C207, Type S or SA.

D. Mortar Aggregate:

1. ASTM C144.
2. Aggregate Color: As indicated below for each application.

E. Water: Potable.

F. Do not use the following ingredients:

1. Do not use antifreeze additives.
2. Do not use calcium chloride, thiocyanates, or other materials containing chloride ions.
3. Other admixtures: Not permitted without prior approval by Engineer.
4. Do not use ready mix mortar.
5. Do not use masonry cement.

- G. PCL mortar mixes to comply with ASTM C270, property specification using component materials listed above:
1. Limit air content to 12 percent, maximum.
 2. Use appropriate type as indicated by following Table 4110A, for each condition.

TABLE 4110A - Basic Mortar Type Selection		
Location	Building Segment	Mortar Type per ASTM C270
Exterior Masonry at or below grade	Foundation walls Retaining walls Sewers & manhole, and paving	M
Exterior Masonry above grade	Reinforced or Load Bearing brick / block walls Glass Unit Masonry Veneer Masonry, Parapets, and Chimneys greater than 30 feet above grade Other areas with severe exposure	S
	Non-load bearing brick/block walls Veneer Masonry, where less than 30 feet above grade	N (or S)
	Parapets and chimneys where less than 30 feet above grade	N
Interior Masonry	Load bearing brick/block walls Non-load bearing brick/block walls Glass Unit Masonry Brick/block veneers	N

- H. Use following mortar colors in conjunction with Table 4110A to determine mixes of appropriate combinations of type and color for each project condition.
1. Mortar Color MC-1:
 - a. Location used:
 - 1) Typical at face brick veneer, See Section 03 45 00
 2. Mortar Color MC-2:
 - a. Location used:
 - 1) CMU walls. See Section 04 22 00.
 - b. Method:
 - 1) Factory pre-blended mortar.
 - c. Mortar Color:
 - 1) Natural Grey, no pigment.
 - d. Portland Cement Color:
 - 1) Natural.
 - e. Aggregate Color:
 - 1) Natural.
- I. Grout:
1. Site Mixed PCL Grout:
 - a. Use approved mix designs.
 - b. Mix on-site using approved materials as indicated.

- c. Factory pre-blended dry grout mixes may be used at contractor's option.
 - d. Ready-mixed product, delivered to site for direct placement in walls, may be used at contractor's option.
- 2. Factory pre-blended PCL grout mix:
 - a. Use approved mix designs.
 - b. Blend cementitious materials, aggregate and admixtures in factory under controlled conditions, which requires only the addition of water at the project site.
 - c. Oven-dry aggregates prior to measuring and include in the pre-blended mix supplied to the site.
- 3. PCL Grout Mixes:
 - a. Comply with ASTM C476.
 - b. Portland Cement: ASTM C150, Type I, II or III.
 - 1) Air-entraining cement is not permitted.
 - 2) Maximum percent of alkalis: 0.60.
 - c. Grout aggregate: ASTM C404.
 - 1) Maximum Aggregate Size: 3/8 inches 9.5 mm.
 - 2) The use of blast furnace slag is not permitted.
 - d. Hydrated lime:
 - 1) ASTM C207, Type S.
 - e. Water: Clean and potable.
 - f. Other admixtures: Not permitted without prior approval by Architect.
 - g. Compressive Strength: As indicated by GROUT MIX SCHEDULE, below, for each type.
 - h. Slump for Grout Measured in accordance with ASTM C143:
 - 1) Minimum: 8 inches 200 mm.
 - 2) Maximum: 10 inches 250 mm.
- 4. Grout Mix GM-1:
 - a. Site mixed grout.
 - 1) Redi-mixed or factory pre-blended may be used at contractor's option.
 - 2) Gypsum is not allowed in grout mixtures.
 - b. Compressive strength, 28-day:
 - 1) Minimum 2000 psi 13.8 MPa.
 - c. Location used:
 - 1) Fill for CMU walls.
 - 2) Hollow metal door frames.
 - 3) Other indicated locations.
 - d. Grout color: Natural grey, no pigment.
 - e. Portland cement color: Natural.
 - f. Aggregate color: Natural.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.

2.2 MORTAR INSTALLATION

- A. Mix materials minimum of 5 minutes, but not more than 10 minutes.
- B. Adjust consistency to satisfaction of mason subject to compliance with specified criteria.
- C. Install in accordance with BIA Standards.
- D. Strike joints to create a uniformly concave final joint.
- E. Strike joints flush on wall surfaces scheduled to receive an air barrier.
- F. If mortar begins to stiffen, it may be re-tempered in accordance with ASTM C270, Subparagraph 7.4.
- G. Use mortar within 2-1/2 hours of initial mixing.
- H. Remove units which are disturbed after laying. Clean off original mortar and reset with fresh mortar.

2.3 GROUT INSTALLATION

- A. Mix materials minimum of 5 minutes, but not more than 10 minutes.
- B. Use grout within 1-1/2 hours after initial mixing.
- C. Use coarse grout in spaces larger than 2 inches 50 mm in both directions.
- D. Use fine grout in spaces with least dimension is less than 2 inches 50 mm.
- E. Grout installation – Walls:
 - 1. See Section 04 22 00.

2.4 FIELD QUALITY CONTROL

- A. Inspection: Verify by observation the method of measuring material quantities for the mortar used in construction accurately maintains the required proportions. Verify the individual mortar materials being used are those approved for the project.
- B. Field Testing: Provide testing of mortar prepared at the construction site in accordance with ASTM C780 for the following properties:
 - 1. Consistency - ASTM C780, Annex 1.
 - 2. Board Life - ASTM C780, Annex A2 or A3.
 - 3. Mortar Aggregate Ratio - ASTM C780, Annex A4.
 - 4. Air Content - ASTM C780, Annex A5.
- C. Measured volumetric proportions of the construction site-produced mortar shall meet requirements of ASTM C270 Proportion Specifications or the volumetric proportions derived for the Property Specifications, whichever applies.

END OF SECTION

SECTION 04 22 00
CONCRETE UNIT MASONRY (CMU)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Masonry (CMU), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. More than five (5) years successful experience in installation of concrete masonry unit systems similar to system required.
 - 2. Include five (5) references with bid from similar size projects.
- B. Reference Standards:
 - 1. ASTM A36 - Standard Specification for Carbon Structural Steel
 - 2. ASTM C33 - Standard Specification for Concrete Aggregates
 - 3. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units
 - 4. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
 - 5. ASTM C780 Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - 6. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials
 - 7. ACI 216.1/TMS 0216 - Code Requirements for. Determining Fire Resistance of Concrete and Masonry. Construction Assemblies
 - 8. ACI 530/530.1 – Building Code Requirements and Specification for Masonry Structures.
 - 9. NMCA TEK 7-1B - Fire Resistance Ratings of Concrete Masonry Assemblies
- C. Test results performed to qualify materials and establish mix designs
- D. Mock-up:
 - 1. Use materials and procedures accepted for the work.
 - 2. Minimum sample panel size is 4 feet 1.2 M square.
 - 3. Acceptable standard for the work is established by accepted sample panel.
 - 4. Retain sample panel at site until Work has been completed.
 - 5. Include a grouting demonstration panel if grouting operations planned exceed or vary from limitations set forth in ACI 530.1-05 - Section 3.5

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data sheet describing properties of concrete masonry units and demonstrating conformance with specified standards.
 - 2. Certification of level of fire resistance provided by units used in fire rated walls.
 - 3. Reinforcing.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Units to be used in fire resistive wall assemblies:
 - 1. Where units are used in assemblies with fire resistive rating:
 - a. Provide units with aggregate type, and equivalent thickness that yield fire-resistances indicated for each wall assemblies.
 - b. Acceptable calculation methodologies for determining equivalent thickness:
 - 1) ASTM C140.
 - 2) NCMA TEK 7-1B.
 - 3) ACI 216.1 / TMS 0216.
 - c. Units tested per ASTM E119 are also acceptable.
 - 2. Provide solid units, or grouted hollow units, under lintels.
 - 3. Provide matching concrete bricks as required.
 - 4. Do not use chipped, cracked, spalled units exposed in finish work.
 - 5. Provide reinforced concrete masonry lintels fabricated from precast or site cast load bearing masonry units, filled and reinforced as indicated.

2.2 CONCRETE MASONRY UNITS - GENERAL PURPOSE

- A. Concrete Masonry Units (CMU):
 - 1. Modular units complying with ASTM C90.
 - 2. Aggregate:
 - a. Normal Weight: In accordance with ASTM C33.
 - 3. Sizes and shapes as indicated or required for conditions.
 - 4. Face shell and web thickness: Table 1, ASTM C90.
- B. Corner Units:
 - 1. Exposed to view: Use bullnose units at external corners and jambs of openings.
 - 2. Not Exposed to view: Square-nosed units may be used where corners will not be visible in completed wall.

2.3 CONCRETE LINTELS AND SILLS

- A. General:
 - 1. Fabricate concrete lintels and sills in plant or site cast.
 - 2. Use concrete having minimum 28 day compressive strength of 4000 psi.
 - 3. Exposed surfaces to have surface texture and color to match adjacent concrete masonry units.
 - 4. Fabricate lintels to modular sizes to match coursing.
 - 5. Mark tops of lintels with lintel schedule number.
- B. Fabricate lintels by one of following methods:
 - 1. Use masonry lintel units and reinforced concrete fill.
 - 2. Cast lintels monolithically with reinforcement.
 - 3. Provide vertical dummy joints matching pattern of vertical joints and scoring in concrete masonry walls in which installed.

2.4 REINFORCING

- A. Horizontal Reinforcing products including wire ladder truss: Specified in Section 04 05 23.
- B. Reinforcing Bars (vertical and horizontal): Specified in Section 03 20 00.

2.5 ACCESSORY ITEMS

- A. Mortar and Grout: See Section 04 05 16.
- B. Sealants: See Section 07 92 13 and Section 07 92 16 for non-rated wall penetrations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate to accept work.
- B. Verify that anchors and flashings are correct.
- C. Installation constitutes acceptance of substrate and responsibility for performance.

3.2 INSTALLATION

- A. General:
 - 1. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of Contract Documents.
 - 2. Perform cutting with masonry saws.
 - 3. Cut as required to provide pattern indicated.
 - 4. Use solid units where cutting or laying would expose holes.
 - 5. Do not install damaged units.
 - 6. Do not wet concrete masonry units.
 - 7. Avoid use of less than half size units.
 - 8. Build chases and recesses as indicated and required for work of other trades.
- B. Install in running bond unless otherwise indicated.

3.3 LAYING AND TOOLING

- A. Lay out walls in advance for uniform and accurate spacing of bond patterns and joints.
- B. Properly locate openings, movement joints and offsets.
- C. Lay masonry units with face shells of bed joints fully mortared.
 - 1. Mortar webs in courses of piers, columns, and pilasters, in starting course on foundations and when necessary to confine grout or loose filled insulation.
 - 2. Mortar head joints a minimum distance from each face equal to face shell thickness.
 - 3. Align vertical cells and maintain openings unobstructed to be grouted.
- D. Maintain nominal 3/8 inches 9.5 mm joint widths.
 - 1. Cut joints flush where concealed.
 - 2. Tool exposed joints.
 - 3. Compress mortar in below ground joints.
- E. Enlarge voids or holes, except weep holes, and fill with mortar during tooling.
- F. Point up joints at corners, openings and adjacent work to provide neat, uniform appearance.

- G. Remove masonry disturbed after laying.
 - 1. Clean and relay in fresh mortar.
 - 2. Do not pound units to fit.
 - 3. If adjustments are required, remove units, clean, and reset in fresh mortar.
- H. Where work is stopped and later resumed, rake back 1/2 masonry unit length in each course; do not tooth.
 - 1. Remove loose units and mortar prior to laying fresh masonry.
- I. Protect against weather, when work is not in progress.
 - 1. Cover top of walls with waterproof sheeting, extend at least 4 feet 1.2 M down both sides of walls; anchor in place.
 - a. Do not use adhesives on surface of brick.
 - b. Do not set sheeting in joint.
 - 2. Provide cold weather protection; Section 04 05 05.
- J. Build in items indicated and specified.
 - 1. Fill with mortar around built-in items.
 - 2. Grout fill space between metal frames and masonry.
 - 3. Where built-in items are to be embedded in cores of hollow masonry units, place layer of metal lath in joint below and fill core with grout.
- K. Remove masonry protrusions extending 1/2 inches 13 mm or more into cells or cavities to be grouted.

3.4 REINFORCING

- A. General:
 - 1. In addition to the following general requirements, provide reinforcing size type and spacing as indicated on Drawings and Details.
- B. General Reinforcing Requirements:
 - 1. Reinforce masonry openings over 12 inches 300 mm wide, where control and expansion joints are not provided, with horizontal joint reinforcing placed in 2 horizontal joints above lintel and below sill.
 - a. Extend reinforcing minimum of 24 inches 300 mm beyond jambs of opening.
 - 2. Embed horizontal reinforcing in bed joint mortar for entire length with minimum cover of 5/8 inches 16 mm on exterior side of walls and 1/2 inches 13 mm at other locations.
 - a. Provide same minimum cover for other embedded items.
 - 3. Minimum laps for horizontal reinforcing: 6 inches 150 mm.
 - 4. Do not bridge Control Joints or Expansion Joints with horizontal reinforcing.
 - a. Install smooth dowels or other approved device across Control Joints which resist shear loads but allow in-plane expansion, contraction and linear shrinkage movements.
- C. Horizontal Reinforcing (wire ladders/trusses):
 - 1. Provide continuous horizontal joint reinforcing concrete masonry walls.
 - 2. Unless otherwise indicated:
 - a. Install horizontal reinforcing within 8 inches 200 mm of first bed joint.
 - b. Running Bonds: Install horizontal reinforcing at 16 inches 400 mm OC vertically thereafter.

3. Make corners and wall intersections by use of prefabricated L and T sections.
 - a. Cut and bend as required.
4. At intersecting load bearing walls install rigid steel anchors not over 24 inches 600 mm OC vertically.
 - a. Embed ends in grout filled cores.
- D. Horizontal Reinforcing Bars:
 1. Install where indicated.
 2. Sizes as indicated.
- E. Vertical Reinforcing Bars at CMU Walls other than Anchored Veneers:
 1. Install vertical reinforcing bars as indicated.
 2. When not indicated, provide the following minimum vertical reinforcing:
 - a. Provide one No.5 continuous at 48 inches 1200 mm on center.
 - b. Provide one No.5 continuous at each corner, at each side of each opening, at each side of each control joint, and at the ends of walls.

3.5 GROUT FILL

- A. Do not place grout until entire portion of wall to be grouted has attained strength to resist grout pressure.
- B. Use mechanical vibrator to remove voids and to consolidate fill.
- C. Grout walls incrementally as CMU is placed.
- D. Minimize lift heights to ensure walls remain safe and stable until grout has attained strength to resist overturning or collapse.
 1. Consider detrimental lateral loads which could be anticipated including storms, winds, seismic and soil conditions.
 2. Adequately brace.
- E. Where vertical or horizontal reinforcing bars are required, place and inspect prior to filling operation.
- F. Fill cores containing vertical reinforcing.
- G. Place in maximum 4 feet 1.2 M lifts.
- H. Leave lifts minimum 1-1/2 inches 38 mm below top of course to form key with next lift.

3.6 CONTROL JOINTS (CJ)

- A. Provide control joints and other movement joints as indicated.
- B. Where not indicated:
 1. Locate control joints at natural planes of weakness in masonry wall such as:
 - a. Changes in wall height.
 - b. Changes in wall thickness, such as at pipe and duct chases and pilasters.
 - c. At (above) movement joints in foundations and floors on which wall is bearing.
 - d. At (above) movement joints in roofs and floors that bear on wall.
 - e. Within 8 inches 200 mm of one or both jambs of door, window, louver and similar openings:
 - 1) Place CJ at one side of openings less than 6 feet 1.8 M wide.
 - 2) Place CJ at both sides of openings greater than 6 feet 1.8 M wide.

- f. Within 4 feet 1.2 M of corners on one leg, minimum.
 - 1) Opposing leg: No more than 20 feet 6 M from corner.
 - g. Intersections: Within 12 feet 3.6 M of wall intersections.
 - 2. In addition to the above, locate control joints at no more than the following maximum (horizontal) distances:
 - a. Walls greater than 16 feet - 8 inches 5.1 M tall: No more than 25 feet 7.6 M O.C.
 - b. Walls between 8 feet 2.4 M and 16 feet - 8 inches 5.1 M tall: Not more than 1-1/2 times wall height.
 - c. Walls less than 8 feet 2.4 M tall: 12 feet 3.6 M.
- C. Installation/construction of control joints:
 - 1. Utilize sash blocks or similar shapes which have slotted end to accept gaskets.
 - a. Pre-molded Control Joint Strips:
 - 1) Provide at control joints in CMU walls:
 - 2) Base:
 - a) Hohmann & Barnard, Inc.
 - 3) Optional:
 - a) Williams Products, Inc.
 - b) Wire-Bond
 - c) Heckmann Building Products, Inc.
 - 2. Cut ladder/truss type horizontal reinforcing as it crosses control joints.
 - 3. While mortar is still fresh, rake out mortar from joint, leaving a completely clean joint.
 - 4. After wall has cured, install backer rod and sealant on both wall faces.
 - a. Sealant and Backer Rod: Specified in Section 07 92 13 and Section 07 92 16.

3.7 LINTELS, FLASHING AND SEALANTS

- A. Sealant installation requirements:
 - 1. Sealant and Backer Rod: Specified in Section 07 92 13 and Section 07 92 16.
 - 2. Remove mortar in joint under relieving lintel and at ends.
 - 3. Seal joints between CMU's and relieving lintels.
 - 4. Seal Expansion and Control Joints.
- B. Provide precast masonry lintels wherever openings more than 12 inches wide are indicated without other structural support or other supporting lintels.
 - 1. Thoroughly cure lintels before handling and installation.
 - 2. See lintel schedule for size and type required.

3.8 INSTALLATION TOLERANCES

- A. Maximum variation from plumb in vertical lines and surfaces of columns, walls and arises:
 - 1. 1/4 inches 6 mm in 10 feet 3 M.
 - 2. 3/8 inches 9 mm in a story height not over 20 feet 6 M.

- B. Maximum variation from plumb for external corners, control joints, expansion joints and other conspicuous lines:
 - 1. 1/4 inches 6 mm in any story or 20 feet 6 M maximum.
 - 2. 1/2 inches 12 mm in 40 feet 12 M or more.
- C. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
 - 1. 1/4 inches 6 mm in any bay or 20 feet 6 M.
 - 2. 1/2 inches 12 mm in 40 feet 12 M or more.
- D. Maximum variation from plan location of related portions of columns, walls and partitions:
 - 1. 1/2 inches 12 mm in any bay or 20 feet 6 M.
 - 2. 3/4 inches 18 mm in 40 feet 12 M or more.
- E. Maximum variation in cross section of columns and thicknesses of walls from dimensions indicated:
 - 1. Minus 1/4 inches 6 mm.
 - 2. Plus 1/2 inches 12 mm.

3.9 REPAIR, POINTING AND CLEANING

- A. Remove and replace loose, stained, or damaged units.
 - 1. Provide new units to match.
 - 2. Install in fresh mortar.
 - 3. Point to eliminate evidence of replacement.
- B. Clean in accordance with Section 04 05 10.

3.10 INSPECTION AND TESTING

- A. Comply with the requirements of ACI 530.1 Section 1.6C and facilitate the testing and inspection agency's needs.
- B. The Owner will provide testing and inspection services. This does not relieve the contractor of the responsibility to furnish materials and construction in full compliance of contract documents.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Miscellaneous Metal Fabrications, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Section Includes:
 - 1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be supplied under work of other Specification Sections:
 - a. Steel Support Angles, Support Frames, and Loose Lintel Steel Members
 - b. Miscellaneous Equipment Supports
 - c. Bollards

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. ASTM A27 Standard Specification for Steel Castings, Carbon, for General Application
 - b. ASTM A36 Standard Specification for Carbon Structural Steel
 - c. ASTM A47 Standard Specification for Ferritic Malleable Iron Castings
 - d. ASTM A48 Standard Specification for Gray Iron Castings
 - e. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - f. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - g. ASTM A148 Standard Specification for Steel Castings, High Strength, for Structural Purposes
 - h. ASTM A197 Standard Specification for Cupola Malleable Iron
 - i. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 psi Tensile Strength
 - j. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - k. ASTM A354 Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
 - l. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - m. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - n. ASTM A668 Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
 - o. ASTM A992 Standard Specification for Structural Steel Shapes
 - 2. American Society of Mechanical Engineers (ASME):
 - a. ANSI/ASME-A17.1 Handbook on Safety Code for Elevators and Escalators

3. American Institute of Steel Construction (AISC)
 - a. Steel Construction Manual
4. American Iron and Steel Institute (AISI):
 - a. Specification for the Design of Cold-Formed Steel Structural Members.
5. American Welding Society (AWS):
 - a. ANSI/AWS C1.1M/C1.1 Recommended Practices for Resistance Welding
 - b. ANSI/AWS D1.1 Structural Welding Code - Steel.
 - c. ANSI/AWS D1.3 Structural Welding Code - Sheet Steel.
6. National Association of Architectural Metals Manufacturers (NAAMM):
 - a. Class 1, Architectural, per NAAMM AMP-555, Code of Standard Practice for the Architectural Industry.
- B. Provide Miscellaneous Metals Fabrications engineered to support dead, live, and lateral (wind or seismic) loads where indicated or required by code.
 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
 2. Include headers and reinforcing members around openings.
 3. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.

1.3 SUBMITTALS

- A. Product Data:
 1. For each type of material and accessory.
- B. Shop Drawings:
 1. Plans and elevations showing members and connections.
 2. Anchors and accessory items.
- C. Project Information:
 1. Structural calculations for Miscellaneous Metals Fabrications indicating design conforms to specified design criteria, sealed by the Specialty Structural Engineer.
 2. Submit concurrent with Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Materials Listed:
 1. Base: As noted.
- B. Galvanizing Repair Paint:
 1. Base:
 - a. Tnemec.
 2. Optional:
 - a. ZRC Worldwide.
 - b. Sherwin-Williams.
- C. Shop Primer:
 1. Base:
 - a. As recommended by finish coat manufacturer for substrate.

- 2. Optional:
 - a. Sherwin-Williams.
 - b. Tnemec.
- D. Non-shrink Grout:
 - 1. Base:
 - a. Dayton Superior Corporation.
 - 2. Optional:
 - a. Sauereisen.
 - b. CGM Building Products.
- E. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Structural Steel:
 - 1. Structural W and T shapes: ASTM A992, 50KSI yield point.
 - 2. Other steel shapes and plate: ASTM A36.
 - 3. Pipe: ASTM A53 Grade B.
 - 4. Tubing: ASTM A500, Grade B, 46KSI minimum.
- B. Cast Steel:
 - 1. ASTM A27, Grade-65-35; and ASTM A148, Grade-80-50.
- C. Steel Forgings:
 - 1. ASTM A668.
- D. Bolts:
 - 1. ASTM A307, ASTM A325, ASTM A354.
- E. Filler Metal:
 - 1. AWS Standards.
- F. Cast Iron:
 - 1. ASTM A48, Class 30, minimum 30,000 psi 206.8 MPa tensile.
- G. Malleable Iron:
 - 1. ASTM A47 and ASTM A197.
- H. Aluminum:
 - 1. ASTM B308 for particular alloy in standard shapes and extrusions.
 - 2. ASTM B26 for castings.
- I. Stainless Steel:
 - 1. ASTM A484 and ASTM A276.
 - 2. Concealed: Type 302 or Type 304.
 - 3. Exposed: Type 316.
 - a. Finish: ASTM A480 AISI finish No. 4, unless otherwise indicated.
- J. Masonry Anchorage Devices:
 - 1. Standard manufactured items.
 - 2. Lead expansion shields for machine screws and bolts 1/4-inch 6 mm and smaller: Head out embedded nut type.
 - 3. For machine screws and bolts larger than 1/4-inch 6 mm: Manufacturers' standard.

4. Bolt anchor expansion shields for lag bolts: Zinc alloy, long shield anchors.
 5. Bolt anchor expansion shields for bolts: Closed end bottom bearing type.
 6. Anchor to embed or set device in setting compound or epoxy grout where shown.
- K. Fasteners:
1. Galvanized or stainless where built into exterior walls
 2. Select fasteners for type, grade and class required
 3. Bolts and Nuts: Regular hexagon head ASTM A307, Grade A
 4. Lag Bolts: Square or octagonal head type
 5. Machine Screws: Zinc-Nickel plated steel
 6. Wood Screws: Flat head carbon steel
 7. Plain Washers: Round carbon steel
 8. Lock Washers: Helical spring carbon steel
- L. Non-shrink Grout:
1. Compressive strength: 9000 psi at 7 days.
 2. Base Product: 1107 Advantage Grout by Dayton Superior.

2.3 FABRICATION

- A. Form to shapes indicated with straight lines, sharp angles, and smooth curves.
- B. Shop-fabricate in as large assemblies as practicable.
- C. Anchorage Accessories:
 1. Items required securing wood to metal, wood to masonry, metals to masonry or concrete, metal to metal or metal to other items.
- D. Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.
 1. Conceal fastenings where practicable.
- E. Make permanent shop and field connections with continuous fillet type welds.
 1. Grind exposed welds smooth.
- F. Supply items required to complete construction and installation.
- G. Meet requirements specified under Structural Steel for fabricating items of structural nature or use.

2.4 FINISHES

- A. Items not to receive coatings:
 1. Surfaces scheduled to be fireproofed with spray-on material.
 2. Machined surfaces.
 3. Surfaces adjacent to field welds.
 4. Contact surfaces of bolt connections at slip connections.
 5. Top flanges of beams to receive shear connectors.
 6. Anodized aluminum.
 7. Items for which no coating or field finish is specified.
- B. Shop Primer for Interior Non-wet Items:
 1. Primer: Coordinate with field applied finish systems specified in Section 09 91 23.

2. Apply primer for interior finish paint to following surfaces not receiving other coating:
 - a. Surfaces exposed on interior.
3. Clean thoroughly before priming; remove mill scale, rust, dirt, oil, and grease in accordance with SSPC-SP3.
4. Apply in accordance with paint manufacturer's instructions.
 - a. Apply minimum 0.002-inch 0.05 mm, dry film thickness.
- C. Hot-dip Galvanized (HDG) Coating for Exterior Items:
 1. Galvanize (HDG) the following items:
 - a. Items to be installed on site, roof or other areas that are outside of building enclosure walls. This shall include items attached to exterior walls of building.
 - b. Items to be installed in wet or humid (greater than 70 percent RH) areas of building.
 - c. Partial listing of items to receive HDG:
 - 1) Masonry lintels, ledge angles and shelf angles.
 - 2) Pipe Bollards.
 - 3) Exterior Ladders, Stairs, and railings.
 - 4) Exterior gratings and substructure.
 - 5) Exterior equipment supports.
 - 6) Similar items which are exposed to weather or built-in to Exterior walls.
 - 7) Other items indicated.
 2. Clean thoroughly before galvanizing.
 3. Galvanize in accordance with ASTM A123.
- D. Galvanizing Repair Coating:
 1. Tnemec Series 94-H20 Hydro-Zinc.
 2. ZRC Worldwide, Galvilite 221.
 3. Sherwin Williams Zinc Clad III HS 100.
- E. Finish Painting:
 1. Exterior: See Section 09 91 13.
 2. Interior: See Section 09 91 23.

2.5 METAL FABRICATIONS

- A. Steel Support Angles, Support Frames, and Loose Lintel Steel Members:
 1. ASTM A36 steel, sizes and configurations as indicated.
 2. Items to be hot dip galvanized:
 - a. Items to be permanently exposed to weather, high humidity, or wet conditions.
 - b. Items set into exterior walls.
 3. Shop prime interior items not required to be galvanized.
- B. Miscellaneous Equipment Supports:
 1. ASTM A36 steel, Sizes and configurations as indicated.

2. Examples of items included:
 - a. Supports for Folding Partitions, Operable Walls, Coiling Doors and Grilles.
 - b. Ceiling hung toilet partitions.
 - c. Other miscellaneous support items as indicated.
 3. Items to be hot dipped galvanized:
 - a. Items to be permanently exposed to weather, high-humidity, or wet conditions.
 - b. Items set into exterior walls.
 4. Shop Prime interior items (in non-wet areas).
- C. Bollards:
1. Provide where indicated.
 2. Supply items required to complete construction and installation.
 3. Minimum Workmanship Standards (unless noted otherwise): Class 1, Architectural, per NAAMM AMP-555, Code of Standard Practice for the Architectural Industry.
 4. Utility Bollards Type UB-1:
 - a. 6-inch 150 mm nominal diameter extra strength, HDG (galvanized), steel pipe or round structural tube.
 - b. Length: Unless otherwise indicated; minimum 42-inch 1050 mm projection above ground and 36-inch embedment into concrete.
 - c. Fabricate with welded on anchors.
 - d. Fill bollard with 3000 psi 6.2 MPa concrete with rounded top.
 - e. Field paint by Division 09.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.
- C. Verify wall backing has been installed for wall-mounted items specified in this Section.
 1. See Section 09 22 16.

3.2 INSTALLATION

- A. General:
 1. Set work level, true to line, plumb.
 2. Weld field connections and grind smooth.
 3. Conceal fastenings where practical.
 4. Secure metal to wood with lag screws of adequate size with appropriate washers.
 5. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
 - a. Use expansion bolts, toggle bolts, or screws for light duty service.
 6. Meet structural requirements for erecting items of structural nature.
 7. Do not field splice fabricated items unless size requires splicing.
 8. Weld splices.
 9. Provide fabricated items complete with attachment devices as required to install.

- B. Galvanic Repair:
 - 1. After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.
 - 2. Surface preparation: Remove contaminates in accordance with SSPC SP-1.

C. Bollards:

- 1. Direct buried:
 - a. Hole Depth: 6 inches 150 mm deeper than embedment length specified for bollard.
 - b. Hole Diameter: 24-inch 600 mm diameter for 6-inch 150 mm diameter bollard.
 - c. Set bollards plumb and to the exposure height indicated.
- 2. Fill annular space with concrete fill having a compressive strength of at least 3000 psi 6.2 MPa.
- 3. Paint as scheduled.

3.3 TOUCH-UP AND REPAIR

- A. Verify installations are neat and flush in appearance, and that there are no burrs, projections, or defects on exposed surfaces that might snag fingers or clothing. Correct deficiencies.
- B. Touch-up damage to powder coat finishes in manner satisfactory to Engineer.
- C. Galvanic Repair:
 - 1. After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.
 - 2. Surface Preparation: Remove contaminates in accordance with SSPC SP-1.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Rough Carpentry, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 REFERENCES

- A. Lumber Grading Rules and Species:
 - 1. US Department of Commerce (DOC):
 - a. PS 20 American Softwood Lumber Standard.
 - 2. Western Wood Products Association (WWPA).
 - 3. Southern Forest Products Association (SFPA).
- B. Plywood Grading Rules and Recommendations:
 - 1. US Department of Commerce (DOC):
 - a. Softwood plywood: PS1 Structural Plywood.
 - 2. American Plywood Association (APA).
- C. Preservative and Fire Retardant Treatment Standards:
 - 1. American Wood Protection Association (AWPA):
 - a. AWPA U1 User Specification for Treated Wood.
 - b. AWPA T1 Processing and Treatment Standard.
 - 2. Underwriters Laboratories (UL)
 - 3. ASTM International requirements:
 - a. ASTM E84 Standard Test Method for Surface Burning Characteristics
 - b. ASTM D2898 Standard Method of Accelerated Weathering of Fire Retardant Treated Wood for Fire Testing
 - c. ASTM D3201 Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Shop Drawings:
 - 1. Fabricated items.
 - 2. Fastener Patterns: Full-size templates for fasteners in exposed framing.
- C. Project Information:
 - 1. Certification of fire retardant treated material.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- B. Factory Marking:
 - 1. Identify type, grade, moisture content, inspection service, producing mill, and other qualities.

2. Mark each piece of fire retardant treated material with Underwriters Laboratory Classification mark and fire-retardant treatment for identification.
3. International Building Code (IBC):
 - a. Requirements for identification and labeling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire-retardant Treated Lumber and Plywood:

1. Base:
 - a. Hoover Treated Wood Products, Inc.
2. Optional:
 - a. Arxada.
 - b. Koppers Performance Chemicals.
 - c. Viance, LLC.

B. Preservative Treated Lumber and Plywood:

1. Base:
 - a. Hoover Treated Wood Products.
2. Optional:
 - a. Arxada.
 - b. Koppers Performance Chemicals.
 - c. Stella-Jones, Inc.
 - d. Viance, LLC.

C. Wood Connectors:

1. Simpson Strong-Tie Co.

2.2 MATERIALS

A. Dimensional Lumber and Plywood:

1. Thoroughly seasoned, non-treated, well-fabricated materials.
2. Longest practical lengths and sizes.
3. Application, except where treated types are indicated:
 - a. Non-structural framing, blocking, backing, nailers, grounds, and similar members.
 - b. Other locations where indicated.

B. Fire-retardant Treated Lumber and Plywood (FRT):

1. Flame spread index: Less than 25.
2. Smoke developed index: Less than 450.
3. Free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, and urea formaldehyde.
4. Kiln dried after treatment, (KDAT).
5. FRT material for interior and above grade locations:
 - a. Base: PyroGuard by Hoover Treated Wood Products, Incorporated
 - b. Optional:
 - 1) Dricon FS by Arxada.
 - 2) FirePro by Western Wood Preservers, Ltd.

- c. Natural wood products treated to add fire-retardant qualities.
 - d. Type A: not more than 28 percent moisture when tested according to ASTM D3201.
 - e. Interior and above grade applications include but not limited to:
 - 1) Platforms and Stages.
 - 2) Wood in concealed spaces.
 - 3) Framing, blocking, cants, and nailers within roof covering and waterproofing systems.
 - 4) Interior wood items in direct contact with exterior concrete and exterior masonry walls.
 - 5) Window frame blocking within non-rated exterior walls.
 - 6) Plywood backing panels for electrical, telecommunication equipment.
 - 7) Similar locations where wood products are indicated and building code does not permit non-fire-resistive treated products.
 - 8) Above grade dimensional lumber and plywood, unless indicated otherwise.
 - a) Exception: Upgrade to exterior grade where scheduled in the following article.
6. FRT material for exterior and wet locations:
- a. Base:
 - 1) ExteriorFireX by Hoover Treated Wood Products, Incorporated
 - b. Optional:
 - 1) Dricon FRX by Arxada.
 - c. Natural wood products treated to add fire-retardant qualities plus decay and termite resistance.
 - d. Non-leaching treatment under direct exposure to precipitation, sunlight, and effects of weather.
 - e. Exterior applications include but not limited to:
 - 1) Fire-treated wood that is directly exposed to weather.
 - 2) Fire-treated wood in areas of high-humidity, Greater than 80 percent RH.
 - 3) Other areas where indicated.
- C. Preservative Treated Lumber and Plywood:
- 1. Natural wood products treated to add decay and termite resistance.
 - 2. Use appropriate materials for application by listed Manufacturers.
 - 3. Preservatives:
 - a. Compatible with direct exposure to precipitation, sunlight, and effects of weather.
 - b. Authenticate by factory marking each piece with manufacturer's mark and applicable standards.
 - c. Acceptable treatments:
 - 1) Alkaline Copper Quaternary (ACQ).
 - 2) Copper Azole (CA).
 - 3) Wolman AG non-metallic preservative.

4. Lumber Species:
 - a. Hem-Fir.
 - b. Spruce.
 - c. Pine.
 - d. Other species meeting requirements.
5. Plywood:
 - a. Grading:
 - 1) PS1, B-C Grade.
 - 2) PS1, A-C Grade where exposed.
 - b. Veneers:
 - 1) Softwood species.
 - 2) Glue with waterproof adhesives.
6. Application:
 - a. Below grade, or in contact with earth.
 - b. Where indicated in Drawings.
- D. Sill Sealing Gaskets:
 1. Closed cell neoprene foam.
 2. Thickness: 1/4-inch 6 mm.
 3. Match width of sill members indicated.
- E. Adhesives for bonding furring, sleepers, sills, and similar items to concrete or masonry:
 1. Approved for indicated use by adhesive manufacturer.
 2. Comply with ASTM D3498.
- F. Water-Repellent Preservative:
 1. Treat of exposed ends of posts and beams.
 2. National Wood Window and Door Association (NWWDA) tested and accepted formulation.

2.3 FASTENERS

- A. General:
 1. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture.
 2. Where rough carpentry is exposed to weather, in contact with earth, pressure-preservative treated, or in area of high relative humidity:
 - a. Use fasteners with hot dip zinc coating complying with ASTM A153.
 - b. Use fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: ASTM A307, Grade A steel bolts with ASTM A563 hex nuts and washers.
- G. Expansion Anchors:
 1. Tested in accordance with ASTM E488.

2. Anchor bolt and sleeve assembly:
 - a. Masonry assemblies: Sustain load equal to 6 times load imposed when installed in unit.
 - b. Concrete assemblies: Sustain load equal to 4 times load imposed when installed in unit.
3. Interior applications:
 - a. Carbon-steel components.
 - b. Zinc plated to comply with ASTM B633, Class Fe/Zn 5.
4. Exterior and wet applications:
 - a. Stainless Steel components, ASTM F593 and ASTM F594 Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine conditions under which work is to be installed.
- B. Verify measurements, dimensions, and details before proceeding.
- C. Coordinate location of furring, nailers, blocking, grounds, and similar supports.
- D. Correct unsatisfactory conditions.

3.2 INSTALLATION OF ROUGH CARPENTRY

- A. Form to shapes indicated.
- B. Cut and fit accurately.
- C. Set work to required levels and lines, plumb and true.
- D. Shim as required.
- E. Provide wood grounds or nailers as required for attachment of other work and surface applied items.
- F. Grounds:
 1. Dressed, key beveled lumber.
 2. Minimum 1-1/2-inch 38 mm wide by thickness required to bring face of ground even with finish material.
 3. Remove temporary grounds when no longer required.
- G. Wall Blocking:
 1. Provide in-wall fire-treated wood blocking reinforcement where following items are required to be wall-mounted to interior walls:
 - a. Architectural casework, millwork, cabinets, shelving, wardrobes, and bookcases.
 - b. Handrails at stairwells.
 - c. Between studs at height of wall-mounted door stop, behind stop.
 2. Metal wall backing:
 - a. See Section 09 22 16.
- H. Anchor work to support applied loading.
 1. Provide washers under bolt heads and nuts.
 2. Fasten plywood in accordance with APA recommendations.
 3. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.

4. Pre-drill holes to avoid splitting wood with fasteners.
5. Do not drive threaded friction type fasteners.

3.3 INSTALLATION OF BLOCKING AND NAILERS FOR ROOFING AND PARAPETS

- A. Install in accordance with ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- B. Minimum Wood Member Size: 2 by 6-inch 50 mm x 150 mm nominal.
- C. Fasteners:
 1. Corrosion resistant.
 - a. Hot dip galvanized: Comply with ASTM A153 or ASTM A653, Class G185.
 - b. Stainless steel: Types 304 or 316.
 2. Countersink heads of fasteners.
 3. Types required for substrate conditions.
 4. Fasteners of diameter and spacing required to resist forces indicated.
 5. Spacing:
 - a. Threaded anchor bolts; 3/8-inch 9.5 mm or larger:
 - 1) Provide 5/8-inch 16 mm OD washers or larger.
 - 2) Maximum spacing: 48 inches 1200 mm OC.
 - 3) Stagger 1/3 nailer width.
 - b. Other fastener types:
 - 1) Maximum Spacing:
 - a) Typical: 12 inches 300 mm OC.
 - b) Up to 16 inches 400 mm OC where necessary to match spacing of structural members.
 - 2) Stagger 1/3 nailer width.
 - 3) Install 2 fasteners and within 6 inches 150 mm of nailer ends.
 6. Anchor nailers to resist minimum vertical force of 300 pounds/LF 446 kg/M in any direction.
 - a. Locate fasteners approximately 4 inches 100 mm from ends but not less than 3 inches 75 mm.
 - b. Use minimum of 3 anchors for each nailer.
 - c. Where members are wider than 6 inches 150 mm, stagger fasteners from side to side to avoid splitting of the wood member.
 - d. Corner region enhancements:
 - 1) Double the above listed vertical force which must be resisted.
 - 2) Length and width of corners as prescribed by ANSI/SPRI RP-4:
 - a) 40 percent of the building height, but not less than 8-1/2 feet 2.6 M.
- D. Nailers used for perimeter securement of roofing membranes:
 1. Install nailers where indicated and where required to secure perimeter of membrane roofing.
 2. Match height of nailers to adjacent insulation.

- 3. Where multiple layers are required to match depth of insulation:
 - a. Attach base layer as indicated in General Requirements above.
 - b. Apply a bead of construction adhesive between laminations.
 - c. Attach subsequent layers using fastener type which is appropriate for wood-to-wood securement.
 - d. Size and locate fasteners as required to resist uplift loading indicated.
- E. Install blocking as indicated for securement of sheet metal edge flashings, parapet copings, and similar items.

3.4 INSTALLATION OF FIRE RETARDANT TREATED WOOD

- A. Fire retardant treated lumber and plywood used in structural applications shall be applied according to lumber and plywood strength tables provided by manufacturer.
- B. Use only fasteners approved by the manufacturer of fire retardant treated or preservative treated wood.
- C. Field Cuts:
 - 1. Dimensional Lumber: Do not rip or mill fire retardant treated lumber.
 - a. Cross cuts, joining cuts, and drilling holes are permitted.
 - 2. Plywood: Fire retardant treated plywood may be cut in any direction.
 - 3. Field treat cuts and holes in preservative and fire retardant treated material in accordance with AWWA M4.

END OF SECTION

SECTION 06 11 10
WOOD FRAMING AND SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Wood Framing and Sheathing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Minimum five years of experience in wood frame construction similar in material, design, and extent indicated on Drawings.
- B. Local Building Code shall govern when conflicts occur.
- C. Dimension Lumber: US Product Standard PS20-10 American Softwood Lumber Standard.
- D. Plywood Sheathing: US Product Standard PS1-07 Structural Plywood.
 - 1. Oriented Strandboard Sheathing: US Product Standard PS2-04 Performance Standard for Wood Based Structural Use Panels.
 - 2. AWC National Design Specification for Wood Construction and Supplement ANSI/AWC NDS.
- E. Obtain engineered wood products from one source and by a single manufacturer.
- F. Obtain each type of fire retardant treated wood product from one source and by a single producer.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Engineered wood products.
 - 2. Underlayment.
 - 3. Metal framing anchors.
 - 4. Construction adhesives.
 - 5. Wood treatment data:
 - a. Chemical treatment manufacturer's instructions for handling, storing, installing and finishing treated materials.
 - b. For each type of preservative treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained and compliance with applicable standards.
 - c. For waterborne treated products, include statement that moisture content of treated materials were reduced to levels indicated before shipment to project site.
 - d. For fire retardant treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener holding capacities of treated materials.
 - 6. Material test reports from a qualified independent testing agency indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.

7. Research or evaluation reports acceptable to authorities having jurisdiction that evidence following products compliance with building code:
 - a. Engineered wood products.
 - b. Metal framing anchors.
 - c. Power driven fasteners.
 - d. Fire-retardant treated wood.
- B. Project Information:
 1. Proof that framing installer has a minimum of five years of experience, including a list of last four wood framed buildings completed by installer.
 2. Certification of fire retardant treated material.
- C. Contract Closeout Information:
 1. Certificate by framing installer that wood frame was constructed in accordance with project plans and specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Engineered Wood Products:
 1. Base:
 - a. Boise Cascade
 2. Optional:
 - a. Georgia Pacific
 - b. Louisiana-Pacific
 - c. RedBuilt
 - d. Weyerhaeuser
- B. Preservative Treated Materials:
 1. Base:
 - a. Hoover Treated Wood Products.
 2. Optional:
 - a. Arxada AG
 - b. Kopper Performance Chemicals.
 - c. Lonza Companies.
 - d. Stella-Jones, Inc.
 - e. Viance, LLC.
 - f. Western Wood Preservers, Ltd.
- C. Fire-Retardant Treated Materials:
 1. Base:
 - a. Hoover Treated Wood Products
 2. Optional:
 - a. Continental Wood Preservers, Inc.
 - b. Lonza Companies.
 - c. Stella-Jones, Inc.
 - d. Viance, LLC.

- D. Metal Framing Anchors:
 - 1. Base:
 - a. Simpson Strong-Tie.
 - 2. Optional:
 - a. United Steel Products.
- E. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DIMENSION LUMBER

- A. Dimension Lumber - General:
 - 1. Provide dimension lumber of grades indicated according to ALSC National Grading Rule (NGR) provisions of inspection agency indicated.
 - 2. Inspection agencies and abbreviations used to reference include following:
 - a. NELMA: Northeastern Lumber Manufacturers Association.
 - b. NLGA: National Lumber Grades Association.
 - c. RIS: Redwood Inspection Service.
 - d. SPIB: Southern Pine Inspection Bureau.
 - e. WCLIB: West Coast Lumber Inspection Bureau.
 - f. WWPA: Western Wood Products Association.
 - 3. Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
 - 4. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece or omit grade stamps and provide grade compliance certificates issued by inspection agency.
 - 5. Where nominal sizes are indicated, provide actual sizes required by DOC PS20 for moisture content specified.
 - a. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 6. Provide dressed lumber, S4S, unless otherwise indicated.
 - 7. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2 inches 50 mm nominal thickness or less, unless otherwise indicated.
- B. Exterior and Load-Bearing Walls:
 - 1. Provide framing of following grade and species:
 - a. Grade: No.2. unless noted otherwise in Structural documents
 - b. Species: spruce-pine-fir south; NELMA.
 - c. Species: Douglas fir-larch north; NLGA.
 - d. Species: Hem-fir north; NLGA.
 - e. Species: Spruce-pine-fir north; NLGA.
 - f. Species: Southern pine; SPIB.
 - g. Species: Douglas fir-larch; WCLIB or WWPA.
 - h. Species: Hem-fir; WCLIB or WWPA.
 - i. Species: Douglas fir south; WWPA.
 - j. Species: Any species above.

- C. Ceilings; non-load bearing:
 - 1. For ceiling framing that does not support a floor, roof or attic, provide following grade and species:
 - a. Grade: No.2. unless noted otherwise in structural documents
- D. Other framing not listed above:
 - 1. Provide following grade and species:
 - a. Grade: Construction, stud, or No.3.
 - b. Species: Northern species; NLGA.
 - c. Species: Southern pine; SPIB.
 - d. Species: Hem-fir; WCLIB or WWPA.
 - e. Species: Spruce-pine-fir south; WCLIB or WWPA.
- E. Exposed Framing:
 - 1. Provide material hand-selected from lumber of species and grade indicated below for uniformity of appearance and freedom from characteristics that would impair finish appearance:
 - a. Species and grade: As indicated above for load bearing construction.
- F. Timbers:
 - 1. For timbers of 5-inch 120 mm nominal size and thicker, provide material complying with following requirements:
 - a. Species and grade: Douglas fir-larch north, Select Structural per NLGA rules.
 - b. Species and grade: Southern pine, No.1 Dense per SPIB rules.
 - c. Species and grade: Douglas fir-larch, Select Structural per WCLIB or WWPA rules. Timbers shall be free of heart centers.
- G. Miscellaneous Lumber:
 - 1. Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members.
 - 2. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
 - 3. Grade: For dimension lumber sizes, provide No.3 or Standard grade lumber per ALSC's NGRs of any species. For board size lumber, provide No.3 Common grade per NELMA, NLGA or WWPA; No.2 grade per SPIB, or Standard grade per NLGA, WCLIB, or WWPA of any species.

2.3 ENGINEERED WOOD PRODUCTS

- A. Engineered Wood Products - General:
 - 1. Provide engineered wood products acceptable to local building code authorities.
 - a. Provide engineered wood products with allowable design stresses, as published by manufacturer, which meet or exceed those indicated.
 - b. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
 - 2. Comply with APA (Engineered Wood Association) standards and recommendations.

- B. Laminated Veneer Lumber (LVL):
 - 1. Lumber manufactured by laminating wood veneers in a continuous press using an exterior type adhesive complying with ASTM D2559 to produce members with grain of veneers parallel to their lengths and complying with following requirements:
 - a. Extreme fiber stress in bending: 2900 psi .
 - b. Modulus of elasticity: 2,000,000 psi.
 - c. Shear modulus: 128,800 psi.
 - d. Compression parallel to grain: 2300 psi.
 - e. Compression perpendicular to grain: 750 psi.
 - f. Horizontal shear: 285 psi.
- C. Concealed, performance rated structural use panels – General:
 - 1. Plywood Quality:
 - a. Provide plywood panels complying with DOC PS1, U.S. Product Standard for Construction and Industrial Plywood, where plywood is indicated.
 - 2. Oriented Strandboard Quality:
 - a. Provide either veneer, mat formed or composite panels complying with DOC PS2, Performance Standard for Wood Based Structural Use Panels, unless otherwise indicated.
 - 3. Where structural use panels are indicated for following concealed types of applications, provide APA performance rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail.
 - a. Panels shall have an APA trademark evidencing compliance with grade requirements.
 - 4. Thickness: Provide panels meeting requirements specified but not less than thickness indicated.
 - 5. Provide panels with span ratings required to meet Code Plus provisions of APA Form No. E30, APA Design/ Construction Guide: Residential and Commercial.
 - 6. Composite panels used inside building envelope shall be manufactured without urea-formaldehyde resins.
- D. Wall sheathing:
 - 1. APA-Rated Sheathing.
 - 2. Exposure durability classification: Exterior.
 - 3. Span rating: As required to suit stud spacing indicated.
- E. Roof Sheathing:
 - 1. APA-Rated Sheathing.
 - 2. Exposure durability classification: Exterior.
 - 3. Span rating: As required to suit stud spacing indicated.

2.4 FASTENERS

- A. General:
 - 1. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture.

2. Where fasteners, nuts washers or connectors are in contact with pressure treated lumber, provide fasteners with a minimum hot-dip G90 galvanized coating per ASTM A153, ASTM B695, mechanical galvanized coating, silicon bronze, copper, and type 304 or 316 stainless steel fasteners when stainless steel connectors are used.
 3. Provide type 304 and 316 stainless steel fasteners at construction below grade, where exposed to salt used in snow melting operations, and severe exterior applications.
- B. Nails, wires, brads and staples: FS FF-N-105.
- C. Deformed-shank Nails for Sheathing:
1. Corrosion-resistant for exterior exposures.
 2. Barbed or deformed shank.
 3. Comply with ASTM F1667.
- D. Power-driven fasteners: ICC ESR-1539.
- E. Wood Screws:
1. Carbon steel, galvanized, conforming to ASME B18.6.1 IFI 502.
- F. Lag screws or lag bolts:
1. Commercial steel, galvanized, conforming to ASME B18.2.1.
- G. Bolts and Nuts:
1. Carbon steel, galvanized, conforming to ASTM A307, Grade-A; ASTM-F568M, Class 4, 8 or less.
 2. ASTM A563 hex nuts and flat washers.
- H. Galvanized Bearing Plate for Shear Walls: ASTM A653.
- I. Metal Framing Anchors:
1. Provide galvanized steel framing anchors of structural capacity, type and size indicated and as follows:
 - a. Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for this project.
 - b. Provide products with allowable design loads as published by manufacturer, which meet or exceed those indicated.
 - 1) Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
 - c. Galvanized steel sheet:
 - 1) Hot dip zinc-coated steel sheet complying with ASTM A653, coating designation as shown in the Application Matrix and Connection requirements.
 - d. Structural, commercial or lock-forming quality, as standard with manufacturer for type of anchor indicated.

2.5 TREATED MATERIALS

- A. Wood Preservative Treated Materials:
1. The selection of preservative treated material is based on the exposure of the wood members: Interior, Exterior and Extreme Exterior use.
 - a. Extreme exterior use shall include exposure to ocean salty air, large bodies of water, fumes, fertilizers.

2. Application Matrix and Connection finish requirements:

Connector Material					
Wood Treatment	Interior Use		Exterior Use		Extreme Exposure
	No barrier	With barrier	No barrier	With barrier	No barrier
ACQ-C & ACQ-D	G185	G90	G185	G185	SS
CA-B & CBA-A	G185	G90	G185	G185	SS
DOT Sodium Borate	G90	No barrier required	Not allow.	Not allow.	Not allow.
Zinc Borate	G90	No barrier required	Not allow.	Not allow.	Not allow.
Other	SS	Not allow.	SS	Not allow	SS

Notes:

Coating of fasteners shall match connector material

Barrier: Grace Vicar Deck Protection

G90: Hot Dip Galvanized finish per ASTM-A153 Class G90

G185: Hot Dip Galvanized finish per ASTM-A153 Class G185

SS: Stainless Steel

B. Fire-Retardant Treated Materials:

1. Use on fire-rated assemblies, including items used within Fire-rated Exterior Walls.

C. Water-repellent preservative:

1. NWWDA tested and accepted formulation containing 3-iodo-2-propylene butyl carbonate (IPBC) as its active ingredient.

2.6 MISCELLANEOUS

A. Sill sealer gaskets:

1. Glass fiber resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32-inch 8 mm.
2. Selected from manufacturer's standard widths to suit width of sill members indicated.

B. Adhesives for field gluing panels to framing:

1. Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturer.

C. Panel Edge Clips:

1. Extruded aluminum or galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive work.
- B. Correct unsatisfactory conditions.
- C. Start of work constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Verify measurements, dimensions and drawing details before proceeding.
- B. Coordinate location of furring, nailers, blocking, grounds and similar supports for attached work.
- C. Examine conditions under which work is to be installed.
- D. Correct unsatisfactory conditions.

3.3 INSTALLATION - GENERAL

- A. General:
 - 1. Provide wood grounds, nailers, or blocking as required for attachment of other work and surface applied items.
 - 2. Provide wood blocking between studs at height of door stop, behind stop, at every door opening.
 - 3. Grounds: Dressed, key beveled lumber minimum 1-1/2-inch 38 mm wide of thickness required to bring face of ground even with finish material.
 - 4. Remove temporary grounds when no longer required.
 - 5. Install wood furring plumb and level with closure strips at edges and openings.
 - 6. Shim as required.
 - 7. Discard material with defects that impair quality of rough carpentry.
 - 8. Set rough carpentry to required levels and lines with members plumb, true to line, cut and fitted.
 - 9. Fit rough carpentry to other construction; scribe and cope as required for accurate fit.
 - a. Coordinate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other construction.
 - 10. Apply field treatment complying with AWPAC M4 to cut ends of preservative treated lumber and plywood.
 - 11. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated on Drawings and complying with following:
 - a. CABO NER-272 for power driven staples, P-nails, and allied fasteners.
 - b. Published requirements of metal framing anchor manufacturer.
 - 12. Use common wire 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.
 - a. Make tight connections between members. Install fasteners without splitting wood; pre-drill as required.
 - 13. Use hot-dip galvanized or stainless steel nails where rough carpentry is exposed to weather in-ground contact or in areas of high humidity.
 - 14. Countersink nail heads on exposed carpentry work and fill holes with wood filler.
 - 15. Comply with AWC's "Manual for Wood Frame Construction," unless otherwise indicated.
 - 16. Install engineered wood products to comply with manufacturer's written instructions.
 - 17. Install framing members of size and at spacing indicated.
 - 18. Do not splice structural members between supports.

B. Wall Framing:

1. Arrange studs so that wide face is perpendicular to direction of wall or partition and narrow face is parallel.
 - a. Provide single bottom plate and double top plates using members of 2-inch 50 mm nominal thickness (unless larger sizes are indicated on structural documents) whose widths equal that of studs; except single top plate may be used for non-load bearing partitions.
 - b. At bearing and exterior walls provide overlapping top plates at intersecting corners of walls and partitions.
 - c. Nail or anchor plates to supporting construction as indicated.
2. Construct corners and intersections with 3 or more studs.
 - a. Provide miscellaneous blocking and framing as shown and as required to support facing materials, fixtures, specialty items, and trim.
3. Frame openings with multiple studs and headers.
 - a. Provide nailed header members of thickness equal to width of studs.
 - b. Set headers on edge and support on jamb studs.
4. For non-load bearing partitions provide double jamb studs with headers not less than 4-inch 100 mm nominal depth for openings 36 inches 900 mm in width, and not less than 6-inch 150 mm nominal depth for wider openings.
5. For load bearing walls, provide jambs as shown in structural documents, if it is not shown provide double jamb studs for openings 72 inches 1.8 M and less in width, and triple jamb studs for wider openings.
 - a. Provide headers of depth shown.

3.4 INSTALLATION – TIMBER FRAMING

- A. Install timber framing with crown edge up and provide not less than 4 inches 100 mm of bearing on supports.
 1. Provide continuous members, unless otherwise indicated; tie together over supports if not continuous.
- B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch 50 mm air space at sides and ends of wood members.
- C. Install wood posts with metal anchors indicated.
- D. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

3.5 INSTALLATION – ENGINEERED WOOD PRODUCTS

- A. General:
 1. Comply with applicable recommendations contained in APA Form No. E30, APA Design/Constructing Guide: Residential & Commercial, for types of structural use panels and applications indicated.
 2. Space panels 1/8-inch 3 mm at edges and ends.
 3. Utilize framing clips along long edges.
- B. Fastening: As indicated and as follows:
 1. Combination Sub-flooring/Underlayment:
 - a. Glue and nail to framing.
 2. Sub-flooring:
 - a. Glue and nail to framing.

3. Wall Sheathing:
 - a. Nail or screw to framing.
4. Roof Sheathing:
 - a. Install with the grain of the outer plies or long dimension at right angles to framing supports.
 - 1) Stagger end joints and locate over the centerlines of supports.
 - b. Allow 1/8-inch 3 mm spacing at panel ends and 1/4-inch 6 mm at panel edges.
 - 1) Utilize Panel Edge Clips along long edges of sheathing, between framing members.
 - c. Nail or Screw to framing.
 - 1) Nailing:
 - a) Nail panels with 8-penny common nails or 6-penny annular rings or screw-type nails spaced 6 inches 150 mm O.C. at supported edges and 12 inches 300 mm O.C. at intermediate bearings.
 - b) Set nails no less than 3/8 inches 10 mm from edges.
 - 2) Screwing:
 - a) Where framing is metal trusses: Use appropriate screw type spaced as specified above for nails.
 - 3) Do not use staples in roof sheathing.
 - d. Where the support spacing exceeds the maximum span for an unsupported edge, provide adequate blocking, tongue-and-groove edges, or panel edge clips, in accordance with APA E30.

3.6 PROTECTION – ENGINEERED PANEL PRODUCTS

- A. Protect installed sheathings from moisture damage.
 1. Replace panels that show warped or swelling.

END OF SECTION

SECTION 06 12 00
STRUCTURAL INSULATED PANELS (SIPs)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural Insulated Panels.
- B. Related Requirements:
 - 1. Section 06 11 10 Wood Framing and Sheathing
 - 2. Section 06 17 53 Shop-Fabricated Wood Trusses
 - 3. Section 07 61 13 Standing Seam Metal Roofing
 - 4. Section 07 62 00 Sheet Metal Flashing and Trim
 - 5. Section 07 92 13 Exterior Joint Sealants

1.2 REFERENCES

- A. American Society of Civil Engineers (ASCE) Publications
 - 1. ASCE 7 – Minimum Loads for Buildings and Other Structures.
- B. ASTM International Publications:
 - 1. ASTM C578 – Standard Specifications for Rigid, Cellular Polystyrene Thermal Insulation.
 - 2. ASTM D7446 – Standard Specification for Structural Insulated Panel (SIP) Adhesives for Laminating Oriented Strand Board (OSB) to Rigid Cellular Polystyrene Thermal Insulation Core Materials
 - 3. ASTM E72 – Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
 - 4. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
 - 5. ASTM E1803 – Standard Test Method for Determining Structural Capacities of Insulated Panels.
- C. APA The Engineered Wood Association Publications:
 - 1. DOC PS2 – Performance Standard for Wood-Based Structural-Use Panels.
 - 2. APA PRP-108 – Performance Standards and Qualification Policy for Structural-Use Panels
- D. ICC-ES Acceptance Criteria:
 - 1. ICC-ES AC04 – Acceptance Criteria for Sandwich Panels.
 - 2. ICC-ES AC05 – Acceptance Criteria for Sandwich Panel Adhesives.
 - 3. ICC ES AC12 – Acceptance Criteria for Foam Plastic Insulation.

1.3 SUBMITTALS

- A. Product Data: Submit product data for specific products.
 - 1. SIP Code Compliance: Provide code report for SIP to demonstrate compliance with requirements for construction as per current applicable code. {Submit current ICC-ES evaluation report from showing compliance the International Building Code (IBC) and International Residential Code (IRC).
 - 2. EPS Code compliance: Provide evaluation report for EPS insulation with evidence of compliance with current applicable code.

- B. Provide panels engineered by specialty structural engineer to support superimposed dead, live, and lateral, wind or seismic, loads indicated.
 - 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
 - 2. Include panel to structure connection design.
 - 3. Include handling forces and show temporary bracing required during erection.
 - 4. Proportion such that the following deflection limits are not exceeded:
 - a. Live or snow, roof: $L/180$.
 - b. Dead (including long term deflection) plus live or snow: $\text{span}/240$.
 - c. Wind: $L/360$.
- C. Shop drawings: Submit SIP shop drawings showing panel layout, elevations, SIP connection details, product components and accessories.
- D. Quality Assurance Submittals: Submit the following:
 - 1. Submit copy of third party certification label demonstrating that manufacture of panels complies with specified performance characteristics and physical properties.
 - 2. Submit manufacturer-specific installation instructions for SIP system.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installer to have demonstrated experience acceptable to SIP Manufacturer for installation work similar in scope and size to this project. Manufacturer to confirm availability of site advisory service.
- B. Field Measurements: Request field measurements prior to completion of shop drawings and fabrication. Coordinate fabrication schedule with construction schedule to avoid delay of work. Field fabrication is allowed to ensure proper fit only after consultation with manufacturer.
- C. Source limitations: Obtain all SIPs through one source. All accessories to be furnished or recommended by the SIP manufacturer.
- D. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, foundation/structural system/substrate conditions, review SIP manufacturer installation instructions and requirements for SIP manufacturer warranty.

1.5 STORAGE, HANDLING AND PROTECTION

- A. Ordering: Comply with SIP manufacturer ordering instructions and lead time requirements to avoid construction delays.
- B. Delivery: Deliver materials from SIP manufacturer with identification labels or markings intact.
- C. Unloading: Off-load SIPs from delivery truck and handle using fork lift, crane or other means to prevent damage to SIPs.
- D. Storage: SIPs shall be fully supported in level storage and prevented from contact with the ground. Stack SIPs with a minimum of three supports for every eight feet of SIP length.
- E. Protection: SIPs shall be fully protected from the weather. Protect against exposure to rain, water, dirt, mud, and other residue that may affect SIP performance. Cover stored SIPs with breathable protective wraps. Sips shall be stored in a protected area.

1.6 WARRANTIES

- A. Manufacturer's Warranty: Manufacturer shall provide a warranty for SIP panels and their components, including panel joint and edge sealants, panel seal tape, assembly fasteners, and sheathing membranes provided by the SIP manufacturer, for a period of 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Insulspan.
 - 2. Porter SIPS, division of PorterCorp.
 - 3. Extreme Panel Technologies, Inc.
 - 4. Premier SIPS.
 - 5. Acme Panel Company.
 - 6. Other manufacturers as approved by Engineer.

2.2 MATERIALS

- A. Expanded polystyrene (EPS) core –EPS insulation complying with {CAN/ULC-S701, Type 1} {ASTM C578, Type I} (other densities may be specified). Manufacturer to provide Third Party Certification to demonstrate compliance with applicable insulation specification.
- B. Oriented Strand Board (OSB) – a performance rating mark shall be identified on the OSB panel, with an Exposure 1 durability rating; minimum material properties shall be as described in DOC PS2, APA PRP-108 and CSA 0325.0.
- C. Laminating Adhesives – a structural grade laminating adhesive that has demonstrated compliance with ICC ES AC05 – Acceptance Criteria for Sandwich Panel adhesives, CCMC technical evaluation guide for SIPs and ASTM D7446.

2.3 ACCESSORIES

- A. Splines:
 - 1. OSB, dimensional lumber, engineered wood or I-beam for use in joining SIPs shall be supplied by the SIP manufacturer as specified on approved SIP shop drawings.
- B. Fasteners:
 - 1. Nails as per SIP manufacturer design requirements shall be used for spline and plate attachments following fastening requirements specified on approved SIP shop drawings. Nails for field installation of spline and plates to be supplied by the SIP installer.
 - 2. Panel Screws as per SIP manufacturer design requirements shall be used following fastening requirements specified on approved SIP shop drawings. Panel screws are to be supplied by the SIP manufacturer or approved equal supplied by the SIP installer.
- C. SIP Sealant:
 - 1. Sealants shall be specifically designed for use with SIPs. Sealant must be compatible with all components of the SIP. Sealant is to be supplied by the SIP manufacturer or approved equal supplied by the SIP installer.
- D. SIP Panel Seal Tape:
 - 1. Tape with an adhesive suitable for indoor use, minimum 6" (152 mm) wide for use on flat SIP joints and minimum 12" (304 mm) wide for use on opposing angled surfaces including ridge and roof-to-wall connections. SIP tape shall be supplied by the manufacturer.

2.4 FABRICATION

- A. Panel sizes shall be fabricated in accordance with approved shop drawings. Maximum panel size shall be 2440 mm x 7320 mm (8' X 24'). Fabrication tolerances shall comply with values in manufacturer product specification.

- B. Manufacturing Standards: SIPs shall be manufactured under a third party certification program monitored by an accredited agency and manufacturer shall maintain a quality management system in accordance with ISO 9001: 2000.
- C. SIP Thermal Resistance at a Mean Temperature of 75° F (24° C) for SIP only consisting of 7/16" (11 mm) OSB structurally laminated to both faces of EPS insulation core. Thermal resistance values do not include interior/exterior cladding or finish materials and air films. R-value (Inch-pound) units are (ft²•hr•°F)/BTU. RSI-value (SI System) units are (m²•°C)/W.
 - 1. 8 ¼" (210 mm) thick SIP with R-29.2 (RSI-5.15).

2.5 SOURCE QUALITY

- A. Source Quality Assurance: Each SIP component required shall be supplied by SIP manufacturer and shall be obtained from the selected SIP manufacturer of its approved supplier.
- B. Each SIP shall be labeled indicating Third Party Certification.
 - 1. Provide evidence of Third Party Certification and labeling of all insulation used in the manufacturing of SIPs.
 - 2. SIP manufacturer shall provide lamination, R-value (RSI-value) and warranty document for building owner acceptance and execution.
 - 3. Dimensional Tolerance – shall comply with values listed in the SIP manufacturer Quality Control Manual.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Shop drawings shall be reviewed by a qualified engineer and shall be signed and sealed. Deviations from standard details or load design values shall be calculated for the specific use and the calculations and details shall be signed and sealed by a registered design professional and provided to the manufacturer.
- B. Site Verification of Conditions: Verify that substrate conditions are acceptable for product installation in accordance with SIP manufacturer instructions and guidelines.
 - 1. Verify conditions of foundation/structural system/substrate and other conditions which affect installation of SIPs. Any adverse conditions shall be reported in writing to the SIP manufacturer and the lead design professional. Do not proceed with installation until adverse conditions are corrected and documented.

3.2 INSTALLATION

- A. SIP Installation:
 - 1. SIP Support: Provide level and square foundation/structural system/substrate that support wall and/or roof SIPs. For wall SIPs hold sill plate back from edge of deck ½" (12.7 mm) to provide full bearing of both OSB skins. Provide adequate bracing of SIPs during panel erection. Remove debris from plate area prior to application of sealant and SIP placement.
 - 2. Electrical: If required, provide 1 ½" (38 mm) diameter access holes in top and bottom plating to align with electrical wire chases in SIPs. Align all horizontal electrical chases in SIPs and maintain debris free electrical chases.
 - 3. SIP Fastening: Connect SIPs using screws or nails as shown on approved shop drawings. Where manufacturer supplied SIP Screws are used, a minimum of 1 ½" (38 mm) of penetration is required into wood support.
 - 4. SIP Sealant: Sealant must be installed in a continuous bead at all connections.
 - 5. SIP Tape: Apply SIP tape at joints between roof SIPs, at the roof-to-wall connection and at the ridge. Tape shall only be installed after all spline connections are completed as per Manufacturer installation instructions.
 - 6. Vapor Retarders: Provide vapor retarders as required by applicable building code.

7. Thermal Barriers: Interior surface of SIPs shall be finished with a minimum 15-minute thermal barrier consisting of 1 layer 5/8" Type X gypsum board. Apply approved thermal barrier according to requirements of applicable building code.
8. Restrictions: Do not install SIPs directly or in contact with concrete/dirt. Do not install plumbing in a SIP without consulting SIP manufacturer. Do not over-cut panel skins for approved field-cut openings. Do not cut skins to install electrical chases. Do not expose EPS core of SIPs to any solvents or solvent-based adhesives.
9. Remove and replace any SIP wall or roof panels which have become wet or damaged before proceeding with the installation of additional SIPs or other work that may cover a compromised SIP.

3.3 FIELD QUALITY CONTROL

- A. SIP Manufacturer Field Services: Field services as detailed in contract documents consisting of product use recommendations and site visits for site advisory service to ensure SIP installation in accordance with manufacturer requirements to be provided by the SIP Manufacturer.

3.4 PROTECTION

- A. Protection: Protect installed product from exposure and damage during construction.
 1. Wall or Roof SIP Temporary Protection: Protect SIPs from weather with temporary protection at the end of each day or when rain or snow is imminent. Apply wall or roof sheathing membrane to exposed panel faces as soon as practical after installation.
 2. After installation is complete, cover SIPs to prevent contact with excessive water on all exposed SIP edges and faces.
 3. Wall or Roof SIP Cladding: Ventilate backside of wall and roof cladding applied to SIPs.
 4. Roof SIP: Roofing material must only be installed on a dry SIP roof with a moisture content of 17% or less.

END OF SECTION

SECTION 06 16 43 GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Gypsum Sheathing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Related Sections:
 - 1. Plywood Sheathing: Specified in Section 06 10 00 – Rough Carpentry.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C1047 Standard Specification for Accessories for Gypsum Wallboard.
 - 2. ASTM C1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - 3. ASTM C1280 Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
 - 4. ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
- B. Gypsum Association (GA):
 - 1. GA-253 Application of Gypsum Sheathing

1.3 SUBMITTALS

- A. Product Data:
 - 1. Material properties and test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Gypsum Sheathing:
 - 1. Base:
 - a. Georgia Pacific.
 - 2. Optional:
 - a. CertainTeed.
 - b. Continental Building Products.
 - c. National Gypsum Company.
 - d. USG.
- B. Seam Sealant: Refer to Section 07 92 13.
- C. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Exterior Gypsum Sheathing:
 - 1. Water-resistant, mold-resistant, suitable for long term weather exposure during construction.
 - 2. Minimum Mold Resistance: 10 rating per ASTM D3273.
 - 3. Minimum Thickness: 5/8-inch 12 mm thick.

- 4. Base Product:
 - a. Dens-Glass Gold Exterior Sheathing by Georgia Pacific.
- B. Seam Sealant:
 - 1. Coordinate sealant for compatibility with selected air or vapor barrier systems and sheathing.
- C. Fasteners:
 - 1. Screws: Stainless Steel.
 - 2. Clips: Galvanized or zinc.
 - 3. Sized as required.
 - 4. Thread count as appropriate for stud materials specified.
- D. Sheathing control joints and accessories: Galvanized, or zinc complying with ASTM C 1047.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate for suitability to accept work.
- B. Start of work constitutes acceptance of substrate and responsibility for performance.

3.2 INSTALLATION

- A. Install sheathing and accessories per manufacturer's written instructions.
- B. Exterior Sheathing:
 - 1. Align edges of sheathing panels on stud centerlines.
 - 2. Screw to exterior of each stud as recommended by manufacturer.
 - 3. Butt sheathing boards together tightly:
 - a. Maximum gap between boards: 1/8-inch 3 mm.
 - 4. Seal seams with sealant by filling all joints and troweling smooth on sheathing surface to a depth of 1/16-inch 1.5 mm and a width of 2 inches 50 mm.
- C. Control Joints:
 - 1. Locate control joints as per system requirements and in accordance with ASTM C1280 and as follows:
 - a. Subdivide so that no area exceeds 900 square feet 81 square meter, and no area has a length which exceeds 30 feet 9 m.
 - b. Locate control joints at every building construction joint.

END OF SECTION

SECTION 06 17 53
SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Metal Plate Connected Wood Trusses, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Fabricator Qualifications:
 - 1. Minimum five years experience in fabrication of metal-plate-connected wood trusses.
 - 2. Participate in a recognized quality-assurance program that involves inspection by SPIB; Timber Products Inspection.; Truss Plate Institute (TPI); or other independent inspection and testing agency acceptable to Engineer.
- B. Metal-Plate Connector Manufacturer Qualifications:
 - 1. Member of TPI and comply with TPI quality-control procedures for manufacture of connector plates.
 - 2. Provide metal connector plates from one source and by a single manufacturer.
- C. Erector Qualifications:
 - 1. Experienced in wood truss installation and shall have completed wood truss installation similar in material, design, and extent to that indicated on Drawings with a record of successful in-service performance.
- D. Truss Plate Institute (TPI):
 - 1. ANSI/TPI-1 National Design Standard for Metal-Plate-Connected Wood Truss Construction
 - 2. TPI Building Component Safety Information (BCSI) - Guide to Good Practice for Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses.
 - 3. TPI DSB Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses
- E. Reference Standards:
 - 1. National Institute of Standards and Technology DOC PS20 American Softwood Lumber Standard
 - 2. American Wood Council (AWC) National Design Specification for Wood Construction.
- F. Provide trusses engineered by specialty structural engineer to support superimposed dead, live, and lateral, wind or seismic, loads indicated.
 - 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
 - 2. Include truss to truss girder connection design.
 - 3. Include handling forces and show temporary bracing required during erection.
 - 4. Proportion such that the following deflection limits are not exceeded:
 - a. Live or snow: $\text{Span} / 360$.
 - b. Dead (including long term deflection) plus live or snow: $\text{span} / 240$.
 - c. Wind: $\text{Span} / 360$.
- G. Engineer to review design for general conformance with intent of Contract Documents.

1.3 SUBMITTALS

A. Shop Drawings:

1. Indicate location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber to be used; splice details; type, size, material, finish, design values, and orientation and location of metal connector plates; truss to truss girder connection details and truss bearing details.
2. Indicate permanent bracing required including location, size, and connection details.

B. Product Data:

1. Product certificates signed by officer of truss fabrication firm certifying that metal-plate-connected wood trusses supplied comply with specified requirements and shop drawings.
2. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by American Lumber Standards Committee (ALSC) Board of Review.
3. Research or evaluation reports acceptable to authorities having jurisdiction that metal-plate connectors and metal-framing connectors comply with local building code.

C. Project Information:

1. Proof that erector has minimum of five (5) years experience in installation of metal-plate-connected wood trusses.
2. Proof of fabricators participation in a recognized quality-assurance program.
3. Engineering analysis and calculations indicating design moments, shears, and other forces signed and sealed by Specialty Structural Engineer.
 - a. Submit concurrent with Shop Drawings.

D. Contract Closeout Information:

1. Certificate by erector, that trusses were installed in accordance with approved erection plans and specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Metal Connector Plates:

1. Base:
 - a. Alpine Engineered Products.
 - b. Mitek Industries.
 - c. Tee-Lok.
 - d. Truswal Systems.

B. Metal Framing Anchors:

1. Base:
 - a. United Steel Products.

C. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Dimensional lumber: Comply with DOC PS20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

1. Inspection agencies, and abbreviations used to reference them, include following:
 - a. NELMA Northeastern Lumber Manufacturers Association.
 - b. NLGA National Lumber Grades Authority.
 - c. SPIB Southern Pine Inspection Bureau.
 - d. WCLIB West Coast Lumber Inspection Bureau.
 - e. WWPA Western Wood Products Association.
2. Provide lumber with each piece factory marked with grade stamp of inspection agency, evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing and mill.
3. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS20 with 19% maximum moisture content at time of dressing.
4. Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values.
- B. FSC certified.Nails, wires, brads, and staples: Comply with ICC-ES AC233.
- C. Power driven fasteners: Comply with ICC ESR-1078.
- D. Metal framing anchors: Type, size, metal, and finish indicated.

2.3 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate connector plates from hot-dipped galvanized sheet steel complying with ASTM A653, G60; Grade-33 and not less than 0.0359 inches 1 mm thick.
- C. Fabricate metal connector plates to size, configuration and thickness required to withstand design loadings for types of joint designs indicated.
- D. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances of ANSI/TPI-1.
 1. Position members to produce design camber indicated.
- E. Connect truss members by metal connector plates located and securely embedded simultaneously into both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Consider that full structural capacity of trusses is not realized until structural assembly is complete.
 1. Until permanent elements of roof are complete, temporary bracing will be required. Install truss bracing according to recommendations of TPI and as indicated by truss fabricator.
 2. Do not install wood trusses until supporting construction is in place and braced.
- B. Splice trusses delivered to project site in more than one piece before installing.
- C. Install trusses plumb, square and true to line, and securely fasten to supporting construction.
- D. Space, adjust, and align trusses in location before permanently fastening. Space trusses not more than 24 inches 600 mm OC.
- E. Anchor trusses securely at bearing points using metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedule and written instructions.
- F. Securely connect each truss ply for forming built-up girder trusses.

- G. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
- H. Install wood trusses within tolerances of ANSI/TPI-1.
- I. Do not cut or remove truss members.
- J. Do not alter trusses in field.
- K. Repair damaged galvanized coatings with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Architectural Wood Casework, as indicated, in accordance with provisions of Contract Documents.
- B. Related Sections:
 - 1. Section 12 36 63 - Solid Surface Fabrications (SSF).
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Firm with manufacturing and delivery capacity required for the project.
 - 2. Successfully completed at least five projects within the past four years, utilizing systems, materials and techniques as specified.
- B. Installer Qualifications:
 - 1. Manufacturer or manufacturer's authorized representative.
- C. North American Architectural Woodwork Standards (NAAWS), latest edition:
 - 1. Grade: Premium, with exceptions indicated.
 - 2. Exposed cabinet body edges are to be fabricated flush before and after installation of edge banding.
- D. ASTM D1037 Standard Test Methods for Evaluating Properties of Wood Base Fiber and Particle Panel Materials.
- E. ANSI 208.2: MDF for Interior Applications.
- F. Composite Panel Association listed NAUF (No Added Urea Formaldehyde).

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Plans of casework at 1/8 inches = 1 foot scale or larger.
 - 2. Elevations of casework at 1/4 inches = 1 foot scale or larger.
 - 3. Cross reference shop drawings to Contract Documents casework elevations.
- B. Product Data:
 - 1. Typical details of casework construction.
- C. Contract Closeout Information:
 - 1. Warranty.
 - 2. Operation and Maintenance Data.
 - a. See Section 01 78 23.

1.4 WARRANTY

- A. Manufacturer five year warranty against defects in materials and workmanship, such as but not limited to delamination, swelling, or warping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufactured Casework:
 - 1. Base:
 - a. Wisconsin Built, Inc.

- 2. Optional:
 - a. Becks Quality Cabinets, Inc.
 - b. J.A. Eisch, LLC.
 - c. Heritage Woodworks, Inc.
- B. Plastic Laminate:
 - 1. Base: Wilsonart.
 - 2. Alternates:
 - a. Formica
 - b. Nevamar
- C. Contact Adhesive:
 - 1. Base:
 - a. Wilsonart
 - b. Formica
 - c. Nevamar
- D. Wood Glue:
 - 1. Base:
 - a. Franklin (TiteBond)
 - b. Wilsonart (Lokweld)
- E. Low Pressure Decorative Laminate (LPDL) Panels:
 - 1. Base:
 - a. Casework Manufacturer
 - 2. Optional:
 - a. Uniboard
- F. Medium Density Fiberboard:
 - 1. Base:
 - a. Roseburg Forest Products.
 - 2. Optional:
 - a. Georgia Pacific.
 - b. Uniboard.
- G. PVC Edge Banding:
 - 1. Base:
 - a. Doellken-Woodtape.
 - 2. Optional:
 - a. Rehau.
 - b. Charter Industries.
 - c. Canplast.
- H. Cabinet Hardware:
 - 1. Base:
 - a. Accuride.
 - b. Epco.
 - c. Hafele.

- d. Blum.
- e. Knappe & Vogt.
- f. Grant.
- g. National Lock.
- h. Ilco Unican Corporation.
- i. Stanley Hardware.
- j. Stylmark.
- k. HEWI.
- l. TMI Systems Design.
- m. Rockford Process Control.
- n. U.S. Futaba.
- o. Weber Knapp Company.
- p. CCL Security Products.
- q. Schlage Lock.
- r. Olympus Lock.
- s. Sugatsune America.
- t. Colson Caster Corporation.
- u. AllenField.

I. Miscellaneous items:

- 1. Products and Manufacturers as listed.

J. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

A. Design and construct to support listed minimum loads.

- 1. These loads are not intended to limit other locations in the section where more stringent requirements are called for.
- 2. Base Units: 500 pounds per lineal foot across the cabinet ends.
- 3. Suspended Units: 300 pounds static load.
- 4. Drawers: 100 pounds.
- 5. Hanging Wall Cases: 300 pounds.
- 6. Shelves: 100 pounds minimum unless heavier weights are designated.

2.3 MATERIALS

A. General:

- 1. FSC certified wood components.
- 2. No Added Urea Formaldehyde (NAUF) in materials or fabrication.
- 3. Verify adhesives have a VOC content of 70 g/L or less.

B. Medium Density Fiberboard (MDF):

- 1. ANSI A208.2 Grade 155 MR50.
- 2. Moisture resistant:
 - a. Water Absorption: 6 percent average, 24 hour soak.
 - b. Thickness Swell: 3 percent
- 3. 48 pcf density

4. Base: Medex by Roseburg
 5. Core material for plastic laminate casework.
 6. Core material for counters, backsplash, and sidesplashes with sinks.
- C. Plastic Laminate Facings:
1. Standard: NEMA LD3.
 2. NEMA LD3, Impact rated at 43IN when adhered to MDF.
 3. Thickness and Grade:
 - a. Formed surfaces: Post form Grade-HGP, 0.048 inches thick.
 - b. Other exposed surfaces: Grade-VGS, 0.028 inches thick.
 4. Backer Sheets for laminated items.
 - a. Semi-exposed cabinet liner: Grade-CLS, 0.020 inches thick; color to match LPDL.
 - b. Concealed backer sheet: Grade-CLS, 0.020 inches thick; any color.
 5. See Drawings for finish selections.
- D. Low Pressure Decorative Laminate (LPDL):
1. Resin impregnated 80 gram paper overlay, heated and fused onto substrate.
 2. Material: Polyester or melamine; phenolic resin may be used on concealed surfaces.
 3. NEMA LD3, Grade-VGL requirements.
 4. NEMA LD3, Impact rated at 15 inches when adhered to MDF.
 5. Finish: Satin.
 6. Color:
 - a. As selected by Engineer from manufacturer's standard color line.
- E. PVC-Free Edge Banding:
1. Machine applied with waterproof hot melt adhesive.
 2. Edge of case body and exposed components:
 - a. Thickness: 1mm.
 - b. Color: To match case exterior.
 3. Edge of shelves inside plastic laminate clad units:
 - a. Thickness: 1mm.
 - b. Color: To match shelf.
 4. Edges of doors and drawer fronts, exposed finished shelves and removable panels:
 - a. Thickness: 3mm.
 - b. Color: To match exterior face of panel.
 5. Edges of plastic laminate countertops and tops of backsplashes and side splashes:
 - a. Thickness: 3mm.
 - b. Color: To match plastic laminate.

- F. Contact Adhesives:
 - 1. Description:
 - a. Viscosity: 760 cps.
 - b. Density: 7.7 pounds/GAL.
 - c. Solids content: 36 percent +/- 1 percent.
 - d. VAHP content: None.
- G. Wood Glue:
 - 1. Description:
 - a. Bond Strength per ASTM D905: 4,000 psi at room temperature.
 - b. ANSI/HPVA Type I water resistant.
 - c. Application temperature: Above 47 deg F.
 - d. FDA approved for indirect food contact.
- H. Sealant:
 - 1. Silicone sealant in colors matching components.
 - 2. Specified in Section 07 92 16.

2.4 CABINET HARDWARE

- A. Five Knuckle Hinges:
 - 1. Institutional (hospital tip), five knuckle, wrap around type with barrel only projecting beyond face of cabinet.
 - 2. Use on cabinets unless noted otherwise.
 - 3. Minimum Height: 2-3/4 inches.
 - 4. Minimum 8 screws per hinge.
 - 5. ANSI/BHMA-A156.9 Grade-1.
 - 6. Hinge Quantities per leaf:
 - a. For doors up to 48 inches high: 2 hinges.
 - b. For doors over 48 inches high: 3 hinges.
 - c. For doors over 84 inches high: 4 hinges
 - 7. Finish: 26D Dull Chrome.
 - 8. Base Product: 370/450 series hinge by Rockford Process Control (RPC).
- B. Drawer Slides:
 - 1. Full extension.
 - 2. Stainless steel ball bearings
 - 3. Soft closing.
 - 4. Pull out stops - drawer removable without use of tools.
 - 5. Capacity:
 - a. Standard Drawers: 100 pounds.
 - 6. Base Product:
 - a. Model 3832EC by Accuride
- C. Straight Wire Pulls:
 - 1. 4 inches centers.
 - 2. Finish: Satin stainless steel.

- D. Catches:
 - 1. Magnetic or roller type, adjustable.
 - 2. Minimum 4 pound pull.
 - 3. Provide two catches on doors more than 48 inches high.
- E. Elbow Catch:
 - 1. Provide at pairs of doors with locks.
- F. Door Stops:
 - 1. Braided steel cable with clear PVC coating, mounting eyelets, and screws.
 - a. Base Product: Hafele 366.74.900.
 - 2. Finish: zinc plated.
 - 3. Length: 163 mm 6 inches nominal.
 - 4. Provide at locations where door opens adjacent to walls, cabinets and equipment.
 - 5. Mount to prevent contacting wall or equipment with door or hardware.
- G. Door Bumpers:
 - 1. Provide on backside of doors and drawer faces.

2.5 SUPPORTS AND BRACKETS

- A. Adjustable Shelf Supports:
 - 1. Friction fit pins into cabinet end panels and vertical dividers.
 - 2. Space 1/4 inches holes on 1 1/4 inches centers.
 - 3. Locate support holes to avoid conflict with installation of hinges.
 - 4. Retain shelves on support with spring clip shelf lock or screw attachment.
 - 5. Material:
 - a. Injection molded clear polycarbonate.
 - 6. Capacity: 200 pound minimum, per support device.
- B. Metal Bracket for Cantilevered Countertop:
 - 1. Material: 1/8 to 1/4 inches thick, 6063 T-6 extruded aluminum.
 - 2. Pre-drilled for attachment to wall and countertop.
 - 3. Include fasteners suitable for conditions.
 - 4. Coordinate locations of blocking (see Section 09 22 16). Brace studs according to bracket manufacturer instructions.
 - 5. Capacity: 450 pounds per bracket.
 - 6. Base Products:
 - a. Rakks Inside Wall Mount EH Counter Support by Rangine Corporation.
 - b. Rakks Surface Mount EH Counter Support by Rangine Corporation.
 - c. Use inside wall mount model unless construction does not allow.
 - 7. Finish: Black.

2.6 MISCELLANEOUS CABINET HARDWARE

- A. Grommets:
 - 1. Base Product: XG-3 by Doug Mockett & Company, Inc.
 - 2. Finish: Black or putty as selected by Engineer.

3. Size: Provide 3-1/2 inches diameter flip top grommet cap with 7/8 inches x 1-3/8 inches cord slot.
4. Provide as directed by Owner after installation of equipment at each location such as, but not limited to, undercounter electrical or systems outlet, cord drops, and keyboard drawers.

2.7 FABRICATION

A. General:

1. See Drawings for casework quantities, configurations, finishes, countertops, and casework accessories.
2. Verify dimensions at site.
3. Verify locations of items furnished in other Sections.
4. If necessary to vary from arrangement indicated because of structural, mechanical, electrical or other considerations, make such variations only after approval of Engineer.

B. Definitions:

1. Exposed surfaces: Surfaces visible when doors and drawers are closed.
 - a. Door and drawer fronts, and their edges.
 - b. Exposed ends.
 - c. Bottom of wall case.
 - d. Countertop and backsplash and their exposed edges.
 - e. Face of cabinet body not covered by doors or drawer fronts.
 - f. Interior of open cabinets, including shelving.
2. Concealed surfaces: Surfaces not visible after installation.
 - a. Solid top panels.
 - b. Security panels.
 - c. Locking rails.
3. Semi-exposed surfaces: Surfaces only visible when doors and drawers are opened.
 - a. Interior of cabinets with opaque doors.
 - b. Back sides of doors.
 - c. Top of wall cabinets and tall cases.
 - d. Drawer boxes.

C. Plastic Laminate Faced Casework:

1. Factory built casework finished on exterior with high pressure laminate.
2. Core Material:
 - a. Medium Density Fiberboard (MDF).
 - b. MR moisture resistant panels where work surfaces include a sink.
 - c. MR panels shall have 50 percent reduction in thickness swell by ANSI A208.1.
3. Provide units complete with hardware, subbases and trim, in sizes and configurations indicated.

4. Style:
 - a. Reveal overlay, with doors and drawer fronts overlapping case front with minimum reveal.
 - b. Edge doors and drawer fronts with 3mm PVC banding, machine applied using waterproof hot melt adhesive. Machine profile exposed edges with 1/8 inches radius.
5. Finishes:
 - a. Exposed surfaces: Plastic Laminate.
 - b. Grain Direction, where laminate finish is directional: Vertical grain at frames, cases, door faces, drawer faces and other vertical surfaces.
 - c. Semi-exposed surfaces: LPDL.
 - d. Concealed surfaces: LPDL.
 - e. Edges of Doors and Drawer Fronts: 3 mm PVC edge banding.
 - f. Edges of Case Body panels: 1mm PVC edge banding.
 - g. Edges of Shelves: 1mm PVC edge banding (four sides).
- D. Casework Components:
 1. Case Body:
 - a. Sides: 3/4 inches thick.
 - 1) Locate shelf support holes to avoid conflict with installation of door and drawer hardware.
 - b. Top and Bottom Panels: 3/4 inches thick.
 - c. Backs: 1/2 inches thick.
 - 1) Exception: Where back face is exposed to view: Upgrade to 3/4 inches.
 - d. Security Panels: 1/2 inches thick.
 - e. Drawer Lock Rails: 3/4 inches thick.
 - f. Base: 3/4 inches thick, with intermediate reinforcing at 24 inches on center maximum.
 2. Shelves:
 - a. Less than 30 inches long: 3/4 inches thick.
 - b. Between 30 and 40 inches long: 1 inch thick.
 3. Doors:
 - a. 3/4 inches thick.
 - b. Doors not to exceed 25 inches in width.
 4. Drawers:
 - a. Drawer Fronts: 3/4 inches thick.
 - b. Sub-fronts, Sides and Backs: 1/2 inches thick.
 - c. Bottoms: 1/2 inches thick.
 - 1) Include intermediate reinforcing rails where drawer width exceeds 18 inches.
 5. Small Compartment Dividers: 1/4 inches clear acrylic panel.
 6. Filler Panels and Scribe Pieces: 3/4 inches thick.

7. Soffits:
 - a. Material and finish to match cabinets.
 - b. 3/4 inches thick.
 - c. Abut soffit to acoustical tile ceiling without reveal or gap.
 - d. Cope tegular ceiling tile to overhang face of soffit.
 - e. Where distance between top of cabinet and ceiling is greater than 24 inches: Soffits to be sloped 30 degrees, unless noted otherwise.

E. Case Configuration:

1. Plastic Laminate Faced Units:
 - a. Provide reveal, approximately 1/8 inches, at top of doors and drawer fronts, and between doors and drawer fronts in same unit; reveal approximately 7/16 inches at sides.
2. Provide reveal 1/8 inches x 1/8 inches (black) in upper edge of exposed sides of wall case when plastic laminate soffits provided.
3. Toe space:
 - a. 4 inches high by approximately 3 inches deep; provide on front of each base unit unless noted on architectural drawings.
4. Countertop:
 - a. Plastic laminate units:
 - 1) Overhang 3/4 inches beyond doors, drawer fronts and exposed ends.
5. Hardware mounting:
 - a. Drawers:
 - 1) Center the pull in drawer front, horizontally.
 - 2) No more than 4 inches from top.
 - b. Drawers with 2 pulls:
 - 1) Set pulls at 1/4 points.
 - 2) No more than 4 inches from top.
 - c. Swinging doors:
 - 1) Set door pull in swing side corner, vertically, at top of base units, at bottom of wall units.
6. Adjustable shelves:
 - a. Use drilled hole supports.
 - b. Depth: 1/2 inches less than inside cabinet depth.
 - c. Width: 1/8 inches, maximum, less than inside cabinet width.
7. Provide doors at locations requiring access to electrical devices, as indicated on drawings.

F. Joinery

1. Construct cabinet body of 3/4 inches thick core joined with 10mm diameter industrial grade hardwood dowels, securely glued and clamped under pressure during assembly.

2. Case body:
 - a. Sides, dividers, bottom, and top panels:
 - 1) Minimum of 6 dowels at each joint for 24 inches deep cabinets.
 - 2) Minimum of 4 dowels for 12 inches deep cabinets.
 - 3) Glue joints.
 - b. Back:
 - 1) For dadoed backs, dado into sides, bottom and top. Locate dado 3/4 inches in from back face of cabinet.
 - 2) For on-set backs, rabbet at finished ends, screw at the top and bottom, staple at the sides.
 - 3) Glue joints.
 - c. Compartment dividers and lock rails:
 - 1) Dowel and glue.
 - d. Base:
 - 1) Integral or separate.
 - 2) Construct to receive base material to match adjacent walls, unless shown otherwise.
 - 3) Blind fasten to bottom of case body when separate.
3. Drawers:
 - a. Sub-front, sides and back: Doweled and glued corner joints.
 - b. Bottom: Dado into 4 sides and glued or screwed to the bottom with the use of bottom supporting drawer slide hardware.
 - c. Front: Secured from sub-front side with no less than four screws.
 - d. Use no blocking or fasteners in exposed or semi-exposed locations.

G. Mechanical Fasteners:

1. Countertop joints:
 - a. Provide joint connectors every 6 inches on-center.
2. Pre-drill and countersink screw holes before installation.
3. Do not use mechanical fasteners or blocking in exposed locations. When fasteners are required on exposed surfaces color, materials and finish to be approved by Engineer.

2.8 COUNTERTOP MATERIALS AND FABRICATION

- A. Solid Surface Countertops (SSF): See Section 12 36 63.

PART 3 - WINDOWSILLSEXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate to accept installation.
- B. Ensure that adequate Wall Backing has been installed.
 1. Metal Wall Backing: See Section 09 22 16.
 2. Coordinate and direct installation of backing where required.
- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Use manufacturer's printed instructions or drawings in cases where items or details are not indicated.
- B. Install casework level and plumb.
- C. Securely attach casework to wall blocking
 - 1. Shim to maintain stable location.
 - 2. Do not fasten with drywall or bugle head screws.
 - 3. Fasten to floor or ceiling if casework does not attach to wall.
 - 4. Fasten in concealed or semi-exposed location.
- D. Hardware:
 - 1. Install hinges, stops, guides and other door and drawer hardware to avoid adjustable shelf holes in case body.
 - 2. Install up to 10 extra door locks and 10 extra drawer locks in casework not previously shown or scheduled to have locks.
 - 3. Install extra locks where directed by Owner.
 - 4. Turn over extra, uninstalled locks to Owner.
- E. Construct units with sinks or lavatories to withstand an applied vertical load of not less than 250 pounds on the front edge of countertop.
- F. Provide cutouts for mechanical and electrical items.

3.3 SEALING OF JOINTS

- A. Seal casework, countertops, and splashes to walls, to seal joints.
 - 1. Sealant color to match countertop color.
- B. Seal perimeter of counter mounted sink fixtures.
 - 1. Sealant color to match countertop or sink color.
- C. Seal windowsills to walls and window frames to seal joints.
 - 1. Sealant color to match color of sill material specified.

3.4 ADJUSTMENTS AND CLEANING

- A. Test and adjust items of equipment for satisfactory operation.
- B. Adjust hinges for proper door alignment.
- C. Adjust drawer guides for proper drawer front alignment and operation.
- D. Adjust countertops to a level position and align to adjacent unit.
- E. Repair damage to casework or countertops to appear in original new condition.
- F. Repair damage to premises as a result of installation.
- G. Remove debris left by this installation.
- H. Clean casework and countertops after above items have been completed.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Building Insulation in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 RELATED SECTIONS

- A. Section 03 45 00 "Architectural Precast Concrete (APC)" for rigid insulation used within insulated precast concrete panels.
- B. Section 06 12 00 "Structural Insulated Panels" for rigid insulation used as a component of structural insulated roofing panels.
- C. Section 09 29 00 "Gypsum Board" for sound attenuation batts used in interior partitions.

1.3 REFERENCES

A. Referenced Standards:

- 1. ASTM International (ASTM):
 - a. C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - b. C578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - c. C947 Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam with Third-Point Loading).
 - d. C1104/C1104M Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
 - e. D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 deg C and 30 deg C with a Vitreous Silica Dilatometer.
 - f. D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - g. D2842 Standard Test Method for Water Absorption of Rigid Cellular Plastics.
 - h. E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - i. E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - j. E96/E96M Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
 - k. E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
 - l. E136 Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 deg C
- 2. National Fire Protection Association (NFPA):
 - a. NFPA 268 Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source
 - b. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components

1.4 SUBMITTALS

A. Action Submittals:

1. Product Data: Manufacturers' product data sheets, details and installation instructions including components and accessories, indicating product is in compliance with specifications.

B. Informational Submittals:

1. Product Test Reports: For each product, for tests performed by a qualified testing agency.
2. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- ##### A. Surface-Burning Characteristics:
- As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- ##### A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Rigid Board Insulation Extruded Polystyrene (XPS):

1. Base:
 - a. Owens-Corning.
2. Optional:
 - a. DuPont.
 - b. Kingspan.

B. Concrete Faced Insulation Panel:

1. Base:
 - a. T. Clear Corporation.
2. Optional:
 - a. Tech-Crete Processors Ltd.

C. Polyisocyanurate Insulated Wall Sheathing:

1. Base:
 - a. RMax.
2. Optional:
 - a. Atlas.
 - b. Carlisle.

- c. DuPont.
 - d. Firestone.
- D. Fiberglass Batt Insulation:
 - 1. Base:
 - a. Owens-Corning.
 - 2. Optional:
 - a. CertainTeed
 - b. Johns Manville.
 - c. Knauf Insulation.
- E. Vapor Retarder (VR):
 - 1. Base:
 - a. Griffolyn, Reef Industries.
 - 2. Optional:
 - a. Lamtec.
- F. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Rigid Board Insulation - Extruded Polystyrene Foam (XPS):
 - 1. Minimum Compressive Strength:
 - a. 40 psi 276 kPa. (type VI) ..
 - 2. Minimum Surface Burning Characteristics per ASTM E84 and NFPA 268:
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: less than 450.
 - c. No ignition from radiant heat source.
 - 3. Water vapor permeance per ASTM E96:
 - a. 1.50 10 perm 85.8 NG/S/M2/Pa, maximum.
 - 4. Water absorption per ASTM D2842:
 - a. 0.3%, maximum.
 - 5. Thermal resistance per ASTM C518:
 - a. R-value of 5.0 per inch at 75 deg F 0.88 per 25 mm at 24 deg C mean temperature.
 - 6. Base Product:
 - a. Foamular Next Generation Extruded (NGX) 400 by Owens Corning.
 - 7. Optional:
 - a. GreenGuard by Kingspan.
 - b. Styrofoam by DuPont.
 - 8. Minimum thickness: 2 inches 50 mm or as indicated on drawings.
 - 9. Adhesives for adhering polystyrene insulation: As recommended by insulation manufacturer.
- B. Polyisocyanurate (PISO) Insulation:
 - 1. ASTM C1289 rigid polyisocyanurate boards.
 - 2. Facer: Coated Fiberglass (Type II).
 - 3. Compressive Strength: 25 psi (Grade 3).

4. Surface Burning Characteristics per ASTM E84.
 - a. Flame Spread: less than 75.
 - b. Smoke Developed: less than 450.
 5. Moisture Resistance: Absorbs less than 0.5% by volume, per ASTM C209.
 6. R-value: 6.0 per inch.
 7. Base Product: Durasheath by RMax.
- C. Unfaced Fiberglass Batt Insulation:
1. Inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets.
 2. Un-faced, Type I in accordance with ASTM C665.
 3. Minimum Surface Burning Characteristics per ASTM E84: Flame Spread: Less than 25; Smoke Developed: Less than 50.
 4. Combustion characteristics: Noncombustible; unfaced per ASTM E136.
 5. Manufactured without urea-formaldehyde binders.
 6. Nominal Thickness / Thermal Resistance Value, measured at 75 deg F 23.9 deg C:
 - a. Nominal Thickness: 3-1/2 inches / R-13 92 mm/R-2.3.
- D. Vapor Retarder (VR):
1. Three plies of low density polyethylene, bonded with two layers of scrim reinforcing.
 2. Fire retardant type: Flame Spread 5/ Smoke developed 90 per ASTM E84.
 3. Permeance: Not exceeding 0.015 Perm 0.86 NG/Pa*S*M2.
 4. Puncture Strength: 54 pounds 240 N.
 5. Base Product: Type 90 FR by Griffolyn.
 6. Optional Product: R-3035HD by Lamtec.
 7. Seaming Tape:
 - a. Self-adhering, asphaltic mastic.
 - b. Base Product: Fab Tape by Griffolyn.
 - c. Optional Product: 491 FSK by American Biltrite, Inc.
 8. Repair Tape, for punctures and other damaged areas:
 - a. Base Product: Griff Tape by Griffolyn.
 - b. Optional Products: Same products listed for optional seaming tapes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate to accept installation.
- B. Installation indicates acceptance of responsibility for performance.

3.2 INSTALLATION

- A. General:
 1. Insulate full thickness over surfaces to be insulated.
 2. Fit tightly around obstructions, fill voids.
 3. Cover penetrations with insulation.
 4. Comply with manufacturer's instructions for installation unless more stringent requirements are specified.

5. Consult manufacturer's technical representative if installation instructions are not applicable.
 6. Where rigid insulation is indicated over 2 inches 50 mm thick, apply in double layer with staggered joints to achieve total thickness.
 7. Do not use broken or torn pieces of insulation.
 8. Provide minimum cover of 5/8 inches 16 mm type X gypsum wallboard over exposed foam surfaces.
- B. Un-Faced Batt Insulation and Vapor Retarder in exterior Stud Wall systems:
1. Installing Batts:
 - a. Friction fit un-faced batts between studs.
 - b. Tightly butt ends.
 - c. Where specified thickness of batts is less than the depth of framing, install retaining devices to prevent sagging.
 2. Installing Vapor Retarder:
 - a. Position vapor retarder over inside face of framing.
 - b. Install vapor retarder in 50 inches 1270 mm wide sheets.
 - c. Install vapor retarder vertically.
 - d. Install in continuous sheets, floor to structure above, without horizontal joints.
 - e. Vertical Seams:
 - 1) Tape vertical edge of vapor retarder to stud.
 - 2) Position subsequent adjoining sheet and continuously tape vertical edge to preceding sheet.
 - f. Tape bottom and top edges to structure continuously.
 - g. Tape edges to window, door frames, and penetrations to maintain continuity.
- C. Rigid Board Insulation at foundations:
1. Extend down for distance indicated in one layer.
 - a. If not indicated, extend down to design frost line.
 2. Install in mastic with tight joints on walls.
 3. Protect from damage and/or displacement during backfilling.

3.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 27 46
VAPOR PERMEABLE AIR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Vapor Permeable Air Barrier, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Air and vapor barrier systems shall be manufactured by firm with minimum of 20 years of experience in production of waterproofing.
 - 2. Obtain primary air barrier materials and air barrier accessories from single source from single manufacturer.
- B. Installer Qualifications:
 - 1. Minimum five years of continued experience in successful installation of vapor and water resistive air barrier products on similar project applications.
- C. ASTM International (ASTM):
 - 1. ASTM D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
 - 2. ASTM D1876 Test Method for Peel Resistance of Adhesives.
 - 3. ASTM E96 Test Methods for Water Vapor Transmission of Materials.
 - 4. ASTM E2178 Standard Test Method for Air Permeance of Building Materials.
 - 5. ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
- D. International Code Council Evaluation Service, Inc.: ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers.
- E. National Fire Protection Association (NFPA):
 - 1. NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Show locations and extent of air barrier.
 - 2. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Details and isometrics at openings showing layouts of air barrier flashings and sequence of installation.
- B. Product Data:
 - 1. Manufacturer's literature indicating specified material and required components.
- C. Project Information:
 - 1. Written documentation demonstrating applicator's qualifications.
- D. Contract Closeout Information:
 - 1. Installer Warranty.

1.4 WARRANTY

- A. Installer five year warranty for air and vapor barrier and accessories have been installed in accordance with manufacturer's recommendations, and that components used in this section have been sourced from one manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Vapor Permeable Air Barrier:
 - 1. Base:
 - a. Henry Company.
 - 2. Optional:
 - a. Carlisle Coatings and Waterproofing.
 - b. GCP Applied Technologies
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

- A. General:
 - 1. Air barrier capable of performing as a continuous, vapor permeable air barrier. Design system to accommodate substrate movement and to seal to substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air Permeance:
 - 1. M 0.004 cubic feet per minute per square foot 0.3 water pressure differential, as tested in accordance with ASTM E2178.
- C. Vapor Permeance:
 - 1. Minimum 10 perms when tested in accordance with ASTM E96.
- D. Exposure Rating:
 - 1. Provide material with appropriate exposure rating to suit construction schedule.
- E. Application Window:
 - 1. Provide standard or low temperature air barrier based upon ambient weather conditions at time of installation.
 - 2. Low temperature product shall meet or exceed design criteria of standard product.

2.3 MATERIALS

- A. Self-adhesive air barrier membrane:
 - 1. Microporous sheet membrane with factory applied adhesive.
 - 2. Base Product:
 - a. Blueskin VP160 by Henry.
 - 3. Optional Products:
 - a. Fire Resist 705 VP by Carlisle.
 - b. Perm-A-Barrier VPS by Grace.
- B. Fluid applied air barrier membrane:
 - 1. 35 dry MIL elastomeric membrane.
 - 2. Base Product:
 - a. Henry Air Bloc 17MR.

3. Optional Product:
 - a. Carlisle Fire Resist Barritech VP.
 - b. GCP Perm-A-Barrier VPL.
- C. Transition Membrane:
 1. Self-adhesive.
 2. Compatible with air barrier and adjacent substrate.
 3. As recommended by air barrier manufacturer.
- D. Primer: Spray applied adhesive as directed by manufacturer for substrate.
- E. Termination Sealant:
 1. Silicone sealant.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine conditions for compliance with requirements for installation, tolerances and other specific conditions affecting performance of air barrier.
- B. Substrate to be smooth and free of voids, spalled areas and sharp protrusions.
- C. Exterior Sheathing Panels:
 1. Pre-treat joints with reinforced self-adhesive tape or mesh style wallboard tape.
 2. Caulk gaps greater than 1/4 inches.
- D. Remove deleterious materials from surfaces to be covered.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.
- F. Installation indicates acceptance of substrates and responsibility for performance.

3.2 INSTALLATION

- A. Install according to manufacturer's directions.
- B. Perform work only when existing and forecast weather conditions are within limits established by manufacturer.
- C. Join air barrier in an airtight and flexible manner to air barrier material of adjacent systems, allowing for relative movement of systems due to thermal and moisture variations and creep, between:
 1. Foundation and walls.
 2. Walls and windows or doors.
 3. Different wall systems.
 4. Wall and roof.
 5. Wall and roof over unconditioned space.
 6. Walls, floors and roof across construction, control and expansion joints.
 7. Walls, floors and roof to utility, pipe and duct penetrations.
- D. Air and Vapor Barrier Membrane:
 1. Primer: Apply at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application.
 2. Sheet Membranes:
 - a. Apply membrane horizontally or vertically and press firmly into place with hand roller.
 - b. Start at the bottom of vertical surfaces and work up.

- c. Do not reverse shingle membranes or detail tape.
 - d. Stagger end lap seams.
 - 3. Fluid Applied Membranes:
 - a. Spray or trowel apply continuous uniform film using multiple, overlapping passes to ensure even thickness and coverage.
 - b. Carry membrane into openings minimum 3 inches.
 - c. Seal brick ties and penetrations as work progresses.
 - E. Transition Membrane:
 - 1. Install mastic at terminations, substrate transitions, penetrations and overlaps according to manufacturer's standard details.
 - 2. Overlap fluid applied membrane onto each surface at beams, columns and joints.
 - 3. Tie in to window and door frames, spandrel panels, roof and floor intersections, and changes in substrate.
 - 4. Seal top edge of flashing with termination mastic.
- 3.3 PROTECTION
- A. Schedule work to ensure that system is covered as soon as practicable.
 - 1. Protect system from damage during subsequent operations.
 - B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer.
 - 1. Apply temporary UV protection if system cannot be covered within prescribed period.
 - 2. Replace air barrier if determined be damaged by UV exposure by Manufacturer.
 - 3. Replace air barrier exposed to UV for longer than recommended period.
 - C. Clean spills, stains, and soiling from construction that would be exposed in completed work as recommended by manufacturer of affected construction.
 - D. Remove masking materials after installation.

END OF SECTION

SECTION 07 46 46 FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fiber cement lap siding, trim, and soffit boards.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM D3359 - Standard Test Method for Measuring Adhesion by Tape Test, Tool and Tape
2. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

B. Product Data: Submit Manufacturer's storage and handling requirements, preparation instructions, and installation methods.

C. Samples: Submit two 6" long samples for each type of siding specified.

D. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Minimum of 2 years' experience with installation of similar products.
2. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship. Approved mock-up may be incorporated into the final work.

1.4 STORAGE, HANDLING AND PROTECTION

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.6 WARRANTIES

A. Product Warranty: 30 years. Limited, non-pro-rated product warranty.

B. Finish Warranty: Limited product warranty against manufacturing finish defects: 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.

C. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. James Hardie.
2. Allura USA.
3. Nichicha.

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Lap siding and trim: fiber cement boards in compliance with the following:
 - 1. ASTM C 1186 Type A Grade II.
 - 2. ASTM E 136 as a noncombustible material.
 - 3. ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.
- B. Lap siding
 - 1. Texture: smooth.
 - 2. Sizes: 8.25" (8" exposure) and 5.25" (5" exposure) where indicated on Drawings.
 - 3. Colors: prefinished siding selected by Engineer from Manufacturer's standard range of colors.
 - 4. Basis of design:
 - a. 8" lap siding: Basis of design – "Mountain Sage" by James Hardie
 - b. 5" lap siding: Basis of design – "Light Mist" by James Hardie
- C. Trim and Fascia
 - 1. Texture: smooth.
 - 2. Width: As indicated on Drawings.
 - 3. Thickness: $\frac{3}{4}$ ".
 - 4. Color: As selected by Engineer from Manufacturer's full range of colors.

2.3 ACCESSORIES

- A. Fasteners: wood framing fasteners as recommended by Manufacturer.
- B. Finishes: touchup paint as required to match prefinished siding color.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Clean surfaces thoroughly prior to installation.
- C. Install air barrier and penetration and junction flashing in accordance with local building code requirements.

3.2 APPLICATION

- A. Install materials in accordance with Manufacturer's instructions.
- B. Install $\frac{1}{4}$ " thick minimum starter strip at the base of a new course of lap siding.
- C. Do not nail within 2" of the end of a plank of siding.
- D. Splices and vertical joints shall not be closure than 12" from any wall opening.
- E. Trim and fascia boards:
 - 1. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum $\frac{3}{4}$ inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
 - 2. Place fasteners no closer than $\frac{3}{4}$ inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.
 - 3. Allow $\frac{1}{8}$ inch gap between trim and siding. Seal gap with paintable exterior caulk.

3.3 PROTECTION

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

END OF SECTION

SECTION 07 61 13
STANDING SEAM METAL ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Standing Seam Metal Roofing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Company engaged in copper or other unpainted metal roofing work with three years' experience in similar size and type of installations.
 - 2. Architectural roofing fabricated in a permanent stationary indoor facility.
- B. Installer Qualifications:
 - 1. Minimum of two (2) years' experience in installation of concealed clip architectural standing seam metal roofing and show evidence of successful completion of at least 3 projects of similar size, scope, and complexity.
 - 2. An entity that employs installers and supervisors who are trained or approved by manufacturer.
- C. ASTM International (ASTM):
 - 1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers.
 - 3. ASTM D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - 4. ASTM E1646 Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
 - 5. ASTM E1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. Architectural Sheet Metal Manual
- E. American Welding Society (AWS):
 - 1. AWS Sheet Steel in Structures, Specification for Welding AWS D1.3.
- F. National Roofing Contractors Association (NRCA):
 - 1. Roofing Manual, Metal Panel and SPF Roof Systems.
- G. Underwriters Laboratories (UL):
 - 1. UL 263 - Fire Tests of Building Construction and Materials.
 - 2. UL 580 - Test for Wind-Uplift Resistance of Roof Assemblies.
 - 3. UL-2218 - Impact Resistance Test

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.

- B. Shop Drawings:
 - 1. Complete layout indicating types of roofing, anchorage, sections of flashing and trim conditions, cut openings and accessories.
 - 2. Drawings shall distinguish between factory and field fabrication.
- C. Samples:
 - 1. Color samples of finishes.
- D. Project Information:
 - 1. Certification of conformance with wind uplift standard listed.
- E. Contract Closeout Information:
 - 1. Warranty.

1.4 WARRANTY

- A. General Warranty:
 - 1. Provide two year warranty for water tightness of roof and associated flashing signed by roofing installer.
 - 2. Provide 20 year warranty for water tightness of roof and associated flashing signed by roofing materials manufacturer.
 - 3. Warrant water tightness of roof and associated flashing.
- B. PVDF Finish:
 - 1. Provide 20 year warranty against fading, chalking, cracking or failure resulting in corrosion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Standing Seam Metal Roofing:
 - 1. Base:
 - a. Petersen Aluminum
 - 2. Optional:
 - a. Berridge Manufacturing
 - b. Centria
 - c. Fabral
 - d. Firestone Una-Clad
 - e. Morin
 - f. Ryerson Metals
- B. Underlayment:
 - 1. Base:
 - a. Same as Metal Roof Manufacturer
 - 2. Optional:
 - a. Approved by Metal Roof Manufacturer
- C. Reglets, Downspouts and Gutters:
 - 1. Specified in Section 07 62 00.
- D. Galvanizing repair paint:
 - 1. Base:
 - a. Thnemec

- 2. Optional:
 - a. ZRC Worldwide
- E. Snow Guards:
 - 1. Base:
 - a. Petersen Aluminum.
 - 2. Optional:
 - a. Zaleski Snow Guards
 - b. Sno-Gem
 - c. Vermont Slate and Copper Services
 - d. Snojax
 - e. LMCurbs
- F. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

- A. Static Air Infiltration:
 - 1. Maximum infiltration: 0.007 cubic feet/M²/SQ FT 0.00003556 m³/s per m² at a pressure differential of 6.24 psf 298 Pa when tested in accordance with ASTM E1680.
- B. Static Water Infiltration:
 - 1. No uncontrollable water leakage at a pressure differential of 6.24 psf 298 Pa when tested in accordance with ASTM E1646.
- C. Wind Uplift Approval:
 - 1. UL-90 rating when tested per UL 580.

2.3 MATERIALS

- A. Factory formed, pre-finished, standing seam metal roofing system with concealed fasteners over solid substrate.
- B. Fabricate trim and flashings from same material as roof system material.
- C. Painted Steel Panels:
 - 1. Sheet Steel: ASTM A653, Grade-A.
 - 2. Galvanized Coating: ASTM A653, G90 Z275 zinc coating.
 - 3. Base Product: Snap Clad Standing Seam by Peterson Aluminum.
 - a. Standing Seam Panels.
 - 4. Minimum Sheet Thickness:
 - a. Steel: 24 GA 0.6 mm.
 - b. Reglets, Downspouts and Gutters: Specified in Section 07 62 00.
 - 5. Spacing of Standing Seams:
 - a. 18 inches 450 mm.
 - 6. Height of Standing Seam: 1-3/4 inches 45 mm.
 - 7. Finish:
 - a. Exposed:
 - 1) Minimum 70% PVDF.
 - 2) Minimum DFT: 1.0 mils 0.025 mm.

- 3) Color:
 - a) PAC-CLAD 'Dark Bronze' by Peterson Aluminum or equal as approved by Engineer.
 - b. Solar Reflectance Index: 29 or greater.
 - c. Concealed:
 - 1) PVDF Wash coat.
 - 2) Minimum DFT: 0.3 mils 0.0076 mm.
 - 8. Protective film: Strippable vinyl film applied during panel fabrication and finishing; removed after installation.
 - 9. Metal roofing clips and fasteners:
 - a. ASTM A653, Z180 G60 galvanized sheet steel.
 - b. Minimum 26 GA 0.55 mm before coating.
 - c. Configurations and sizes required by Manufacturer.
- D. Underlayment:
 - 1. Cold-applied, self-adhering rubberized asphalt membrane with cross laminated polyethylene film.
 - a. Minimum sheet thickness: 40 mil 1 mm.
 - b. Vapor Permeance: less than 0.05 perms 2.86 ng/s/m²/Pa.
 - c. Tensile Strength: 250 psi 1.7 MPa.
 - d. Rated for use from -20 degrees F to 250 degrees F -29 degrees C to 121 degrees C.
 - e. Primer as required for substrate.
 - 2. Base Product:
 - a. Grace Ice and Water Shield manufactured by Grace Construction Products.
 - 3. Optional:
 - a. Other products approved by Roof Manufacturer for warranty.
- E. Fasteners:
 - 1. Nails:
 - a. Large head galvanized roofing nails.
 - 2. Screws:
 - a. Stitch Tek's, 12-14 x 3/4 hex washer head with pilot point.
 - b. Color to match roofing.
- F. Snow Guards:
 - 1. Base Product: Sno-Barricade by Sno Gem.
- G. Roof Sheathing:
 - 1. Specified in Section 06 11 10.
 - 2. Fire rated assemblies:
 - 3. Non-fire rated assemblies:
 - a. Minimum 5/8 inches 16 mm thick preservative treated, exterior grade wood and plywood.
- H. Insulation:
 - 1. Specified in Section 06 12 00.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine entire area to be roofed for acceptability.
- B. Correct unsatisfactory conditions.
- C. Commencement of roofing activities constitutes acceptance of conditions affecting installation and responsibility for roofing system performance.

3.2 INSTALLATION

- A. Do not start placement of roofing until supporting members are installed complete.
- B. Install metal roofing panels to profiles, patterns and drainage indicated and required for leak-proof installation.
- C. Provide for structural and thermal movement.
- D. Prevent galvanic action of dissimilar metals.
- E. Conceal fasteners where possible in exposed work.
- F. Form joints to conceal sealant.
- G. Deck Reinforcement:
 - 1. Reinforce openings between 6 and 12 inches 150 and 300 mm with 20 GA 0.9 mm steel sheet 12 inches 300 mm greater in each dimension than opening.
 - 2. Place sheet around opening and weld to top surface of deck at each corner and each side midway between each corner.
- H. Underlayment:
 - 1. Install membrane directly on clean, dry, continuous structural deck in accordance with manufacturers recommendations.
 - 2. Place first course starting at the eave.
 - 3. Overlap subsequent layers.
 - 4. Install additional layers of underlayment at ridges, valleys, penetrations, equipment curbs, adjoining walls and similar conditions.
- I. Standing Seam Metal Roofing:
 - 1. Install cleats as required.
 - 2. Place each panel on supporting structural frame, adjust to final position, and accurately align with ends bearing on supporting members.
 - a. Install panels in one continuous length.
 - b. Do not stretch or contract side lap interlocks.
 - c. Place panels flat and square and secure to framing without warp or excessive deflection.
 - 3. Remove and replace panels which are structurally weak, unsound or have burn holes scratches or other damage caused by shipping or installation.
 - 4. Form trim with flush, telescoped, or nested 2 inches 50 mm end and side laps.
 - 5. Cut and fit panels and accessories around other work projecting through or adjacent to roofing.
 - a. Make cutting and fitting neat, square and trim.
 - b. Neatly and accurately reinforce openings exceeding 6 inches 150 mm in diameter or on a side.

- 6. Install metal closure strips as required.
 - a. Provide where rib openings in top surface of roof decking occur adjacent to edge and openings.
 - b. Form tight-fitting closures at open ends and sides.
 - c. Securely fasten closure strips into position.
 - J. Snow Guards:
 - 1. Locate snow guard arrays as indicated on Drawings. Mechanically attach snow guards using non-penetrating clamps.
- 3.3 CLEANING AND PROTECTION
- A. Cleaning:
 - 1. Remove temporary coverings and protection of adjacent work areas.
 - 2. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.
 - B. Touch Up:
 - 1. Retouch scarred areas, welds and rust spots.
 - 2. Touch-up damaged galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
 - 3. Touch-up PVDF surfaces with material used in shop, as recommended by metal roofing material manufacturer.
 - C. Protect installed product from damage during construction.
- END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Flashing and Sheet Metal, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 2. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM B209 Standard Specification for Aluminum-Alloy Sheet and Plate
 - 4. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
 - 5. ASTM B308/B308M Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
 - 6. ASTM F2329/F2329M Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
- B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. Architectural Sheet Metal Manual

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Shop Drawings:
 - 1. Dimensioned drawings of profiles and shapes.
 - 2. Plans and elevations to show locations of each shape.
- C. Samples:
 - 1. For finish, color and color range selection.
- D. Contract Closeout Information:
 - 1. Warranty

1.4 WARRANTY

- A. Furnish 20 year finish warranty on PVDF coated sheet metal, covering color, fade, chalking and film integrity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Formed Sheet Metal:
 - 1. Base:
 - a. Petersen Aluminum, PAC-CLAD.
 - 2. Optional:
 - a. Berridge Manufacturing Company.
 - b. AlumaKlad/ColorKlad.

- B. Sheet Metal Systems:
 - 1. Base:
 - a. Petersen Aluminum.
 - 2. Optional:
 - a. Metal-Era.
 - b. MM Systems.
- C. Reglets:
 - 1. Base:
 - a. Fry Reglet.
- D. Other materials:
 - 1. Base:
 - a. Manufacturers as noted.
- E. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Sheet Metal – Galvanized Steel with PVDF coating.
 - 1. ASTM A653/A653M galvanized steel, Z275 G90.
 - 2. Minimum thickness: 0.024 inches 0.6 mm or as noted for individual fabrications.
 - 3. Smooth
 - 4. PVDF coating: Minimum 1 mil 0.025 mm fluorocarbon coating, 70% PVDF.
 - a. Color:
 - 1) Match color selected for Standing Seam roof specified in 07 61 13.

2.3 SHEET METAL FABRICATIONS

- A. Formed Roof Edge Flashing, Gravel Stop and Fascia Coping:
 - 1. Fabricate to size and profile indicated.
 - 2. Supply sections with minimum length of 96 inches 2440 mm, but not exceeding 10 feet 3 M.
 - 3. Joint Style:
 - a. Single Overlap, 4 inches 100 mm wide
 - b. 1/4 inches 6 mm Butt Joint with 6 inches 150 mm wide, exposed cover plate
- B. Hanging Gutters:
 - 1. Fabricate to size and profile indicated, complete with end pieces, outlet tubes, and other accessories as required.
 - a. Gutters shall be complete with mitered corners, end caps, and outlets sized to fit downspouts.

2. Material:

Hanging Gutters - Minimum Sheet Thickness / Weight				
Material	Gutter Girth			
	up to 20 inches up to 520 mm	21 to 25 inches 521 to 650 mm	26 to 30 inches 651 to 770 mm	31 to 35 inches 771 to 890 mm
PVDF coated Galvanized Steel	0.024 inches 0.61 mm	0.034 inches 0.864 mm	0.040 inches 1.016 mm	0.052 inches 1.132 mm
PVDF coated Galvanized Steel	0.040 inches 1.016 mm	0.050 inches 1.27 mm	0.063 inches 1.6 mm	-
PVDF coated Galvanized Steel	0.019 inches 0.483 mm	0.025 inches 0.635 mm	0.031 inches 0.787 mm	0.038 inches 0.965 mm

3. Fabricate sections in maximum lengths practical; not less than 96 inches 2440 mm long.
4. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice gutter thickness.
5. Fabricate expansion joints, expansion joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
6. Gutter supports shall be adjustable minimum 1 inch 25 mm wide by minimum 0.080 inches 2 mm thick hanger, provided in sufficient number to be located at maximum 30 inches 760 mm on center, or minimum 0.032 inches 0.81 mm thick continuous cleats.
7. Expansion Joints: Lap or Butt types.

C. Downspouts:

1. Fabricate downspouts to size and profile indicated in minimum 10 feet 3 M lengths with section ends formed for minimum 1/2 inches 12 mm telescoped and locked joints with formed or mitered elbows.
2. Match material and thickness to gutter material.
3. Shape: Rectangular.
4. Furnish with metal hangers, from same material as downspouts, and anchors.
5. Provide wire ball strainers for gutter outlets, elbows and offsets.
6. Downspout supports:
 - a. Minimum 0.060 inches 1.5 mm thick by 2 inches 50 mm wide leader straps or rack and pin type fasteners.
 - 1) Provide a minimum 1 inch 25 mm clearance between downspout and building wall.
 - 2) Locate at maximum 5 feet 1.5 M on center.
 - 3) Use SMACNA standard detail appropriate for downspout.

2.4 ACCESSORIES

A. Splash blocks:

1. Precast concrete block with sloped surface and consistent thickness sides.
2. Thickness: 3IN.
3. Width: 12 inches.
4. Length: [30 inches.
5. Color: white.
6. Provide at locations where downspouts or storm pipe outlets discharge on grass or planting beds.
7. Provide at discharge locations of downspouts or storm pipe outlets.

B. Fasteners:

1. Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by flashing manufacturer.
2. Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
3. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
4. Blind Fasteners: High strength aluminum or stainless steel rivets suitable for metal being fastened.
5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
6. Fastener Materials:
 - a. Fasteners for Galvanized Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329/F2320M.

C. Cleats:

1. 16 GA 1.6 mm galvanized or stainless steel.

D. Dissimilar metal and cementitious materials protection:

1. Alkali resistant bituminous paint.
2. Tnemec TnemTar 46-413.

E. Base Flashing:

1. Fabricate to size and profile indicated.

F. Counterflashing and Flashing Reglets:

1. Fabricate to size and profile indicated.
2. Provide interior and exterior preformed corners as required.
3. Fabricate as required to fit special conditions.

G. Sealants: Specified in Section 07 92 13.

2.5 FABRICATION

A. General:

1. Fabricate true and sharp to profiles and sizes indicated.
2. Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA Architectural Sheet Metal Manual, that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated.
3. Shop fabricate items to greatest extent possible.

4. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 5. Form sheet metal flashing and trim without oil canning, buckling, and tool marks, true to line and level indicated, with exposed edges folded back to form hems.
 6. Conceal fasteners and expansion provisions where possible. Exposed fasteners not allowed on faces exposed to view.
- B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim to tolerance of 1/4 inches per 20 feet 6 mm per 6 M on slope and location lines as indicated and within 1/8 inches 3 mm offset of adjoining faces and alignment of matching profiles.
- C. Sealed Joints: Form movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch 25 mm deep. Fill with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA Architectural Sheet Metal Manual for application, but not less than thickness of metal being secured.
- G. Seams in metals with painted, coated or lacquered finishes:
1. Fabricate nonmoving seams with flat-lock seams.
 2. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
- H. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrates to accept work.
1. Verify continuous wood blocking is sloped 1:12 and covered with one layer of building paper or roofing membrane.
- B. Installation constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Install in accordance with details and recommendations of SMACNA, current edition.
- B. Set shop fabricated interior and exterior preformed corners and intersections.
- C. Set top edges of flashings into reglets as indicated.
- D. Fasten materials at recommended intervals.
- E. Provide slip joints to allow for thermal movement.
1. Use SMACNA Table 3-1, Design J9 - J12, with caulked lap.
 2. Maximum spacing: 10 feet 3 M on center.
 3. Provide slip joint in conjunction with splices and corners.
- F. Caulk joints with 2 beads of sealant on each overlap: See Section 07 92 13.
- G. Turn down cap flashing over base flashings 4 inches 100 mm and caulk.
- H. Form flashings to provide spring action with exposed edges hemmed or folded.

- I. Provide dissimilar metals and materials protection where dissimilar metals come in contact, or where sheet metal contacts mortar or concrete.
- J. Provide miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weathertight installation.

3.3 INSTALLATION – GUTTERS AND DOWNSPOUTS

- A. Install gutters below slope line of roof, supported on adjustable hangers spaced maximum 30 inches 760 mm on center or by continuous cleats.
- B. Join gutter sections with flat locked, riveted and sealed joints with hard setting sealant fill.
- C. Adjust gutters to slope uniformly to downspout outlets, with high point midway between outlets.
- D. Install downspouts supported by leader straps or concealed rack and pin type fasteners at top, bottom and intermediate points not exceeding 5 feet 1.5 M on center.
- E. Install downspout 1 inch clear of building wall.

3.4 INSTALLATION – FORMED COPINGS AND FORMED ROOF EDGES

- A. Prefabricated corner sections with no joint within 30 inches 760 mm of corners.
- B. Space gutter bars and anchor bolts as recommended by coping manufacturer for installation indicated.
- C. Conceal joints with cover plates and top of adjacent wall counter flashing under coping leg.

3.5 CLEAN-UP

- A. Upon completion of work, repair damaged areas.
- B. Repair finish of PVDF coated flashing which fades or is damaged.
- C. Clean stains and debris.
- D. Remove protective coverings.

END OF SECTION

SECTION 07 92 13
EXTERIOR JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Exterior Joint Sealants, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Caulk and Caulking are synonymous with sealant work.
- B. Paving Joints include joints in floor slabs, sidewalks, steps, ramps, and curbs.
- C. Seal joints which would otherwise permit penetration of moisture or air, unless sealant work is specifically required under other Section.
- D. Provide sealant at following locations:
 - 1. Flashing reglets and retainers.
 - 2. Exterior wall joints.
 - 3. Masonry control joints, and between masonry and other materials.
 - 4. Isolation joints.
 - 5. Joints between paving or sidewalks and building.
 - 6. Joints at penetrations of walls, floors, and decks by piping and other services and equipment not requiring firestopping.
 - 7. Perimeters of door and window frames, louvers, grilles, etc.
 - 8. Joints between dissimilar materials, to provide visually acceptable closures.
 - 9. Solidly bed thresholds at exterior doors.
 - 10. Other joints where caulking, or sealant is indicated.
- E. Related materials specified elsewhere:
 - 1. Interior Joint Sealants: Specified in Section 07 92 16.
- F. ASTM International (ASTM):
 - 1. ASTM C510 Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
 - 2. ASTM C920 Standard Specification for Elastomeric Joint Sealants
 - 3. ASTM C1193 Standard Guide for Use of Joint Sealants
 - 4. VOC Limits: SCAQMD Rule 1168
- G. Staining Potential of adjacent materials caused by sealants:
 - 1. Pre-test proposed sealants where sealants are used with any of following materials:
 - a. Architectural Precast Concrete.
 - b. Brick Masonry.
 - c. Concrete Masonry.
 - 2. Test Method: ASTM C1248 Standard Test Method for Staining of Porous Substrate by Joint Sealants.
 - 3. Historical testing using same materials and cataloged by sealant manufacturer will be considered acceptable.

4. Where testing suggests that staining potential exists: Reselect sealant and retest.
5. Certify that staining potential has been evaluated.

1.3 SUBMITTALS

A. Shop Drawings:

1. Sealant Schedule with the following information:
 - a. General description of locations requiring sealants (i.e. Brick to Aluminum Window).
 - b. List type of sealant and name of product proposed for each location.
 - c. Include a blank Color Column on schedule for selection.
 - d. Architect to complete Color Column upon selection from submitted samples.

B. Product Data:

1. Performance characteristics and limitations.
2. Recommended installation.

C. Samples:

1. Cured sample of each color. Submit with Sealant Schedule.

D. Contract Closeout Information:

1. Field Quality Control Test and Inspection Reports.
2. Warranty.

1.4 WARRANTY

A. Provide written warranty that sealant work will remain free of defects for a period of 3 years from Date of Substantial Completion:

1. Failure of water or air tightness constitutes defect.
2. Loss of adhesion, cohesion, or failure to cure constitutes defect.
3. Remove defective work and materials and replace with new work and materials.
4. Non- prorated warranty to include labor and material.
5. Warranty signed by Installer, Contractor, or both.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Silicone Sealant:

1. Base:
 - a. Pecora Corporation.
2. Optional:
 - a. Dow.
 - b. GE Silicone by Momentive Performance Materials.
 - c. Sika Corporation.
 - d. Tremco.

B. Polyurethane Sealants:

1. Base:
 - a. Pecora Corporation.

2. Optional:
 - a. Master Builders Solutions.
 - b. Sika Corporation.
- C. Silane-Modified Polymer Sealant (STPE, STPU, Polyurea):
 1. Base:
 - a. Pecora Corporation.
 2. Optional:
 - a. Master Builders Solutions.
 - b. Tremco.
- D. Other Sealants:
 1. Base: As indicated.

2.2 MATERIALS

- A. Elastomeric Sealants:
 1. ASTM C920 Type S or M, Grade-NS at vertical joints, Grade-P or –NS at horizontal joints, minimum Class as scheduled.
 2. Non-staining sealant complying with ASTM C1248.
 3. Where sealant is not exposed to view, use manufacturer's standard color which has best performance.
 4. Before use of sealant, investigate its compatibility with surfaces, fillers, and other materials in joint system.
 5. Refer to Sealant Selection Guide for Base Products.
 6. VOC content no greater than 250 g/L.
- B. Compressible Backer:
 1. Foam backing with multiple layers of acrylic-impregnated, expanding foam sealant.
 2. Provide behind conventional backer-rod and sealant where indicated.
 3. Movement capability: +/- 25% movement, 50% total.
 4. Material to be sized appropriately for joint widths indicated.
 5. Base Product: Backerseal by Emseal.
- C. Installation Adhesive:
 1. As recommended by manufacturer of compressible sealants and backers.
 2. Comply with VOC limits as required by local laws.
- D. Joint Primer:
 1. As recommended by sealant manufacturer.
 2. Sealant primers for nonporous surfaces as recommended by manufacturer with a VOC content no greater than 250 g/L.
 3. Sealant primers for porous surfaces as recommended by manufacturer with a VOC content no greater than 775 g/L.
- E. Backer Rod:
 1. Polyethylene, polyethylene jacketed polyurethane foam, flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation of joint sealants under following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F 4.4 degrees C.
 - 2. When joint substrates are wet.
- B. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Apply only to joints free of material which may inhibit bond.
- D. Apply to cementitious materials only when thoroughly cured and dry.

3.2 PREPARATION

- A. Clean joints and prime as required by sealant manufacturer.
- B. Install sealant after finish coating or covering is scheduled to be applied.
- C. Limit application to surfaces to receive sealants and mask edges of joints to protect adjacent surfaces.

3.3 INSTALLATION

- A. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Control joint depth.
 - 2. Break bond of sealant at bottom of joint.
 - 3. Provide proper shape of sealant.
 - 4. Do not leave gaps between ends of sealant backings.
 - 5. Do not stretch, twist, puncture, or tear sealant backings.
 - 6. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- B. Make depth of sealant not more than one-half width of joint, but not less than 1/4 inches 6 mm.
- C. Sub-caulk joints without suitable backstop, to proper depth.
- D. Install correctly sized backer rods.
- E. Apply bond breaker as required or recommended by sealant manufacturer.
- F. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- G. Make joints watertight and airtight.
- H. Install sealants using proven techniques that comply with the following and at 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.
- I. Tooling of Non-sag Sealants:
 - 1. Tool immediately after sealant application and before skinning or curing begins, to form smooth, uniform beads, eliminate air pockets, and ensure contact and adhesion of sealant with sides of joint.

2. Remove excess sealant adjacent to joints as the Work progresses with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.
3. Use tooling agents that are approved by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
4. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.

J. At traffic joints, slightly recess sealant to avoid direct contact with wheeled traffic.

3.4 SEALANT USAGE GUIDELINES

Guide to Sealant Types - Exterior				
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions
General Exterior	Cast in Place Concrete	Multi-part Polyurethane, chemically curing, epoxidized	Pecora Dynatrol II	Exception: Use Dymonic where used as bedding sealant for frames, sills, thresholds etc.
	Brick and Concrete Masonry			
	Portland Cement Plaster			
	Hollow Metal Door and Window Perimeters			
	Joints in materials with high coefficients of linear expansion	Silane-Modified Polymer (STPU, STPE, Polyurea)	Pecora Dynatrol I-XL Hybrid	--
	Weatherseals of Aluminum Window Frames (including perimeter joints)			
	Precast Concrete Panels	Silicone or Silyl Terminated Polyether (STPE)	Pecora 890NST or 890FTS or Pecora Dynatrol I-XL Hybrid	--
	General Exterior Glazing	Silicone; Neutral-cure	Pecora 895NST	Exception: Select alternate silicone sealant types as appropriate for specific glazing application.
	Fabrication of Insulating Glass Units (IGU)	Primary Seal: Polyisobutylene	Select high quality sealants, of basic type listed, as appropriate for specific application.	
		Secondary Seal: Silicone	Dowsil 982	--
Exterior Flatwork	Zone dams, shear blocks and other internal component of Aluminum Window Systems	Silicone	Use product which offers optimal adhesion and performance for application.	
	Sheet Metal Gutters, Downspouts, Scuppers, etc	Butyl Rubber	Pecora BC-158	--
Exterior Flatwork	Concrete Walks	Multi-part Polyurethane	Pecora Dynatred	Pecora DynaTred is rated for continual water emersion. Others may not be.

Notes

1. The above is intended to be an overall guide. Additional conditions and materials may be required. Notify Engineer if additional Guidance is required to select unlisted items.
2. Optional sealant products shall offer same number of color choices as the Base Product listed or custom color matching.
3. All of the conditions and materials listed may not apply to subject project.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - a. Extent of Testing: Test completed, and cured sealant joints as follows:
 - 1) Perform 10 tests for the first 1000 ft. (300 m) of joint length for each kind of sealant and joint substrate.
 - 2) Perform one test for each 1000 ft. (300 m) of joint length thereafter or one test per each floor per elevation.
 - b. Test Method: Test joint sealants in accordance with Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - c. Inspect tested joints and report on the following:
 - 1) Whether sealants filled joint cavities and are free of voids.
 - 2) Whether sealant dimensions and configurations comply with specified requirements.
 - 3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 - e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

B. Prepare test and inspection reports.

END OF SECTION

SECTION 07 92 16
INTERIOR JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Interior Joint Sealants, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Definitions:
 - 1. Caulk and Caulking are synonymous with sealant work.
 - 2. Interior Wet Areas includes restrooms, custodial closets, kitchens, and similar areas where sealant is subject to moisture.
- B. Seal joints which permit penetration of moisture or air, unless sealant work is specifically required under other sections.
- C. Provide sealants at the following:
 - 1. Masonry control joints and between masonry and other materials.
 - 2. Flooring joints.
 - 3. Isolation joints.
 - 4. Joints at penetrations of walls, floors, and decks by piping and other services and equipment not requiring firestopping.
 - 5. Perimeters of door and window frames, louvers, grilles, etc.
 - 6. Between cabinets, casework, countertops, and back splashes where adjacent to walls.
 - 7. Joints between dissimilar materials, to provide visually acceptable closures.
 - 8. Other joints where caulking, or sealant is indicated.
- D. ASTM International (ASTM):
 - 1. ASTM C510 Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
 - 2. ASTM C711 Standard Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants
 - 3. ASTM C719 Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement
 - 4. ASTM C792 Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
 - 5. ASTM C793 Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
 - 6. ASTM C910 Standard Test Method for Bond and Cohesion of One-Part Elastomeric Solvent Release-Type Sealants
 - 7. ASTM C920 Standard Specification for Elastomeric Joint Sealants
 - 8. ASTM C1193 Standard Guide for Use of Joint Sealants
- E. South Coast Air Quality Management District (SCAQMD), Rule #1168.

F. Staining:

1. Pre-test proposed sealants where used with following materials and where potential of staining may occur as result from use of those sealants:
 - a. Marble, sandstone, limestone, granite, and other types of stonework.
 - b. Architectural Precast.
 - c. Brick Masonry.
 - d. Concrete Masonry.
2. Test in accordance with ASTM C1248 Standard Test Method for Staining of Porous Substrate by Joint Sealants.
3. Historical testing using same materials and cataloged by sealant manufacturer is acceptable.
4. Where testing suggests staining potential exists, reselect sealant and retest.
5. Certify staining potential has been evaluated.

1.3 SUBMITTALS

A. Shop Drawings:

1. Sealant Schedule with the following information:
 - a. Generally describe locations requiring sealants (i.e. GWB to Aluminum Window).
 - b. List type of sealant and name of product proposed for each location.
 - c. Include a blank Color Column on schedule for selection.
 - d. Engineer to complete Color Column upon selection from submitted samples.

B. Product Data:

1. Performance characteristics and limitations.
2. Recommended installation.

C. Samples:

1. Submit cured sample of each color with Sealant Schedule.

D. Contract Closeout Information:

1. Warranty.

1.4 WARRANTY

A. Provide written warranty that sealant work will remain free of defects for a period of three (3) years from Date of Substantial Completion:

1. Failure of water or air tightness constitutes defect.
2. Loss of adhesion, cohesion, or failure to cure constitutes defect.
3. Remove defective work and materials and replace with new work and materials.
4. Repair other work damaged by defective sealant work at no additional expense to Owner.
5. Non- prorated warranty to include labor and material.
6. Warranty signed by Installer, Contractor, or both.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Polyurethane Sealants:
 - 1. Base:
 - a. Pecora
 - 2. Optional:
 - a. Bondaflex
 - b. Master Builders Solutions
 - c. Sika
 - d. Tremco
- B. Silane-Modified Polymer (STPU, STPE, or Polyurea) Sealants:
 - 1. Base:
 - a. Pecora
 - 2. Optional:
 - a. Master Builders Solutions
 - b. Tremco
- C. Silicone Sealants:
 - 1. Base:
 - a. As noted for individual items.
 - 2. Optional:
 - a. Color Rite
 - b. Pecora
 - c. Dow
 - d. GE Silicones
 - e. Tremco
- D. Acoustical Sealant:
 - 1. Base:
 - a. Pecora
 - 2. Optional:
 - a. Grabber
 - b. Hilti
 - c. STI
 - d. 3M
- E. Other Sealants:
 - 1. Base: As indicated.
- F. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Volatile Organic Compounds (VOC):
 - 1. Comply with South Coast Air Quality Management District (SCAQMD), Rule 1168.
 - a. Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L
- B. Elastomeric Sealants:
 - 1. Refer to Sealant Selection Guide for types required.
 - 2. Silicone and Hybrid sealants: ASTM C920 Type S or M, Grade-NS, minimum Class as scheduled.
 - 3. Latex sealants: ASTM C834, Type OP, Grade -18 degrees Celsius.
 - 4. Non-staining sealant complying with ASTM C1248.
 - 5. Where sealant is not exposed to view, use manufacturer's standard color which has best performance.
 - 6. Use non-sag sealant in vertical joints.
 - 7. Use self-leveling or non-sag sealant in horizontal joints.
 - 8. Before use of sealant, investigate its compatibility with surfaces, fillers, and other materials in joint system.
- C. Casework Sealant:
 - 1. 100 percent silicone.
 - 2. Colors:
 - a. Colors to match Plastic Laminate, Stone, Wood, Solid Surfacing and other materials specified for casework bodies, countertops and splashes.
 - 3. Base Product:
 - a. Solid Colors: Color-Sil by Color Rite; 100 percent Silicone, no suspended particles.
 - b. Engineer to select final colors and locations during submittals phase.
- D. Acoustical Sealant:
 - 1. Flexible, non-hardening.
 - 2. UL listed.
 - 3. Seal construction joints and through-penetration openings in non-fire-rated acoustic barriers and smoke partitions.
 - 4. Seal perimeter of sound rated partitions.
 - 5. Seal perimeter and cover outside faces of electrical boxes and similar utilities in sound rated partitions.
 - 6. Base Products: Pecora AIS-919 (gun and airless spray).
- E. Joint Cleaner, Primer, Bond Breaker:
 - 1. As recommended by sealant manufacturer.
- F. Backer Rod:
 - 1. Polyethylene, polyethylene jacketed polyurethane foam, flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation of joint sealants under following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F 4.4 deg C.
 - 2. When joint substrates are wet.
- B. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Apply only to joints free of material which may inhibit bond.
- D. Apply to cementitious materials only when thoroughly cured and dry.

3.2 PREPARATION

- A. Clean joints and prime as required by sealant manufacturer.
- B. Install sealant after finish coating or covering is scheduled to be applied.
- C. Limit application to surfaces to receive sealants and mask edges of joints to protect adjacent surfaces.

3.3 INSTALLATION

- A. Install sealant backings to support sealants during application.
 - 1. Control joint depth.
 - 2. Break bond of sealant at bottom of joint.
 - 3. Provide proper shape of sealant.
 - 4. Do not leave gaps between ends of sealant backings.
 - 5. Do not stretch, twist, puncture, or tear sealant backings.
 - 6. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- B. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- C. Install sealants using proven techniques that comply with the following and at same time backings are installed:
 - 1. Place sealants to 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 allowing optimum sealant movement capability.
- D. Prime joint surfaces as recommended by sealant manufacturer for conditions:
 - 1. Limit application to surfaces to receive sealants.
 - 2. Mask off adjacent surfaces.
- E. Sub-caulk joints without suitable backstop, to proper depth.
- F. Tool sealants using sufficient pressure to fill voids.
- G. Remove excess sealant adjacent to joints.
- H. Hollow Metal Frames:
 - 1. Seal frames to wall.
 - 2. Seal frames to floor substrates and hard floor finishes.
 - 3. Do not seal frames to previously installed carpet and similar finishes.

I. Acoustical Sealant:

1. General:

- a. Apply acoustical sealant at joints, voids, and penetrations through wallboard to maximize sound control.
 - 1) Seal wallboard edges to adjacent construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant.
 - 2) Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
 - 3) Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

2. Base of walls:

- a. Apply acoustical sealant to bottom edge of gypsum wallboard at floor.

3. Head of walls:

- a. Apply acoustical sealant to top edge of gypsum wallboard at building structure.

3.4 SEALANT USAGE GUIDELINES

Guide to Sealant Types - Interior				
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions
Interior (General)	Window Sills and Stools	100 percent silicone	Color-Sil Poly-Sil Pecora 898NST	Do not use in areas subject to abrasion or physical abuse
	Cabinets and Casework to wall			
	Countertops and Backsplashes			
	Sinks in Countertops			
	Fixtures and Casework to floor			
	Interior Alum Doors and Window Frame Perimeters	One-part neutral curing silane-modified polyurethane (STPU)	Pecora Dynatrol I-XL Hybrid	Paintable
	Non-rated wall, floor and deck penetrations.			
	Interior joints at exterior wall.	Siliconized Acrylic Latex (paintable)	Tremco Tremflex 834 Pecora AC-20+ Silicone	Exception: Where sealant will not be painted and white color will not be visually compatible with adjacent finishes use Dynatrol I-XL Hybrid of matching color.
	Hollow Metal Door and Window Frames			
	Acoustical Sealant Joints at top and bottom terminations of Interior Non-rated Walls.	Water-based acrylic; paintable	Pecora AC-20 feetR or AIS-919	
		Water-based acrylic spray	Hilti CP 572 Pecora AIS-919	

Guide to Sealant Types - Interior				
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions
	Acoustical Sealant Joints at top and bottom terminations of Interior Fire-Rated Walls and Building Perimeter Gaps between slabs and facades.	Acrylic	Pecora AC-20 feetR	
		Silicone	Pecora 864NST	
Interior Flatwork	Control Joints in Concrete Floors in Mechanical Rooms and other unfinished spaces	Multi-part Polyurethane	Pecora DynaTred	DynaTred may be subjected to continual water immersion. For resistance to high heel traffic, use Pecora Dynaflex or Dynaflex SC
Interior Wet Areas	Porcelain, Ceramic Tile, Metals, and surfaces with Epoxy Paints	Silicone; Air cure	Pecora 860 (acid cure) or Pecora 898NST	--

Notes

1. The above is intended to be an overall guide. Additional conditions and materials may be required. Notify Engineer if additional Guidance is required to select unlisted items.
2. Optional sealant products shall offer same number of color choices as the Base Product listed.
3. All conditions and materials listed may not apply to subject project.
4. Not all project conditions may be addressed on above table; Refer also to other specification sections and install sealants where called for by other sections.
5. Materials and Conditions conventionally occurring on Exterior but used on Interior (e.g. Brick Masonry on interior) may not be listed on this Table. Refer to Exterior Guide (Section 07 92 13) for appropriate sealant type.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL (HM) DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Hollow Metal Doors and Frames in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM A568 Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled
- B. Hollow Door and Frame Standards:
 - 1. ANSI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors
 - 2. ANSI A250.8 / SDI 100 Recommended Specifications for Standard Steel Doors and Frames
 - 3. ANSI A250.11 Recommended Erection Instructions for Steel Frames
 - 4. Positive Pressure:
 - a. Comply with Positive Pressure Requirements UL 10C, Category A or NFPA 252.
 - b. Comply with NFPA 257 for sidelights.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Use same reference numbers for openings as those in Door and Frame Schedule in Drawings
 - 2. Indicate door elevations, gauges; frame configuration; anchor types and spacing; location of reinforcement and preparations for hardware, including items recessed within door edges; details of moldings, removable stops, glazing and louvers; details of conduit and preparations for power, signal, and control systems.
- B. Product Data:
 - 1. Include construction details, material descriptions, core descriptions, fire resistance rating and finishes.
 - 2. Shop primer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Base:
 - a. Ceco Door Products
 - 2. Optional:
 - a. Curries
 - b. Philipp Manufacturing Company
 - c. Republic Doors and Frames
 - d. Steelcraft Manufacturing

- B. Thermally Broken Hollow Metal Frames:
 - 1. Base:
 - a. Curries
 - 2. Optional:
 - a. Ceco Door Products
- C. Galvanizing Repair Coating:
 - 1. Base:
 - a. Tnemec
 - 2. Optional:
 - a. ZRC Worldwide
 - b. SherwinWilliams
- D. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Steel Sheet and Strip:
 - 1. Comply with ASTM A568.
- B. Corrosion Resistant Coating:
 - 1. Hot dip galvanized: A60 per ASTM A653.
 - 2. Minimum zinc-iron alloy coating: 0.6 oz/FT² 183 g/m².
 - 3. Provide corrosion resistant coating at door and frame components where used at wet and humid locations as defined by the following:
 - a. Openings located in an exterior wall.
 - b. Interior openings:
 - 1) Restrooms and custodial closets.
- C. Primer:
 - 1. Shop prime.
 - 2. Clean and phosphatize doors and frames.
 - 3. One coat of baked-on rust inhibiting primer paint in accordance with ANSI A250.10.
 - 4. Suitable and compatible as base for specified finish paints.
- D. Galvanizing Repair Coating:
 - 1. Galvanized coating repair.
 - 2. VOC 250 g/L maximum.
- E. Hollow Metal Doors:
 - 1. Comply with ANSI/SDI A250.8.
 - 2. Determination of performance level for each door:
 - a. Use level of HM door indicated for its location, size, and other listed criteria.

Schedule of HM Door Levels			
Location	Additional Criteria	HMMA Level	Miscellaneous
Exterior Doors ¹ (flush)	Openings where each leaf is less than 47 inches	Level 3 (Extra Heavy duty)	Galvanized / galvanized, Thermally Insulated

Refer to Door Schedule for indication of the Door Type (I.e. Width, Fire Rating, Flush vs. Stile & Rail, etc.)

Refer to Plans for door location (Exterior vs. Interior).

Where Hurricane or Tornado resistant openings are specified: Refer to ADDITIONAL REQUIREMENTS for appropriate door/frame construction.

Not all items included in table may apply to subject project.

Footnotes

1. Refer to Part 2.2 MATERIALS for definition of Exterior locations.

2. Refer to Part 2.2 MATERIALS for definition of Wet/Humid locations.

3. Door Thickness: 1-3/4 inches 45 mm.
4. Exterior doors: ANSI A250.8 Level 4, Maximum duty, physical performance Level A.
 - a. Face Sheet Thickness: 0.067 inches (14 GA) 1.7 mm.
5. Interior doors: ANSI A250.8 Level 3, Extra Heavy duty, physical performance Level A.
 - a. Face Sheet Thickness: 0.053 inches (16 GA) 1.3 mm.
6. ANSI A250.8 Model 2, Seamless.
7. End closures at top and bottom of door:
 - a. Top: Flush closure top cap. Minimum Sheet thickness: 0.032 inches (20 GA) 0.8 mm.
 - b. Bottom: Flush closure. Minimum Sheet thickness: 0.032 inches (20 GA) 0.8 mm.
 - c. Bottom: Inverted channel. Minimum Sheet thickness: 0.053 inches (16 GA) 1.3 mm.
8. Vertical door edges:
 - a. Lock Stile Edges: Beveled 1/8 inches 3 mm per 2 inches 50 mm.
 - 1) Exception for inactive leaves: Fabricate inactive leaves with a square edge at the lock stile edge. Active leaves to be beveled per above.
 - 2) Hinge Stiles Edge: Beveled 1/8 inches 3 mm per 2 inches 50 mm.
9. Hardware Reinforcement (doors):
 - a. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as door face sheets.
 - b. Minimum thickness: As prescribed in ANSI/SDI A250.6; Upgrade as necessary for conditions such as door weight, size, frequency, etc. and as follows:
 - c. Butt Hinges: 0.167 inches (7 GA) 4 mm plate reinforcement or continuous 0.104 inches (12 GA) 2.6 mm channel engineered for equal strength.

- d. Continuous hinges: Reinforce with 0.067 inches (14 GA) 4 mm thick x 1-1/4 inches 32 mm wide strapping extending full height and welded to hinge edge of door.
 - e. Closers and Overhead Stops: 0.067 inches (14 GA) 4 mm.
- 10. Cores:
 - a. Steel stiffeners where structurally required.
 - b. Exterior Doors:
 - 1) Thermally insulated core.
 - a) 1.0 pounds/CF 16 kg/M3 Polystyrene.
 - b) Minimum R-value: 2.0 when tested according to ASTM C1363.
 - c. Interior doors:
 - 1) Non-rated doors: Kraft honeycomb laminated to face sheets.
 - 2) Rated doors: Fire resistant core as required by label.
 - 3) Wet/humid Areas: Moisture resistant materials, fire resistant where applicable.
 - d. Specific materials used for above listed core types: Manufacturer's option.
 - e. Reinforce for Hardware.
- F. Hollow Metal (HM) Frames:
 - 1. Comply with ANSI/SDI A250.8 and with details indicated for type and profile in accordance with SDI 111.
 - 2. Fabricate frames with mitered or coped corners and 1/2 inches 13 mm nominal backbend.
 - a. Touch-up galvanized/galvannealed frames with zinc-rich primer.
 - 3. Fabricate frames as Face Welded (modified ANSI definition):
 - a. Face Joints: Continuously back weld face joints (weld on concealed side).
 - 1) Fill and finish exposed sides to be free of visible seams.
 - b. Intersections of Rabbets, Stops and Soffit Joints: Fabricate to hairline joints. Stitch weld on concealed side.
 - c. Split type frames and knock down type frames are not acceptable.
 - d. Fasteners which are exposed to view are not acceptable.
 - 4. Provide minimum steel gauge as indicated for its location, size and other listed criteria per following schedule.

Schedule of HM Frames			
Location	Criteria	Minimum Thickness	Miscellaneous
Exterior Frames ¹	Standard and Thermally Enhanced	0.067 inches (14 GA)	Galvanized / galvanized
Interior Frames ¹	Non-fire rated	0.053 inches (16 GA)	--
	Fire rated	0.053 inches (16 GA)	--
	Frames for doors with automatic openers	0.067 inches (14 GA)	--
	Wet / Humid Areas ²	0.053 inches (16 GA)	Galvanized / galvanized

Notes

Gauge of frame listed is the minimum. Use heavier gauge as required due to size, physical configuration or if required to meet fire label requirements.

Refer to Door Schedule for indication of the Frame Type (I.e. Width, Single vs. Pair; Fire Rating, etc)

Refer to Plans for door location (Exterior vs. Interior).

Where Hurricane or Tornado resistant openings are specified: Refer to ADDITIONAL REQUIREMENTS for appropriate door/frame construction.

Some items listed may not apply to subject project.

Footnotes

1. Refer to Part 2.2 for definition of Exterior locations.

2. Refer to Part 2.2 for definition of Wet/Humid locations.

G. Lite Kits:

1. See 08 81 00 for glass used in side lites.
2. Label for intended opening.
3. Fixed Stop:
 - a. Locate at exterior face.
 - b. Integral to door/frame.
4. Removable Stop:
 - a. Locate on interior face.
 - b. Snap-in stops or stops secured with countersunk Phillips head machine screws.

H. Silencers:

1. ANSI/BHMA 156.16
 - a. Diameter: 1/2 inches.
 - b. Projection: 1/8 inches.
 - c. Tamper-proof.
 - d. Base Product – Steel Frames: SR64 by Ives.
2. Quantity:
 - a. Three on strike jamb of single frames.
 - b. Two per door for pair doors. Locate at head.
3. Space per manufacturer's recommendations.

I. Hardware Reinforcement:

1. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2. Minimum thickness: As prescribed in ANSI/SDI A250.6; upgrade as necessary for conditions such as door weight, size, frequency, etc. and as follows:
 - a. Butt Hinges: 7 GA.
 - b. Continuous hinges: Reinforce with 0.067 inches (14 GA) 1.7 mm thick x 1-1/4 inches 32 mm wide strapping extending full height and welded to hinge jamb door rabbet of frame.
 - c. Closers and Overhead Stops: 0.093 inches (12 GA) 2.4 mm thick x 12 inches 305 mm long strapping welded to vertical flange of frame.
- J. Head Stiffeners:
 1. Provide at double egress frames:
 2. Position stiffeners at mid span of frame opening.
- K. Junction Boxes:
 1. Sheet metal enclosure:
 - a. Provide to facilitate pulling of wires and making electrical connections.
 - b. Weld to back side of frames.
 2. Material: 0.032 inches (20 GA) 0.80 mm sheet steel.
 3. Size and shape: As required by hardware device.
 4. Include knockout to receive 1/2 inches 13 mm conduit.
 5. Locate Junction Boxes in frames scheduled to receive electrified security, door hardware devices, or both.
- L. Jamb Anchors:
 1. ASTM A879 Commercial Steel, 4 oz/SF coating; mill phosphatized.
 - a. Frames in exterior walls:
 - 1) Steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.
 2. Provide anchors in accordance with manufacturer's recommendations on fire rated doors.
 3. Provide minimum number as indicated in following table:

Minimum Quantity of Jamb Anchors	
Nominal Frame Height	Minimum Quantity per Jamb
Less than 60 inches 1.5 M	2
60 inches to 90 inches 1.5 M to 2.3 M	3
90 inches to 120 inches 2.3 M to 3 M	4
120 inches to 150 inches 3 M to 3.8 M	5
Greater than 150 inches 3.8 M	Add 1 additional for each 30 inches 760 MM increase in height thereafter

- a. Jamb anchors for stud framed walls:
 - 1) Z-shaped clips, welded to inside of frames; not less than 0.042 inches (18 GA) 1 mm thick, or compression anchors to suit frame size.
 - 2) Attach anchors to studs with screws.

- b. Jamb anchors for masonry walls:
 - 1) Minimum 0.042 inches (18 GA) 1 mm.
 - 2) Corrugated or perforated straps:
 - a) Minimum 2 inches 50 mm wide by 10 inches 254 mm long.
 - 3) Wire anchors:
 - a) Minimum 0.184 inches (6 GA) 5 mm thick.
 - 4) Embed long leg into masonry wall as units are placed.
 - 5) Post installed expansion type for in place concrete or masonry:
 - a) Minimum 3/8 inches 10 mm countersunk, flat head expansion bolts with expansion shields or inserts.
 - b) Include pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
 - c) Minimum embedment length: 1-3/4 inches 45 mm.
- c. Floor Anchors:
 - 1) Same for Jamb Anchors but not less than 0.053 inches (12 GA) 2.4 mm thick.
 - a) Anchors built into exterior walls:
 - (1) Steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.
 - b) Monolithic concrete slabs:
 - (1) Clip type anchors, with two holes to receive fasteners.
 - c) Topped slabs:
 - (1) Adjustable anchors with extension clips allowing not less than 2 inches 50 mm height adjustment. Terminate bottom of frames at finish floor surface.
 - 2) Include concealed fasteners.
 - 3) Provide anchors in accordance with manufacturer's recommendations at fire rated openings.
- d. Head Anchors for Double Egress Frames:
 - 1) Provide two head frame anchors for Double Egress frames.
 - 2) Locate at third points of span.
- 4. Spreaders:
 - a. Provide removable spreaders at bottom of door frames.
- 5. Inserts, bolts and fasteners:
 - a. Manufacturer's standard units
 - b. Galvanize items built into exterior walls ASTM A153, Class C or D as applicable.

- M. Thermally Broken HM Frames:
1. Provide thermally broken hollow metal frames at exterior openings.
 2. Construct as specified for conventional frames with two steel sections mechanically joined together, separated by continuous, low-conductivity, thermal break material.

2.3 FABRICATION

- A. Factory fit doors to frame openings with uniform clearances in accordance with:
1. National Fire Protection Association NFPA 80 for fire rated doors.
 2. National Fire Protection Association NFPA 105 for smoke control doors.
 3. American National Standards Institute ANSI A250.8.
 4. Locally adopted Building Code.
 5. Steel Door Institute SDI 117.

Door To Frame Clearances		
Location		Clearance
Door to Frame at top and sides		1/8 inches
Meeting Stiles at Pair Doors		1/8 inches
Face of door to face of Stop		1/8 inches
Door Bottom to Floor / Flooring	Typical; all floor covering types	Up to 1/2 inches
	At non-combustible sills	3/8 inches
	Bare floors- No flooring or sills	Up to 3/4 inches

- B. Hardware Preparation:
1. Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to Door Hardware Schedule and templates furnished as specified in Section 08 71 00.
 2. Locate hardware indicated, or if not indicated, according to ANSI/SDI A250.8.
 3. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 4. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 5. Coordinate locations of conduit and wiring boxes for electrical connections.
 6. Remove mill scale and foreign materials, touch up damaged galvanized or galvanized surfaces.
- C. Hollow Metal Doors:
1. Exterior:
 2. Provide weep openings in bottom of exterior doors.
 3. Seal joints in top edges of doors against water penetration.
 4. Glazed lites:
 - a. Factory cut openings in doors.
 - b. Locate bottom of glazed panel 43 inches maximum above finish floor.
 5. Astragals:
 - a. Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire performance rating or where indicated.

- D. Fire Labels:
1. Affix permanent labels to fire rated units in accordance with testing agency requirements.
 2. Where labels are stamped or embossed directly into frame, ensure label will remain legible upon application of finishes.
 3. At openings where continuous hinges or other items conceal fire label, locate labels on alternative locations as allowed by listing agency and local authorities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine structure, substrates, and conditions under which work is to be installed for conditions detrimental to correct and timely completion.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Frames:
1. Place frames before construction of adjacent walls.
 - a. Where adjacent walls are cast in place concrete, set frames after wall is constructed.
 2. Adjust hollow metal door frames for square, alignment, twist, and plumb to following tolerances:
 - a. Plumb: Plus or minus 1/16 inches 1.5 mm, measured at jambs at floor.
 - b. Level: Plus or minus 1/16 inches 1.5 mm per leaf, measured across width of header.
 - c. Square: Plus or minus 1/16 inches 1.5 mm, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - d. Alignment: Plus or minus 1/16 inches 1.5 mm, measured at jambs on horizontal line parallel to plane of wall.
 - e. Twist: Plus or minus 1/16 inches 1.5 mm, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 3. Do not remove spreaders until surrounding wall construction is complete.
 4. After surrounding walls have been constructed, verify frames remain in alignment.
 - a. Re-check for level, plumb, square, twist and issues that will prevent proper fitting of doors.
 - b. Correct deficiencies before allowing surrounding construction to proceed.
 - c. Coordinate with other trades to correct alignment problems.
 5. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 6. Verify frame alignment, and correct deficiencies prior to hanging doors.
 7. Install frames with removable glazing stops located on secure side of opening.
 8. Provide anchor type specified for wall condition.
 9. Align anchors at hinge centers on hinge jamb and at corresponding heights on strike jamb.
 10. Secure frame to wall per manufacturer's instructions.

- B. Prime Coat Touchup:
 - 1. Immediately after erection, sand smooth rusted or damaged areas of primer coat.
 - 2. Touch up primer coat with compatible air drying primer.
 - 3. Leave surfaces smooth for finish painting.
- C. Field Painting of HM Frames and Doors:
 - 1. Painting of Exterior openings: Specified in Section 09 91 13.
 - 2. Painting of Interior openings: Specified in Section 09 91 23.
- D. Install Sealants:
 - 1. Seal frames to walls.
 - 2. Seal frames to floor slabs and hard floor finishes.
 - 3. Hairline gap at intersections of head and jamb frames intersections of rabbets and stops:
 - a. Fill exposed seam with painter's caulk.
 - 4. Sealants:
 - a. Exterior: See Section 07 92 13.
 - b. Interior: See Section 07 92 16.
- E. Install silencers.

3.3 ADJUSTING AND CLEANING

- A. Verify frames remain in proper alignment.
- B. Correct deficiencies before proceeding with surrounding construction.
- C. Remove protective wrappings from doors and frames.
- D. Verify fire labels are intact, and readily visible.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Flush Wood Doors, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Obtain flush wood doors through one source from a single manufacturer.
- B. Window and Door Manufacturer's Association (WDMA):
 - 1. I.S. 1A Industry Standard for Architectural Wood Flush Doors
- C. American National Standards Institute (ANSI):
 - 1. ANSI A115. W Series, Wood Door Hardware Standards.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate location, size, and hand of each door; elevation of each kind of door; location and extent of hardware blocking.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Describe factory finish and finish requirements.
- B. Product Data:
 - 1. Include details of construction for each type of door.
 - 2. Include factory finishing specifications.
 - 3. Provide manufacturer's technical data for each type of door including details of core and edge construction, trim for openings and factory finishing specifications.
- C. Samples:
 - 1. Factory finishes applied to actual door face materials for each material and finish.
 - a. Provide one piece of specified finished work for each wood species and finish.
 - b. Minimum Size: 8 x 10 inches indicating finish.
- D. Contract Closeout Information:
 - 1. Warranty.

1.4 WARRANTY

- A. Provide written warranty for doors for full life of installation against defects including:
 - 1. De-lamination, warp, twist, bow, telegraphing, and other defects that may impair or affect performance of door for purpose intended, meeting allowable values prescribed by WDMA Standard.
 - 2. Remove and replace defective doors; include cost of removal of defective units, re-hanging and refinishing of replacement units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Flush Wood Doors:
 - 1. Base:
 - a. Masonite Architectural.
 - 2. Optional:
 - a. Oshkosh Door Company.
 - b. VT Industries.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

- A. Wood Door Manufacturers Association (WDMA):
 - 1. Performance: WDMA I.S.1A-11- Heavy Duty.
 - 2. Aesthetic Grade: WDMA I.S.1A-11, - Custom Grade.
- B. Thickness:
 - 1. 1-3/4 inches unless noted otherwise.

2.3 MATERIALS

- A. Veneer:
 - 1. Veneer thickness: 1/50 inches at 12% moisture content.
 - 2. Veneer grade: HPVA Grade A.
 - 3. Veneer Species (both faces unless otherwise noted):
 - a. Select White Birch.
 - 4. Veneer cut:
 - a. Rotary Cut.
 - 5. Veneer leaf match:
 - a. Book match
 - 6. Face assembly match:
 - a. Running
 - 7. Pair and Set match:
 - a. Running match
 - 8. Door vertical edges: Veneer edge banding, same species as face, no joints.
- B. Core:
 - 1. Select core types which comply with label for scheduled ratings, sizes and hardware devices.
 - 2. Bond cores to stiles and rails; drop-in, unbonded cores are not acceptable.
 - 3. Non-Fire Rated Doors:
 - a. PC-5, Extra Heavy Duty Wood Particleboard Core.
- C. Rails:
 - 1. Solid hardwood or structural composite lumber (SCL).
- D. Cross-banding:
 - 1. Engineered wood or wood-based composite, securely bonded to core.
 - 2. Medium density fiberboard (MDF) not acceptable.

- E. Adhesives:
1. Face adhesive per WDMA TM-6.
 2. Utilize waterproof adhesives for doors indicated near potentially wet conditions.
 - a. Non-fire rated doors:
 - 1) Same species or compatible species with door facing.
 - 2) Solid hardwood.

2.4 FABRICATION

- A. Factory fit doors to suit frame openings with most stringent criteria for uniform clearances in accordance with:
1. National Fire Protection Association NFPA 80 for fire rated doors.
 2. National Fire Protection Association NFPA 105 for smoke control doors.
 3. American National Standards Institute ANSI A250.8.
 4. Locally adopted Building Code.
 5. Wood Door Manufacturers Association (WDMA) pre-fit clearances for factory fit doors.

Door To Frame Clearances		
Location		Clearance
Door to Frame at top and sides		1/8 inches
Meeting Stiles at Pair Doors		1/8 inches
Face of door to face of Stop		1/8 inches
Door Bottom to Floor / Flooring	Typical; all floor covering types	Up to 1/2 inches
	At non-combustible sills	3/8 inches
	Bare floors- No flooring or sills	Up to 3/4 inches

- B. Factory machine doors for hardware that is not surface applied.
1. Comply with final hardware schedules, shop drawings, and hardware templates.
 2. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 3. Factory pre-drill pilot holes for surface applied items.
- C. Hardware Preparation:
1. Make cutouts accurately and neatly.
- D. Top and Bottom Edges:
1. Render top and bottom edges smooth, non-absorptive and readily cleanable.
 2. SCL rail finish: Make smooth with the application of veneer tape, plastic laminate or clear sealer to finish rough or porous edges.
- E. Fire Labels:
1. Affix permanent labels to fire rated units in accordance with agency requirements.
 2. On openings where continuous hinges or other items would conceal label, place label in alternate location allowed by listing agency and authorities having jurisdiction.
- F. Finishes:
1. Comply with WDMA finish requirements.
 2. Completely finish doors at factory.

3. Stain (STN):
 - a. Type: Manufacturer's standard type.
 - b. Stain color:
 - 1) To be selected by Engineer from manufacturer's standard line.
 - 2) System WDMA TR-8, UV cured acetylated polyester/urethane
 - 3) Sheen not over 24.
- G. Vertical Door Edges:
 1. Lock stile edges: Beveled 1/8 inches per 2 inches.
 - a. Fabricate inactive leaves with a square edge at lock stile edge.
 - 1) Active leaves to be beveled per above.
 2. Hinge stiles edge: Beveled 1/8 inches per 2 inches.
 3. Double acting doors:
 - a. Provide convex, radiused edges at lock stiles and hinge stiles.
 - b. Kerf for privacy gaskets.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify suitability of openings to accept installation.
- B. Verify frames comply with indicated requirements for type, size, location and swing characteristics and have been installed with level heads and plumb jambs.
- C. Reject doors with defects prior to hanging.
- D. Normalize wood doors to ambient conditions and to temperature and humidity levels recommended by manufacturer.
- E. Do not hang doors in frames set out of plumb, out of square, or out of parallel.
- F. Work with frame installer and wall installer to correct misalignment issues.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.
- H. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Comply with door manufacturer's written instructions, referenced quality standard, and as indicated.
- B. Drill pilot holes for screws attaching hinges, closers, lock hardware and other devices to stile or face of door.
 1. Diameter of pilot hole shall not exceed 90% of the root diameter of the screw.
- C. Fit doors to frames and machine for hardware, to extent not previously worked at factory.
- D. Touch-up stain shall have a VOC content no greater than 250 g/L Hardware: For installation, see Section 08 71 00, Door Hardware.

3.3 ADJUSTING

- A. Adjust and check doors for proper fit function and uniform clearance at each edge to swing and operate freely.
- B. Leave work complete and in proper operating condition.
- C. Ensure fire labels are intact, and readily visible.

END OF SECTION

SECTION 08 36 15
SECTIONAL STEEL DOOR (SSD)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Sectional Steel Door (SSD), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International:
 - 1. ASTM A 653 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 924 Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- B. Provide Sectional Steel Doors engineered to support dead, live, and lateral (wind or seismic) loads indicated.
 - 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
 - 2. Include headers and reinforcing members around openings.
 - 3. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Shop Drawings:
 - 1. Show fabrication details and anchorage.
 - 2. Include door elevations, head, jamb, and overhead track clearances.
- C. Project Information:
 - 1. Structural calculations for Sectional Steel Doors indicating design conforms to specified design criteria, sealed by the Specialty Structural Engineer.
 - a. Submit concurrent with Shop Drawings.
- D. Contract Closeout Information:
 - 1. Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Sectional Steel Overhead Doors:
 - 1. Base:
 - a. Clopay.
 - 2. Optional:
 - a. McKee Door.
 - b. Raynor.
 - c. Wayne Dalton North American.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

A. Design Loads:

1. Design Sectional Steel Doors and anchorage to meet Design Loads.
 - a. Wind Loads: Use the greater of the following:
 - 1) Wind Pressures as required per local building code based on wind speed, exposure factor and importance factor noted in the Structural Drawings.
 - 2) Wind Pressures defined by Building Code as locally adopted and amended.
2. Design Exterior doors to meet Design Wind Load.
 - a. Design wind load pressure: 20 psf minimum.

B. Thermal Expansion and Structural Movement:

1. Expansion and contraction, caused by changes in surface temperature equal to delta T.
 - a. Delta T for this project: 200 deg F.
 - b. Thermal contraction or expansion in this range shall not cause buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects over this temperature range.
 - c. Doors shall function normally over this temperature range.

2.3 MATERIALS

A. Sectional Steel Doors - Insulated, (SSD-I):

1. Base Product: Model 3722 by Clopay.
2. Sandwich construction, nominal thickness: 2 inches.
3. Outside: Flush face, stucco texture, formed of minimum 20 GA Z180 G60 galvanized steel.
4. Inside: Shadow rib, stucco texture, formed of minimum 27 GA galvanized steel.
5. Core: Polyurethane with minimum thermal value: R-18.

B. Seals:

1. Weatherstrip on bottom:
 - a. Motorized doors:
 - 1) Interior: Flexible neoprene safety edge.
 - 2) Exterior: Combination electric safety edge, weatherseal.
2. Weatherstripping, exterior doors:
 - a. Top and sides: Adjustable neoprene seal strip.
3. Maximum air infiltration at exterior doors: Maximum 1 cfm per foot of perimeter.
4. Finish: Parts galvanized, panels and hood primed with finish coat of baked on enamel, color as selected by Engineer from Manufacturer's full range..

C. Track:

1. Type:
 - a. Configuration as indicated.
2. Manufacturer's standard, heavy duty, G90 Z275 galvanized.
3. Mount on inside face of wall.

- D. Torsion springs counterbalance:
 - 1. Helical coil springs rated at 100,000 cycles.

2.4 OPERATION

- A. Motor Operated.
 - 1. Opening rate: Nominal 1 foot per second.
 - 2. Operator:
 - a. UL listed 1/3 hp minimum, 120/1/60.
 - 3. Gear reduction.
 - 4. Solenoid braking.
 - 5. Limit switches for upper and lower limits of travel.
 - 6. Magnetic relay contactor.
 - 7. Overload protection.
 - 8. Pre-wiring to terminal block.
 - 9. Infrared Safety:
 - a. Include sending and receiving units on opposing jambs, near floor.
 - b. Device to stop descending door and reverse motor when object is in beam path.
 - 10. Electric Safety Edge:
 - a. Causes door to stop and reverse when an obstruction is encountered when closing.
 - 11. Back up operation:
 - a. Manual lift.
 - b. Force required: Not to exceed 35 pounds.
 - 12. Controls:
 - a. Key activated, flush mounted, 3 pushbutton control.
 - 1) Install 1 per door opening at locations indicated.
 - b. Operation:
 - 1) OPEN button to fully open door when button is depressed: momentary contact.
 - 2) CLOSE button to close door when button is depressed: momentary contact.
 - 3) STOP button stops door in either direction: momentary contact.
 - c. Interlock motor so that CLOSE button will be deactivated when door is in full down position and OPEN button will be de-energized when door is in fully open position.
 - d. Electronic interlock, which discontinues the motor operator when it senses that the door has been secured by mechanical locking device.
 - 13. Locking at motorized units:
 - a. Primary:
 - 1) Locking by motor operator's brake and gear drive.
 - b. Secondary:
 - 1) Cylinder lock on bottom.
 - a) Cylinder as specified in Section 08 71 00.

- 2) Electric interlock with locking device to prevent operation of motor when manual lock device is engaged.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate and opening to accept installation.
- B. Installation constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION

- A. By manufacturer or authorized representative.
- B. Provide required mounting and accessory items for complete installation.
- C. Prior to occupancy, adjust door for smooth operation and specified weather and air sealing.

3.3 PROTECTION

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

END OF SECTION

SECTION 08 41 13
LOW-RISE ALUMINUM STOREFRONT

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Low-Rise Aluminum Storefront, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Provide aluminum storefront engineered by specialty structural engineer to support superimposed loads indicated.
 - 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
 - 2. Include headers and reinforcing members around openings.
 - 3. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.
 - B. Installer Qualifications:
 - 1. Firm with not less than ten years successful experience in erection and installation of storefront systems similar in design and scale of systems proposed for this project.
 - 2. Certified by storefront manufacturer in erection and installation of manufacturer's products.
 - 3. Submit a minimum of five references of projects similar in size and scope.
 - 4. Submit results of monthly onsite inspections conducted by manufacturer's field service representative, to assure proper installation, to Engineer.
 - 5. Upon completion of project, submit report from manufacturer's field service representative.
 - a. See Submittals, Contract Closeout Information, below.
 - C. Welding and Welders:
 - 1. Utilize skilled and qualified welders, licensed where required in accordance with local building regulations.
 - 2. Perform welding in conformance with AWS structural welding code.
 - D. ASTM International (ASTM):
 - 1. ASTM E1332 Standard Classification for Rating Outdoor-Indoor Sound Attenuation
 - E. Mock-up:
 - 1. Erect mock-up wall 1 bay wide.
 - 2. Install complete with glass, glazing, insulation, spandrels, anchors, and other components required to create entire assembly.
 - 3. Mock-up wall may be retained in place as a permanent part of building.
 - 4. If constructed separate from building, mock-up wall shall remain intact during balance of storefront installation and used for comparative purposes.
- 1.3 TEST REQUIREMENTS**
- A. Air Infiltration:
 - 1. Test in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, NFRC 400, or ASTM E283, as applicable.

2. Maximum Air Infiltration:
 - a. Fixed wall areas:
 - 1) 0.06 cubic feetM/FT2 0.0003 m3/s/m2 when tested at 6.24 psf 300 Pa.
- B. Water Infiltration:
 1. Test in accordance with ASTM E331.
 2. No uncontrolled water penetration through area of wall.
 3. Differential static pressure 20 percent of inward acting design wind load pressure specified but not less than 8 psf 380 Pa.
- C. Structural Performance:
 1. Uniform Load Deflection Test:
 - a. Conduct at Design Test Pressure both positive and negative in accordance with ASTM E330.
 - b. Apply inward and outward test pressures equal to design wind pressures.
 - c. Deflection of framing member in direction normal to plane of wall not exceeding $L/175$ for span under 13 feet - 6 inches 4.1 M and $L/240 + 1/4$ inches 6 mm for span over 13 feet - 6 inches 4.1 M.
 - d. Maximum deflection at cantilevers not to exceed $2L/175$.
 - e. No air and water infiltration, no glass breakage, no damage to fasteners, or anchors and main members, or disengagement.
 - f. Deflection of thin metal panel walls not exceeding $1/60$ of span.
 - g. Measure deflection from gauges located on vertical mullions and horizontal members.
 - h. Deflection of member in direction parallel to plane of wall, when carrying full dead load, not exceeding an amount which will reduce glass bite below 75 percent of design dimension.
 - i. Provide minimum $1/8$ inches 3 mm clearance between member and top of fixed panel, glass, or other fixed part immediately below.
 - j. Clearance between member and door or operable window, minimum $1/16$ inches 1.5 mm.
 2. Uniform Load Structural Test:
 - a. Conduct at 1.5 x Design Test Pressure both positive and negative, acting normal to plane of wall in accordance with ASTM E330.
 - b. No glass breakage; permanent damage to fasteners, hardware parts, or anchors; or permanent deformation of main frame member in excess of 0.2 percent of its clear span.
 3. Vertical Inter-Story Movement:
 - a. No air and water infiltration, no glass breakage, no damage to fasteners, or anchors and main members, or disengagement resulting from vertical displacement of intermediate level support in the plane of the main wall $1/2$ inches 13 mm up and down six complete cycles in accordance with AAMA 501.7.
 4. Dynamic Lateral Racking – Parallel to Wall:
 - a. No air and water infiltration in excess of primary performance requirements, no breakage, no damage, or disengagement resulting from lateral displacement of the intermediate level support in plane of the main wall at ± 0.5 percent of story height for three complete cycles in accordance with AAMA 501.6.

5. Static Lateral Racking – Parallel to Wall:
 - a. No glass breakage, framing member or trim disengagement, catastrophic failure or fall-out resulting from lateral displacement of intermediate level support in plane of main wall at +/-1.5 percent of story height for three complete cycles in accordance with AAMA 501.4.
6. Thermal Cycling:
 - a. No air and water infiltration in excess of primary performance requirements, no breakage, no damage, or disengagement resulting from three thermal cycles of -10 deg F -23 deg C exterior ambient temperature to +180 deg F +82 deg C exterior surface temperature, each held for a two-hour period after equilibrium has been reached.
 - 1) Interior ambient air temperature controlled at 70 deg F +/-5 deg F 21 deg C +/-15 deg C during cold and hot cycles respectively.
 - 2) Test in accordance with AAMA 501.5.
- D. Condensation Resistance and Thermal Transmittance Performance:
 1. Perform thermal tests in accordance with NFRC 102 and/or AAMA 1503 or provide finite element computer thermal modeling and calculations per NFRC 100, NFRC 705 or AAMA 507, using DOE/LBL THERM, WINDOW, and/or CMAST software.
 - a. Thermal Transmittance (U-Factor) for overall window area:
 - 1) 0.32 BTUH/SF/deg F maximum.
 - b. Condensation Resistance Factor (CRF) requirements:
 - 1) 66 minimum.
 2. Sound Transmission Class (STC): Not less than 31.
 3. Outdoor-Indoor Transmission Class (OITC): Not less than 25.
- E. Swinging doors:
 1. Air infiltration: Not more than 0.30 cubic feetM/LF 0.00015 M3/S /305 mm at 1.60 psf 77 Pa static air pressure differential, when tested in accordance with ASTM E283.
 2. Water Leakage: No uncontrolled water entry at 0 psf 0 Pa test pressure per ASTM E331.
 3. Structural Performance: Structural performance per ASTM E330 shall be based on an actual deflection of 0.02 inches 0.051 mm at test pressure of 30.09 psf (1441 Pa).
 4. Thermal Transmittance:
 - a. Thermal transmittance due to conduction (U-value) shall not be greater than 0.651 btu/HR/FT2/deg F 3.696 W/M2 K per AAMA 1503.
 - b. Condensation resistance factor (CRF) shall not be less than 56 per AAMA 1503.
 5. Pairs:
 - a. Less than 1.0 cubic feetM/FT2 0.00508 M3/S/M2 of perimeter crack, when tested at 1.56 psf 75 Pa.

1.4 SUBMITTALS

- A. Shop Drawings:
 1. Prepared and signed by, or reviewed and approved by, Storefront manufacturer.
 2. Elevations, sections, and details for review of design intent and anchorage to building frame.

3. Indicate member type, location, spacing, size of members and method of attachment to support structure.
 4. Indicate supplemental bracing, strapping, splices, bridging, accessories, and details.
- B. Product Data:
1. Manufacturer product literature.
- C. Samples:
1. Range samples of aluminum finishes.
- D. Project Information:
1. Engineering calculations indicating design moments, shears, and other forces sealed by Specialty Structural Engineer.
 - a. Submit concurrent with Shop Drawings.
 2. Communicate special requirements, changes, or modifications to storefront and interface between storefront support system and building structural frame.
 3. Sample of Special Warranty demonstrating compliance with specified requirements.
 4. Meeting minutes from Preinstallation Conference.
 5. Installer Qualifications per Quality Control, above.
 6. Certified independent laboratory test reports verifying compliance with performance characteristics.
- E. Contract Closeout Information:
1. Special Warranty.
 - a. See Section 01 78 36.
 2. Maintenance data.
 - a. See Section 01 78 23.
 3. Warrantable report by manufacturer's field service representative stating storefront systems have been installed in accordance with manufacturer's published specifications, drawings, details, and project design requirements.

1.5 SPECIAL WARRANTY

- A. Written ten year warranty signed jointly by manufacturer and installer, agreeing to repair or replace defective materials or workmanship, including noncompliance with specification requirements and industry standards, which result in failure of the storefront system, finish, glass or parts.
1. Failure includes but not limited to:
 - a. Defects in materials, workmanship, water infiltration of assembly, air infiltration of assembly, glazing, sealant, or defects which influence system capacity to perform as a weather tight envelope.
 2. Finish:
 - a. Cracking, crazing, flaking, blistering, or combination of Anodized finishes:
 - 1) Warranty period: Ten years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Low-Rise Aluminum Storefront:
1. Base:
 - a. Oldcastle Building Envelope

2. Optional:
 - a. EFCO Corporation
 - b. Wausau Window and Wall Systems
 - c. Schuco USA LLLP
 - B. Other manufacturers desiring approval comply with Section 01 61 00.
- 2.2 DESIGN CRITERIA
- A. Design and fabricate storefront systems under responsibility of one manufacturer, with components sized for ease of shipping, distribution, and erection.
 - B. Design Wind Loads - Allowable Stress Design (ASD):
 1. Use most restrictive of following:
 - a. Wind pressures as required per local building code based on wind speed, exposure factor and importance factor noted in the Structural Drawings.
 - b. Wind Pressures defined by Building Code as locally adopted and amended.
 - c. Deflection values: Use the most restrictive of the following:
 - 1) Limit deflection to values specified for Uniform Design Load Test.
 - 2) Limit deflection to comply with Building Code as locally adopted and amended.
 - 3) Limit deflection to L/175 or 3/4 inches 19 mm maximum.
 2. Design structural components, including transoms, mullions, and anchors, complying with deflection and stress requirements.
 - C. Thermal Expansion and Structural Movement:
 1. Expansion and contraction, caused by changes in surface temperature equal to delta T.
 - a. Delta T for this project: 200 deg F.
 - b. Thermal contraction/expansion in this range shall not cause buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects over this temperature range.
 - c. Operating windows and doors shall function normally over this temperature range.
- 2.3 MATERIALS
- A. Extruded Aluminum:
 1. ASTM B221, alloy 6063-T6 for extrusions ASTM B209, alloy 5005-H16 for sheets.
 2. Member wall thickness: Each framing member shall provide structural strength to meet specified performance requirements.
 3. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.
 - B. Framing Systems:
 1. System 1:
 - a. Oldcastle Series 6000 XT
 - b. Size of framing members: 2 inches x 6 inches

2. System 2:
 - a. Oldcastle Series 3000 XT
 - b. Size of framing members: 2 inches x 4-1/2 inches
 3. Position of glass in frame:
 - a. Front glazed.
 4. Provide systems to receive 1 inch 25 mm insulating glass except where noted. Where 1/4" glass is indicated, provide reducer.
 5. Provide strike boxes at openings in framing system.
 6. Provide adaptors, sill flashing, and thermal pocket fillers as required for installation.
- C. Internal Reinforcing:
1. ASTM A36 for carbon steel.
 2. Shapes and sizes to suit installation.
 3. Steel components factory coated with alkyd type zinc chromate primer complying with FS TT-P-645.
- D. Doors:
1. Fabricate of extruded sections assembled with tension rods, or welded corners.
 2. Dimensions:
 - a. Member Wall Thickness: 0.125 inches (minimum).
 - b. Stiles and Top Rail:
 - 1) Medium:
 - a) 4IN 100 mm.
 - b) Base Product: Therml Block, Medium Stile by Wausau.
 - c. Bottom Rail: 10 inches 254 mm.
 3. Offset Pivots: Specified in Section 08 71 00.
 4. Provide manufacturer's standard weatherstripping at edges and door bottom. Provide Threshold. Prepare and reinforce doors to receive additional hardware specified in Section 08 71 00.
- E. Anchorage Devices:
1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars, and tubes.
 2. Hot-dip galvanize steel assemblies per ASTM A123: 2.0 ounce minimum coating.
- F. Fasteners:
1. Anodized aluminum or non-magnetic 300 series stainless steel which will not cause electrolytic action or corrosion.
 2. Provide Phillips flat head screws where exposed.
 3. Finish exposed aluminum fasteners to match aluminum finish.
- G. Sealants:
1. See Section 07 92 13.
 2. Use exposed sealants of color to match aluminum finish.
 3. Include sealants and caulking required within and around storefront.
- H. Glass:
1. See Section 08 81 00 for glass to be installed under this section.

- I. Brackets, anchors, and reinforcements:
 - 1. Aluminum wherever possible.
 - 2. Where steel is used: Include dissimilar metals protection to prevent galvanic action.
- J. Sill Receiver:
 - 1. Continuous, extruded aluminum finished to match frames.
 - 2. Thermal break for improved performance.
 - 3. Seal seams and dam ends per manufacturer's instructions.
- K. Flashings:
 - 1. Manufacturer standard at sill or as indicated.
 - 2. Minimum 0.040 inches aluminum.
 - 3. Finish to match storefront if exposed.
 - 4. Mill finish if concealed.
- L. Anodic Finish:
 - 1. Architectural Class I per AAMA 611.
 - a. 2-step electrolytic.
 - 2. Minimum Coating Thickness: 0.7 mils.
 - 3. Color:
 - a. No. 29, Black, AAM10C21A44.

2.4 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly.
- B. Accommodate expansion and structural movement of adjacent materials.
- C. Fit and assemble work at shop to maximum extent possible.
 - 1. Accurately fit and secure joints and corners.
 - 2. Make joints flush, hairline and weatherproof.
 - 3. Weld by methods recommended by manufacturer and AWS to avoid discoloration.
 - 4. Grind exposed welds smooth and restore finish.
 - 5. Ease corners of cut edges to radius of 1/64 inches.
 - 6. Reinforce work as necessary to withstand wind loadings and to support system.
 - 7. Separate dissimilar metals with bituminous paint or separators to prevent corrosion.
 - 8. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts to prevent joint freeze-up.
- D. Arrange fasteners and attachments to conceal from view.
- E. Fully degrease and clean members prior to assembly or application of sealing compound or protective coatings.
- F. Reinforce frames and doors for hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify building conditions permit installation of Low-rise Aluminum Storefront according to manufacturer's instructions, approved shop drawings, calculations, and contract documents.
- B. Do not install storefront until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Set units plumb, level and true to line, without warp or rack of frame.
 - 1. Erection tolerances:
 - a. 1/8 inches in 10 feet 3 mm in 3 M vertically.
 - b. 1/8 inches in 20 feet 3 mm in 6 M horizontally.
 - 2. Limit variations from theoretical locations: 1/4 inches 6 mm for any member at any location.
 - 3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inches 1.5 mm from flush surfaces not more than 2 inches 50 mm apart or out-of-flush by more than 1/4 inches 6 mm.
- B. Separate dissimilar materials at contact points, including metal in contact with masonry, concrete, bituminous paint, or pre-formed separators.
- C. Allow for required movement, including expansion and contraction.
- D. Anchor interior side of frame to insulated construction.
- E. Install doors and hardware in accordance with manufacturer's instructions.
- F. Sealant:
 - 1. Set sill members in full bed of sealant.
 - 2. Place members with internal sealants and baffles in accordance with manufacturer's instructions.
 - 3. Install perimeter sealant and backing materials between assemblies and adjacent construction.
 - 4. See Section 07 92 13.
- G. Water Drainage:
 - 1. Compartmentalize each light of glass using joint plugs and silicone sealant to divert water to horizontal weep locations.
 - 2. Provide weep holes or drainage slots within glazing pockets to drain any condensation or accumulating water within system to exterior.
- H. Glazing:
 - 1. See Section 08 81 00, "Glass and Glazing."

3.3 FIELD QUALITY CONTROL

- A. Field Tests:
 - 1. Engineer shall select Storefront to be tested when representative portion of work has been installed, glazed, perimeter caulked and cured.
 - 2. Test for water penetration in accordance with AAMA 501.2-03, Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
 - 3. Where test results do not meet requirements: Correct deficiencies and implement improved installation procedures for completing balance of Storefront.

3.4 PROTECTION AND CLEANING

A. Protection:

1. Protect finish surfaces from damage during construction.
2. Protect from damage of grinding, polishing, plaster, lime, acid, cement, and other harmful contaminants.

B. Cleaning:

1. Repair or replace damaged components.
2. Clean in accordance with manufacturer's instructions.
3. Remove construction debris and legally dispose offsite.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 CONDITIONS

- A. Conditions of the contract (General and Supplementary Conditions) and Division 01 - General Requirements, govern the work of this section.
- B. This section includes all material and related service necessary to furnish all finish hardware indicated on the drawings or specified herein.
- C. Furnish UL listed hardware for all labeled and 20 min. openings in conformance with the requirements for the class of opening scheduled. Underwriters' requirements shall have precedence over specification where conflicts exist.
- D. All work shall be in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.

1.2 WORK INCLUDED

- A. This section includes the following:
 - 1. Furnish door hardware specified herein, listed in the hardware schedule, and/or required by the drawings.
 - 2. Cylinders for Aluminum Doors
 - 3. Thresholds and Weather-stripping (Aluminum frame seals to be provided by aluminum door supplier)
 - 4. Electro-Mechanical Devices
 - 5. Access Control components and or systems specified within this section.
- B. Where items of hardware are not definitely or correctly specified and is required for the intended service, such omission, error or other discrepancy should be directed to the Engineer prior to the bid date for clarification by addendum. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.

1.3 RELATED WORK IN OTHER SECTIONS

- A. This section includes coordination with related work in the following sections:
 - 1. Division 06 Section "Finish Carpentry".
 - 2. Division 08 Section "Hollow Metal Doors and Frames".
 - 3. Division 08 Section "Flush Wood Doors"
 - 4. Division 08 Section "Low-Rise Aluminum Storefront"
 - 5. Division 26 "Electrical"

1.4 REFERENCES

- A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.
 - 1. DHI - Recommended Locations for Builders' Hardware.
 - 2. NFPA 80 - Standards for Fire Doors and Windows.
 - 3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
 - 4. UL - Building Material Directory.
 - 5. DHI - Door and Hardware Institute
 - 6. WHI - Warnock Hersey
 - 7. BHMA - Builders Hardware Manufacturers Association
 - 8. ANSI - American National Standards Institute

9. ANSI ICC500 – Standard for the Design and Construction of Storm Shelters
10. IBC- International Building Code (as adopted and amended by local building code)

1.5 SUBMITTALS

- A. Within ten days after award of contract, submit detailed hardware schedule in quantities as required by Division 01 - General Requirements.
- B. Schedule format shall be consistent with recommendations for a vertical format as set forth in the Door & Hardware Institute's (DHI) publication "Sequence and Format for the Hardware Schedule". Hardware sets shall be consolidated to group multiple door openings which share similar hardware requirements. Schedule shall include the following information:
 1. Door number, location, size, handing, and rating.
 2. Door and frame material, handing.
 3. Degree of swing.
 4. Manufacturer
 5. Product name and catalog number
 6. Function, type and style
 7. Size and finish of each item
 8. Mounting heights
 9. Explanation of abbreviations, symbols, etc.
 10. Numerical door index, indicating the hardware set/ group number for each door.
- C. When universal type door closers are to be provided, the schedule shall indicate the application method to be used for installation at each door: (regular arm, parallel arm, or top jamb).
- D. The schedule will be prepared under the direct supervision of a certified Architectural Hardware Consultant (AHC), or certified Door Hardware Consultant (DHC) employed by the hardware distributor. The hardware schedule shall be signed and embossed or stamped with the DHI certification seal of the supervising AHC or DHC. The supervising AHC or DHC shall attend any meetings related to the project when requested by the Engineer.
- E. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.
- F. Review drawings from related trades as required to verify compatibility with specified hardware. Indicate unsuitable or incompatible items, and proposed substitutions in the hardware schedule.
- G. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.
- H. Furnish manufacturers' catalog data for each item of hardware in quantities as required by Division 01 - General Requirements.
- I. Submit a sample of each type of hardware requested by the Engineer. Samples shall be of the same finish, style, and function as specified herein. Tag each sample with its permanent location so that it may be used in the final work.
- J. Furnish with first submittal, a list of required lead times for all hardware items.
- K. After final approved schedule is returned, transmit corrected copies for distribution and field use in quantities as required by Division 01 - General Requirements.
- L. Furnish approved hardware schedules, template lists, and pertinent templates as requested by related trades.

- M. Furnish necessary diagrams, schematics, voltage and amperage requirements for all electro-mechanical devices or systems as required by related trades. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.
- N. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature". Submit copies of owner approved key schedule for review and field use in quantities as required by Division 01 - General Requirements. Wiring diagrams shall be included in final submittals transmitted for distribution of field use.

1.6 QUALITY ASSURANCE

- A. Manufacturers and model numbers listed are to establish a standard of function and quality. Similar items by approved manufacturers that are equal in design, function, and quality, may be considered for prior approval of the Engineer, provided the required data and physical samples are submitted for approval as set forth in Division 01 - General Requirements.
- B. Where indicated in this specification, products shall be independently certified by ANSI for compliance with relevant ANSI/BHMA standards A156.1 - A156.36 – Standards for Hardware and Specialties. All products shall meet or exceed certification requirements for the respective grade indicated within this specification. Supplier shall provide evidence of certification when requested by the Engineer.
- C. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to ensure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.
- E. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.
- F. Hardware supplier shall be factory trained and certified by the manufacture to provide and support all computer managed locks and system components.
- G. Installation of hardware shall be installed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project, or with not less than 3 years' experience in successful completion of projects similar in size and scope.
- H. Provide hardware for all labeled fire doors, which complies with positive pressure fire testing UL 10C.
- I. Comply with all applicable provisions of the standards referenced within section 1.4 of this specification.
- J. Hardware supplier shall participate when reasonably requested to meet with the contractor and or engineer to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy of any unresolved items.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Hardware supplier shall deliver hardware to the job site unless otherwise specified.
- B. All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.
- C. Contractor shall receive all hardware and provide secure and proper protection of all hardware items to avoid delays caused by lost or damaged hardware. Contractor shall report shortages to the Engineer and hardware supplier immediately after receipt of material at the job site.
- D. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

1.8 PRE-INSTALLATION MEETING

- A. Schedule a hardware pre-installation meeting on site to review and discuss the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.
- B. Meeting attendees shall be notified 7 days in advance and shall include: Engineer, Contractor, Door Hardware Installers (including low voltage hardware), Manufacturer's representatives for above hardware items, and any other effected subcontractors or suppliers.
- C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

1.9 WARRANTY

- A. All hardware items shall be warranted against defects in material and workmanship as set forth in Division 01 - General Requirements.
- B. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner.

PART 2 - PRODUCTS

2.1 FASTENERS

- A. All exposed fasteners shall be Phillips head or as otherwise specified and shall match the finish of the adjacent hardware. All fasteners ex-posed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.
- B. Coordinate required reinforcements for doors and frames. Seek approval of the Engineer prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

2.2 BUTT HINGES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Stanley</u>	<u>Hager</u>	<u>McKinney</u>
Standard Weight, Plain Bearing	5PB1	F179	****	T2714
Standard Weight, Ball Bearing	5BB1	BB179	BB1279	TB2714
Standard Weight, Ball Bearing, Non-Ferrous	5BB1	FBB191	BB1191	TB2314
Heavy Weight, Ball Bearing	5BB1HW	FBB168	BB1168	T4B3786
Heavy Weight, Ball Bearing, Non-Ferrous	5BB1HW	FBB199	BB1199	T4B3386

- B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.1 (2006). Hinges shall meet or exceed the following ANSI grade requirements as indicated below:
 - 1. Standard Weight, Plain Bearing Hinges: Grade 3
 - 2. Standard Weight, 2 Ball Bearing Hinges: Grade 2
 - 3. Heavy Weight, 4 Ball Bearing Hinges: Grade 1

- C. Unless otherwise specified, furnish the following hinge quantities for each door leaf.
 - 1. 3 hinges for doors up to 90 inches.
 - 2. 1 additional hinge for every 30 inches on doors over 90 inches.
 - 3. 4 hinges for Dutch door applications.
- D. Unless otherwise specified, top and bottom hinges shall be located as specified in Division 08 Section "Hollow Metal Doors and Frames". Intermediate hinges shall be located equidistant from others.
- E. Unless otherwise specified, furnish hinge weight and type as follows:
 - 1. Standard weight: plain bearing hinge 5PB1 or ball bearing hinge 5BB1 for interior openings through 36 inches wide without a door closer.
 - 2. Standard weight: ball bearing hinge 5BB1 for interior opening over 36 through 40 inches wide without a door closer, and for interior openings through 40 inches wide with a door closer.
 - 3. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
 - 4. Heavyweight: 4 ball bearing hinge 5BB1HWSS for exterior openings unless otherwise listed in groups.
 - 5. Heavyweight: 4 ball bearing hinge 5BB1HWSS 5" for all exterior doors or 4 ball bearing hinge 5BB1HW 5" for interior doors, that have an automatic operator.
- F. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.
- G. Unless otherwise specified, furnish hinges in the following sizes:

5" x 5"	2-1/4" thick doors
4-1/2" x 4-1/2"	1-3/4" thick doors
3-1/2" x 3-1/2"	1-3/8" thick doors
- H. Furnish hinges with width to accommodate trim and allow for 180-degree swing.
- I. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins. Furnish non-removable pin (NRP) hinges at all reverse-handed doors that are furnished with lockable hardware.
- J. Unless otherwise specified, furnish all hinges to template standards.

2.3 CONTINUOUS PIN AND BARREL HINGES

- A. Acceptable manufacturers and respective catalog numbers:

Surface Mount Pin & Barrel Stainless Steel Continuous Hinge	<u>Ives</u> 702 Series
- B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.26, Grade 1 (2012).
- C. Continuous hinges shall be full height pin and barrel type hinge providing full height door support up to 600 lbs. Edge mount (unless noted otherwise).
- D. Construct hinges of heavy-duty 14-gauge material. The stainless internal pin shall have a diameter of 0.25 and the exterior barrel diameter of 0.438.
- E. Hinge shall be non-handed with symmetrical template hole pattern and factory drilled. Hinge must accept a minimum of 21 fasteners on the door and 21 fasteners on the frame.
- F. Each knuckle to be 2 inches, including split nylon bearing at each separation for quiet, smooth, self-lubricating operation.
- G. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 3 hours.

- H. Provide machine screws for doors which have been reinforced to accept machine screws.
- I. Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames.
- J. Provide adjusting screws equal to Ives "Adjust-a-Stud" for continuous hinges specified as 705. Adjustment to be able to correct frame fit problems up to 3/8 inch.

2.4 POWER TRANSFERS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Von Duprin</u>	<u>ASSA</u>
Concealed Two Wire	EPT-2	CEPT-10
Concealed Ten Wire	EPT-10	CEPT-10

- B. Door cords shall be armored cable with screw on caps.
- C. Concealed power transfers shall be concealed in the door and frame when the door is closed.
- D. Concealed power transfers shall have a steel tube to protect wires from being cut.
- E. Concealed power transfers with spring tubes shall be rejected.
- F. Concealed power transfers shall be supplied with a mud box to house all terminations.

2.5 FLUSH BOLTS AND DUST PROOF STRIKES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Door Controls</u>	<u>Hager</u>
Dust Proof Strike	DP2	80	280X
Auto Flush Bolt (Metal Door)	FB31P	842	292D
Auto Flush Bolt (Wood Door)	FB41P	942	291D
Constant Latching Bolt (Metal Door)	FB51P	845	293D
Constant Latching Bolt (Wood Door)	FB61P	945	294D
Manual Flush Bolt	FB458	780	282D

- B. Unless otherwise specified, provide 12" rods for manual flush bolts for door 7'6" or less, 24" top rods for doors over 7'6" to 8'6".
- C. Unless otherwise specified, provide doors over 8'6" with automatic top bolts.
- D. Provide automatic flush bolts where required to maintain fire door listing and or egress requirements on pairs of doors.
- E. All flush-bolt applications shall be UL listed to be installed with top flush-bolt only. Provide auxiliary fire bolt as required for fire rated openings where less bottom bolt has been specified.
- F. Provide all bottom flush bolts with non-locking dust proof strikes.

2.6 EXIT DEVICES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Von Duprin</u>	<u>Sargent</u>	<u>Detex</u>
Wide Stile, Push Pad	99 Series	GL-43-80 Series	Advantex (Wide Stile)
Narrow Stile, Push Pad	33 Series	GL-43-80 Series	Advantex (Narrow Stile)
Lever Trim	996 Series	740 ET	"D/DM" Trim
Pull Trim	990 Series	800 MAL	"C" Trim

Exit devices shall be independently certified by ANSI for compliance with ANSI A156.3, Grade 1 (2008).

- B. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.
- C. All exit devices shall be equipped with a sound-dampening feature to reduce touch pad return noise.

- D. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.
- E. All exit devices shall be provided with flush end caps to reduce potential damage from impact.
- F. All exit devices shall be provided with dead-locking latch bolts to ensure security.
- G. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.
- H. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.
- I. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.
- J. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)
- K. All exit devices shall be provided with trim designs to match other lever and pull designs used on the project.
- L. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.
- M. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.
- N. Provide Von Duprin #154 or equivalent mullion stabilizers at all doors with removable mullions.
- O. Provide reinforced crossbars for all traditional style exit devices applied to doors over 36" wide.

2.7 LOCKS AND LATCHES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Schlage</u>	<u>Falcon</u>	<u>Sargent</u>
Grade 1 Mortise	L Series 17A	MA Series QG	8200 LNP
Grade 1 Cylindrical	ND Series SPA	T Series Q	10 Line LP

Bored locks shall be independently certified by ANSI for compliance with ANSI A156.2 (2011).

Mortise locks shall be independently certified by ANSI for compliance with ANSI A156.13 (2012).

- B. Provide full narrow escutcheon at mortise locks with indicators.
- C. Unless otherwise specified, all locks and latches to have:
 - 1. 2-3/4" Backset
 - 2. 1/2" minimum throw latchbolt
 - 3. 1" throw deadbolt
 - 4. ANSI A115.2 strikes
- D. Provide guarded latch bolts for all locksets, and latch bolts with throw to maintain fire rating of both single and paired door assemblies.
- E. Provide strike with lip length adequate to clear surrounding trim.
- F. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.
- G. Provide temperature control modules for electrified locks to limit transfer of heat to door lever.

2.8 PULLS, PUSH BARS, PUSH/PULL PLATES

A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Burns</u>	<u>Hager</u>
Push Plate (.050 6"X 16")	8200 6" X 16"	56	30S 6 x 16
Pull Plate (1" dia., 10" CTC - .050" X 4" X 16")	8303-0 4" X 16"	5426C	34J 4 x 16
Ladder Pull (1-1/4" dia., flat tip)	9264F	VP4251	910
Flush Pull	459C	16N	960

Adjust dimensions of push plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, push plates shall be factory drilled for cylinders or other mortised hardware. All push plates shall be beveled 4 sides and counter sunk.

- B. When mounting straight pull on a wide stile door will prevent access to key cylinder, mount pull offset from cylinder location to allow access to cylinder.
- C. Where possible, provide back-to-back, and concealed mounting for pulls and push bars. Push bar length shall be 3" less door width, or center of stile to center of stile for stile & rail or full glass doors.

2.9 CLOSERS

A. Acceptable manufacturers and respective catalog numbers:

	<u>LCN</u>	<u>Norton</u>	<u>Sargent</u>
1. 4050A / 4050A EDA		R7500 / PR7500	350 / 351 P10

- B. Door closers shall be independently certified by ANSI for compliance with ANSI A156.4, Grade 1 (2013).
- C. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. Provide extra heavy-duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.
- E. Hardware supplier shall coordinate with related trades to ensure aluminum frame profiles will accommodate specified door closers.
- F. Closers shall use aluminum cylinders.
- G. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.
- H. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.
- I. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.
- J. Provide closers with adjustable spring power. Size closers to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.
- K. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.
- L. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.
- M. Door closers shall be provided with a powder coat finish to provide superior protection against the effects of weathering. Powder coat finish shall successfully pass a 100-hour salt spray test.

2.10 LOW ENERGY ELECTRO-MECHANICAL AUTOMATIC OPERATORS

A. Acceptable manufacturers and respective catalog numbers:

	<u>LCN</u>	<u>Stanley</u>	<u>Besam</u>
Electro-Mechanical Operator	9500 Sr. Swing	MagicForce	SW200i

- B. Low energy operators shall be independently certified by ANSI for compliance with ANSI A156.19 (2002).
- C. Where low kinetic energy, as defined by ANSI/BHMA Standard A156.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the ADA for opening force and time to close standards.
- D. Operator operation shall consist of Push button, push plate, switch-activated, manual or manual/electric power assisted Push 'N' Go opening with power boost closing and holding as specified in hardware sets.
- E. Operators shall comply with ANSI A156.19, UL 325, and the American with Disabilities Act.
- F. In event of power failure, make door operate manually with controlled spring close as though equipped with a #3 manual door closer, without damage to operator components.
- G. Provide adjustment by microprocessor control for:
 - 1. Opening speed.
 - 2. Backcheck.
 - 3. Hold-open, from 5 to 30 seconds.
 - 4. Closing speed.
 - 5. Opening force.
 - 6. Acceleration during opening and recycling, for soft start.
 - 7. Door will safely stop and reverse if an object is encountered in the opening or closing cycle.
- H. Operator equipment shall be completely electromechanical and include the following features:
 - 1. Close and center door against stop after each cycle, and hold against drafts, winds and stack pressure.
 - 2. Manual opening force: 14 lb-force (62 N) maximum.
 - 3. Closing force: 6 lb-force (26.6 N).
 - 4. Factory-set door hold-open voltage.
 - 5. Control box and motor/gear box shall be contained in protective housing; utilize precision-machined gears and bearing seats, all-weather lubricant, and shall be mounted on vibration isolators.
 - 6. Gears shall be manufactured by operator manufacturer specifically for operators.
 - 7. Motor shall consist of a DC permanent magnet motor with shielded ball bearings. Motor shall stop when door stops or is fully open and when breakaway is operated.
 - 8. Door operating arm shall be fabricated from forged steel and attached at natural pivot point of door. Do not use slide block in top of door.
 - 9. Exposed arms shall be factory-polished and finished to match operator enclosure.
 - 10. Control circuits for actuators and safeties shall be low-voltage, NEC Class II.
 - 11. Power operators will require 115 VAC power supply.
- I. Enclosure shall consist of a extruded aluminum header concealing all operating parts except arms and manual control switches.
- J. Exterior actuator switches shall be weather resistant and mount on a single gang electrical box furnished by Division 26.
- K. Power Operators shall be warranted by the manufacture to be free from defects in material and workmanship for a period of two years.

2.11 KICK PLATES AND MOP PLATES

- A. Furnish protective plates as specified in hardware groups.
- B. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.
- C. Protective plates shall be 2" less door width, or 1" less door width at pairs. All protective plates shall be beveled 4 sides and counter sunk.
- D. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing. When protection plates over 16" are provided for labeled doors, the plate shall be labeled.
- E. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.
- F. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

2.12 OVERHEAD STOPS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Glynn-Johnson</u>	<u>Rixson</u>	<u>Sargent</u>
Heavy Duty Surface Mount	GJ900 Series	9 Series	590
Heavy Duty Concealed Mount	GJ100 Series	1 Series	690

- B. Unless otherwise specified, furnish GJ900 series overhead stop for hollow metal or 1-3/4" solid core doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for hollow metal or 1-3/4" solid core doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.
- C. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.
- D. Provide special stop only ("SE" suffix) overhead stops when used in conjunction with electronic hold open closers.
- E. Do not provide holder function for labeled doors.

2.13 WALL STOPS AND HOLDERS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Hager</u>	<u>Burns</u>
Wrought Convex Wall Stop	WS406CVX	232W	570
Wrought Concave Wall Stop	WS406CCV	236W	575
Automatic Wall Holder	WS40	326W	533

- B. Furnish a stop or holder for all doors.
- C. Provide concave style wall stop at all adjacent integral push button locks; provide convex style wall stop at all other locations.
- D. Where wall stops are not applicable, furnish overhead stops.
- E. Furnish floor stops only where specified in hardware sets.
- F. Do not provide holder function for labeled doors.

2.14 WEATHERSTRIP, GASKETING

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>	<u>Pemko</u>	<u>NGP</u>	<u>Reese</u>
Weatherstrip	429	2891_PK	700NA	755
Adhesive Gasket	188	S88	5050	797
Mullion Seal/Silencer	8780	5110	5100N	***
Sweep w/ drip	8198	345_N	C627	354
Drip Cap	142	346	16	R201

- B. Weatherstrip and gasketing shall be independently certified by ANSI for compliance with ANSI A156.22 (2005).
- C. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.
- D. Provide weatherstripping all exterior doors and where specified in hardware sets.
- E. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.
- F. Provide Zero 188 smoke gaskets at all fire rated doors and smoke and draft control assemblies.
- G. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

2.15 THRESHOLDS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>	<u>Pemko</u>	<u>NGP</u>	<u>Reese</u>
Saddle Threshold	8655	171	425	S205
Half Saddle Threshold	1675	****	325	S245

Thresholds shall be independently certified by ANSI for compliance with ANSI A156.21 (2001).

- B. Hardware supplier shall verify finish floor conditions and provide proper threshold as required to provide a smooth transition between finished floor surfaces.
- C. Unless otherwise specified or detailed, provide threshold as follows:
 - 1. Provide Zero 8655 or similar saddle threshold for exterior openings with finished floor height transition of 1/4" or less.
 - 2. Provide Zero 1675 or similar half-saddle threshold for exterior openings with finished floor height transition of 1/4" to 1/2".

2.16 FINISHES AND BASE MATERIALS

- A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

<u>HARDWARE ITEM</u>	<u>BHMA FINISH</u>
Butt Hinges: Exterior, or Non-Ferrous	630 (US32D - Satin Stainless Steel)
Butt Hinges: Interior	652 (US26D - Satin Chromium)
Flush Bolts	626 (US26D - Satin Chromium)
Exit Devices	626 (US26D - Satin Chromium)
Locks and Latches	626 (US26D - Satin Chromium)
Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
Closers	689 (Powder Coat Aluminum)
Protective Plates	630 (US32D - Satin Stainless Steel)
Overhead Stops	630 (US32D - Satin Stainless Steel)
Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
Thresholds	719 (Mill Aluminum)
Weather-strip, Sweeps Drip Caps	Aluminum Anodized
Miscellaneous	626 (US26D - Satin Chromium)

2.17 KEYING

- A. Provide all cylinders in keyways as required to accommodate owners existing key system.
- B. All locks under this section shall be keyed as directed by the owner to an existing Master Key System.
- C. Furnish a total of 2 keys per cylinder. Actual cut keys to be determined by owner.
- D. Master keys, control keys, and change keys shall be delivered by registered mail to the owner. Construction keys shall be delivered to the contractor.

2.18 KEY CABINETS

- A. Acceptable manufacturers and respective catalog numbers:

<u>Lund</u>	<u>Key Control</u>	<u>Telkee</u>
1200-1205 AA	M228-2480	RWC-AWC

- B. Furnish 1 each model 1200 or 1205 AA key cabinet with a capacity 1.5 times the number of key sets.
- C. Provide one key cabinet with at least one hook for each key set, plus additional hooks for 50% expansion.
- D. Furnish key cabinet complete with cam lock, permanent key tags, and change key cards.
- E. Hardware supplier shall prepare all key change index records, tag all keys and place permanent file keys in cabinet.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, installer shall examine door frame installation to ensure frames have been set square and plumb. Installer shall examine doors, door frames, and adjacent wall, floor, and ceiling for conditions, which would adversely affect proper operation and function of door assemblies. Do not proceed with hardware installation until such deficiencies have been corrected.

3.2 INSTALLATION

- A. Before hardware installation, general contractor/construction manager shall coordinate a hardware installation seminar with a 1 week notice to all parties involved. The seminar is to be conducted on the installation of hardware, specifically of locksets, closers, exit devices, continuous hinges and overhead stops. Manufacturer's representative of the above products to present seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical products samples.
- B. Provide blocking or reinforcement for all hardware mounted to drywall construction, including wall mounted door stops and holders.
- C. Shim doors as required to maintain proper operating clearance between door and frame.
- D. Install all hardware in accordance with the approved hardware schedule and manufacturer's instructions for installation and adjustment.
- E. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.
- G. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.
- H. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute.
- I. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.
- J. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.
- K. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.
- L. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.
- M. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.

- N. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.
- O. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.
- P. Overhead stops used in conjunction with electrified hold open closers shall be templated and installed to coincide with engagement of closer hold open position.
- Q. Install door closers on corridor side of lobby doors, room side of corridor doors, and stair side of stairways.
- R. Adjust spring power of door closers to the minimum force required to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to ensure opening force does not to exceed 5 lbs.
- S. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes.
- T. Install "hardware compatible" (bar stock) type weatherstripping continuously for an uninterrupted seal. Adjust templating for parallel arm door closers, exit devices, etc., as required to accommodate weatherstripping.
- U. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.
- V. Compress sweep during installation as recommended by sweep manufacturer to facilitate a water-resistant seal.
- W. Deliver to the owner one complete set of installation and adjustment instructions, and tools as furnished with the hardware.

3.3 FIELD QUALITY CONTROL

- A. After installation has been completed, the hardware supplier for locksets, door closers, exit devices, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.
- B. After installation has been completed, the hardware supplier and manufacturer's representative shall meet with the owner to explain the functions, uses, adjustment, and maintenance of each item of hardware. Hardware supplier shall provide the owner with a copy of all wiring diagrams. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.

3.4 ADJUSTMENT AND CLEANING

- A. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. Lubricate moving parts with type lubrication recommended by the manufacturer.
- B. All hardware shall be left clean and in good operation. Hardware found to be disfigured, defective, or inoperative shall be repaired or replaced.

3.5 HARDWARE SCHEDULE

- A. The following schedule of hardware groups are intended to describe opening function. The hardware supplier is cautioned to refer to the preamble of this specification for a complete description of all materials and services to be furnished under this section.

HW SET: 01

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PASSAGE SET	ND10S	SCH
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F75) PASSAGE LATCH. LATCH RETRACTED BY LEVER EITHER SIDE. BOTH LEVERS ALWAYS UNLOCKED.

HW SET: 02

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PASSAGE SET	ND10S	SCH
1	EA	OH STOP	90S	GLY

FUNCTION: (F75) PASSAGE LATCH. LATCH RETRACTED BY LEVER EITHER SIDE. BOTH LEVERS ALWAYS UNLOCKED.

HW SET: 03

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PASSAGE SET	ND10S	SCH
1	EA	OH STOP	90S	GLY
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE

FUNCTION: (F75) PASSAGE LATCH. LATCH RETRACTED BY LEVER EITHER SIDE. BOTH LEVERS ALWAYS UNLOCKED.

HW SET: 04

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40 OS-OCC	SCH
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F76) PRIVACY LOCK WITH INDICATOR. OUTSIDE LEVER LOCKED BY INSIDE BUTTON. OUTSIDE LEVER UNLOCKED BY INSIDE LEVER, OUTSIDE EMERGENCY BUTTON, OR CLOSING DOOR. INSIDE LEVER ALWAYS UNLOCKED. OUTSIDE INDICATOR DISPLAYS OCCUPIED/VACANT STATUS.

HW SET: 05

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	ND70	SCH
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F84) CLASSROOM LOCK. LATCH RETRACTED BY LEVER EITHER SIDE. OUTSIDE KEY LOCKS/UNLOCKS OUTSIDE LEVER. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 06

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM LOCK	ND80	SCH
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F86) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY OR INSIDE LEVER RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 07

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM LOCK	ND80	SCH
1	EA	OH STOP	90S	GLY

FUNCTION: (F86) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY OR INSIDE LEVER RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 08

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CYL X TURN DEAD LOCK	L460	SCH
1	EA	OH STOP	90S	GLY

FUNCTION: (E06071) CYL X TURN DEAD LOCK. OUTSIDE KEY OR INSIDE TURN EXTENDS OR RETRACTS DEADBOLT.

HW SET: 09

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM LOCK	L9080	SCH
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP/HOLDER	WS40	IVE

FUNCTION: (F07) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED. AUXILIARY LATCH DEADLOCKS LATCH BOLT WHEN DOOR IS CLOSED.

HW SET: 10

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CORRIDOR LOCK W/ OUTSIDE INDICATOR	L9456 OS-OCC	SCH
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F13) KEYED PRIVACY LOCK WITH INDICATOR. OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE KEY OR INSIDE THUMB TURN. DEADBOLT THROWN/RETRACTED BY OUTSIDE KEY OR INSIDE THUMB TURN. TURNING INSIDE LEVER RETRACTS DEADBOLT AND UNLOCKS OUTSIDE LEVER. INSIDE LEVER ALWAYS UNLOCKED. OUTSIDE TRIM INDICATES OCCUPIED/VACANT STATUS.

HW SET: 11

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM W/DEADBOLT	L9480	SCH
1	EA	SURFACE CLOSER	4050 SHCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	EA	RAIN DRIP	142	ZER
1	EA	GASKETING	429	ZER
		(MOUNT PRIOR TO CLOSER)		
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	AS REQUIRED	ZER

FUNCTION: STOREROOM LOCK WITH DEADBOLT. FIXED OUTSIDE TRIM - OUTSIDE KEY RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED. DEADBOLT ACTUATED BY OUTSIDE KEY OR INSIDE TURN. INSIDE LEVER RETRACTS DEADBOLT. AUXILIARY LATCH DEADLOCKS LATCH BOLT WHEN DOOR IS CLOSED.

HW SET: 12

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	FLUSH BOLT	MANUAL	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	STOREROOM W/DEADBOLT	L9480	SCH
1	EA	OH STOP & HOLDER	90H	GLY
1	EA	SURFACE CLOSER	4050 SHCUSH	LCN
2	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	429	ZER
		(MOUNT PRIOR TO CLOSER)		
1	EA	OVERLAP ASTRAGAL	BY DOOR SUPPLIER	B/O
2	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	AS REQUIRED	ZER

FUNCTION: STOREROOM LOCK WITH DEADBOLT. FIXED OUTSIDE TRIM - OUTSIDE KEY RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED. DEADBOLT ACTUATED BY OUTSIDE KEY OR INSIDE TURN. INSIDE LEVER RETRACTS DEADBOLT. AUXILIARY LATCH DEADLOCKS LATCH BOLT WHEN DOOR IS CLOSED.

HW SET: 13

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HARDWARE	BY DOOR SUPPLIER	B/O

HW SET: 14

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	IC CYLINDER	AS REQUIRED	SCH
1	EA	PANIC HARDWARE	CD-99-NL	VON
1	EA	SURFACE CLOSER	4050 SHCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	EA	GASKETING	429	ZER
			(MOUNT PRIOR TO CLOSER)	
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	AS REQUIRED	ZER

FUNCTION: NIGHT LATCH EXIT HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS. LATCH DOGGED BY INSIDE CYLINDER FOR PUSH/PULL OPERATION.

HW SET: 15

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
3	EA	IC CYLINDER	AS REQUIRED	SCH
1	EA	PANIC HARDWARE	CD-3347A-EO	VON
1	EA	PANIC HARDWARE	CD-3347A-NL-OP	VON
2	EA	LONG DOOR PULL	9264F 48" STD	IVE
2	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	SURF. AUTO OPERATOR	9542	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
2	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	AS REQUIRED	ZER

FUNCTION: NIGHT LATCH PANIC HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS. LATCH DOGGED BY INSIDE CYLINDER FOR PUSH/PULL OPERATION. PRESSING INSIDE OR OUTSIDE PUSH PLATE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY WHILE LATCH IS DOGGED AND AUTOMATIC OPERATOR IS ENABLED.

HW SET: 16

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	REMOVABLE MULLION	KR4954	VON
4	EA	IC CYLINDER	AS REQUIRED	SCH
1	EA	PANIC HARDWARE	CD-33A-EO	VON
1	EA	ELEC PANIC HARDWARE	CD-33A-NL-OP	VON
2	EA	LONG DOOR PULL	9264F 48" STD	IVE
2	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	SURF. AUTO OPERATOR	9542	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	MULLION SEAL	8780	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
2	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	AS REQUIRED	ZER

FUNCTION: NIGHT LATCH PANIC HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS. LATCH DOGGED BY INSIDE CYLINDER FOR PUSH/PULL OPERATION. PRESSING INSIDE OR OUTSIDE PUSH PLATE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY WHILE LATCH IS DOGGED AND AUTOMATIC OPERATOR IS ENABLED.

HW SET: 17

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	702	IVE
1	EA	CYL X TURN DEAD LOCK	L460	SCH
1	EA	PULL PLATE	8303 10" 4" X 16" (PULL SIDE ONLY)	IVE
1	EA	FLUSH PULL	960 (PUSH SIDE)	IVE
1	EA	OH STOP	90S	GLY
1	EA	KICK PLATE	8400 10"	IVE

FUNCTION: (E06071) CYL X TURN DEAD LOCK. OUTSIDE KEY OR INSIDE TURN EXTENDS OR RETRACTS DEADBOLT.

END OF SECTION

SECTION 08 71 13
AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Automatic Door Equipment – Swinging Doors, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 REFERENCES

- A. American Association of Automatic Door Manufacturers (AAADM).
- B. ANSI/BHMA-A156.19 Standards for Power Assist and Low Energy Power Operated Doors.National Fire Protection Association (NFPA):
 - 1. NFPA 70 National Electric Code
- C. Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Point to point wiring diagrams showing connections to electrified hardware devices and access control system devices.
- B. Product Data:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators, including actuation and safety devices.
 - 2. Include operating characteristics, electrical characteristics, and furnished accessories.
- C. Project Information:
 - 1. UL listing data.
- D. Contract Closeout Information:
 - 1. Safety inspection report.
 - 2. Operation and Maintenance Data.
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Automatic Swinging Door Operators:
 - 1. Base:
 - a. ASSA ABLOY
 - 2. Optional:
 - a. Horton Automatics.
 - b. Stanley Access Technologies.
 - c. NABCO Entrances.
 - d. Record.
- B. Actuation and Safety Devices:
 - 1. Base:
 - a. BEA.

- C. Other manufacturers belonging to AAADM desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure, normal traffic load for type of occupancy indicated and in compliance with UL 325.
- B. Coordinate operator mechanisms with door operation, hinges, and actuation and safety devices.
- C. Maximum Opening Force if power fails:
 - 1. Not more than 15 pounds of force to fully open door on Low Power Operators (LPO) operators.
- D. Units Scheduled on Exterior Openings:
 - 1. Wind Load Resistance:
 - a. Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to prevailing wind forces.
 - b. Adjust in field to suit localized variation in wind pressure.
- E. Operating Temperature:
 - 1. Designed to operating within temperature ranges of -22 to 122 degrees F.
- F. Operator Covers:
 - 1. Fabricated extruded or formed aluminum extending continuously over full width of door opening including door jambs.
 - a. Minimum sheet thickness: 0.156 inches.
 - 2. Include end caps, provision for maintenance access, and concealed fasteners
- G. Brackets and Reinforcements:
 - 1. Manufacturer's standard, fabricated from aluminum with non-staining, non-ferrous shims for aligning system components.
- H. Aluminum:
 - 1. Sheet: ASTM B206.
 - 2. Extrusions: ASTM B221.
- I. Fasteners and Accessories:
 - 1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

2.3 LOW ENERGY DOOR OPERATORS

- A. General:
 - 1. Electro-mechanical operator, powered by Minimum 1/8 hp, continuous duty.
 - a. Voltage: 110-120 VAC; less than 2 Amp.
 - 2. Factory-assembled and sealed unit including helical gear drive transmission and interconnected rack and gear system for compression heavy duty spiral spring.
 - a. Housing enclosure: Die cast aluminum housing.
 - b. Spring: Replaceable.
 - c. Mount operator using vibration isolators.
 - 3. Operation:
 - a. Power-open/Spring-close.
 - b. Operate as door closer in event of power failure.

- c. Include safe swing circuit that stops and reverses door if sensing device is activated while door is in opening cycle.
 - d. Both OPEN and CLOSE speeds adjustable.
 - e. Include clutch that permits frequent manual use of opening without detrimental wear on operator.
- 4. Electronic Controls:
 - a. Self-contained, solid state integrated circuit controlling operation and switching of the operator.
 - b. Integral low voltage power supply for actuators.
 - c. Time Delay (1.5 to 30 seconds) for normal cycle, as well as, the following built in features:
 - 1) Torque limiting for controlled forces on opening.
 - 2) Acceleration control for smooth starts and recycle.
 - 3) Special circuitry for reducing power to the motor when door is in HOLD-OPEN mode, extending longevity and assuring reliability.
 - d. Provide actuators and controls.
 - e. Provide automatic lock interface for single or pairs of door for electrified exit devices, delayed egress magnetic locks and door electric strike applications.
 - f. Provide additional interface options to operate door with the access control devices.
 - g. Base Product: SW100 by Besam.
- B. Types of Low Energy Door Operators:
 - 1. LPO Low Energy Operator:
 - 2. LPO/FDO Low Energy Fire Door Operator:
 - a. Operators and components complying with NFPA 80 a certified by a nationally recognized testing laboratory.
 - b. Function - Fire Alarm
 - 1) Disconnect from power source by Fire Alarm.
 - 2) Self-close and self-latch by Fire Alarm.
 - 3) Operators shall not re-open doors until Fire Alarm has been reset.
 - c. Function - Loss of Power: Self-close and self-latch upon loss of power.
 - 3. Power-assist Operators – PAO:
 - a. Non-rated Openings:
 - 1) Capable of sensing when user attempt to manual open door; then responding by assisting User.
 - b. Fire-rated Openings and Smoke-rated Openings:
 - 1) Capable of sensing when user attempt to manual open door; then responding by assisting User.
 - 2) Operators and components complying with NFPA 80 as certified by a nationally recognized testing laboratory.

- 3) Function - Fire Alarm
 - a) Disconnect from power source by Fire Alarm.
 - b) Self-close and self-latch by Fire Alarm.
 - c) Operators shall not re-open doors until Fire Alarm has been reset.

2.4 OPERATOR FINISHES SCHEDULE

- A. Interior Operators:
 1. Finish on exposed components: Matching Door and Frame.
- B. Exterior Operators:
 1. Finish on exposed components: Matching Door and Frame.

2.5 ACTUATION DEVICES

- A. Touchless Wall Switch (TWS):
 1. Contact free, microwave technology.
 2. Adjustable: 4 to 24 inches.
 3. Face plate engraved with ADA symbol and WAVE TO OPEN text.
 4. Shape:
 - a. Double gang square.
 5. Mount center line of switch 40 inches above floor.
 6. Locate where indicated in drawings.
 7. Base Product: MS31 by BEA.
 - a. Color: Black.

2.6 SAFETY DEVICES

- A. General:
 1. Provide on SDO and FDO doors.
 2. Provide additional items as required for full compliance with ANSI/BHMA-A156.10.
 3. Anti-vandalism design and concealed adjustments for zone size and sensitivity.
 4. Finish to match door frame.
 5. Unit capable of operating from -30 degrees F for exterior doors.
 6. Provide remote control units for programming.
- B. Presence Sensors:
 1. Capable of sensing object motionless within door swing and inhibit operation of automatic operator until object has vacated field.
 2. Active infrared presence sensing device using focused and diffuse technology.
 3. Ambient light and radio frequencies shall not interfere with proximity detector operation.
 4. Provide compatible lock out relay.
 5. Base Product: Bodyguard and Superscan II by BEA.
- C. Secondary Actuation Sensors:
 1. Capable of sensing object motionless within door swing and holding door in open position until object has vacated field.
 2. Sensor to deactivate when door is within 6 inches of closed position.
 3. Base Product: Eagle, Bodyguard, Superscan II, or both by BEA.

- D. Guide Rails:
 - 1. Conform to ANSI/BHMA-A156.10.
 - 2. Manufacturer's standard guide rails.
- E. Signs:
 - 1. Signage: As required by BHMA standard for the type of operator.
 - 2. Transparent doors: Double sided IN-OUT decals.
 - 3. Opaque doors: Warning signs on both sides.

2.7 MISCELLANEOUS ITEMS

- A. Master Control Toggle Switch:
 - 1. 3-positions: ON / OFF / HOLD-OPEN.
 - 2. Mount on operator housing.

2.8 FABRICATION

- A. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within operator enclosure to the exterior.
- B. Form aluminum shapes before finishing.
- C. Use concealed fasteners to greatest extent possible.
 - 1. Where exposed fasteners are required, use countersunk flat head machine screws, finished to match operator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION

- A. Perform complete installation of automatic door control equipment.
- B. Include electrical connections between components.
- C. Coordinate control wiring with electrical installer.
- D. Apply signage on both sides of each door and sidelite as required by ANSI/BHMA regulations and manufacturer's installation instructions.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's representative shall provide technical assistance and guidance for installation.
- B. Adjust door operators, controls and hardware for smooth and safe operation and for weather tight closure.
- C. Before placing doors into operation, AAADM certified technician shall inspect and approve doors for compliance with ANSI/BHMA regulations.

END OF SECTION

SECTION 08 81 00
GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass and glazing.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 07 92 13 – Exterior Joint Sealants.
 - 2. Section 07 92 16 – Interior Joint Sealants.
 - 3. Section 08 11 00 - Hollow Metal Doors and Frames.
 - 4. Section 08 41 13- Low-Rise Aluminum Storefront

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American National Standards Institute (ANSI):
 - a. Z97.1, Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
 - 2. ASTM International (ASTM):
 - a. C864, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - b. C1036, Standard Specification for Flat Glass.
 - c. C1048, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - d. C1376, Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
 - e. E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
 - f. E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.
 - 3. Code of Federal Regulations (CFR):
 - a. Title 16 - Commercial Practices, Chapter ii - Consumer Product Safety Commission (CPSC), Subchapter B - Consumer Product Safety Act Regulations:
 - 1) 16 CFR 1201, Safety Standard for Architectural Glazing Materials.
 - 4. Glass Association of North America (GANA):
 - a. Glazing Manual.
 - 5. Insulating Glass Certification Council (IGCC).
 - 6. Insulating Glass Manufacturers Alliance (IGMA):
 - a. TM-3000, North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.
 - 7. National Fire Protection Association (NFPA).
 - a. 80, Standard for Fire Doors and Other Opening Protectives.
 - b. 251, Standard Methods of Tests of Fire Resistance of Building Construction and Materials.

- c. 252, Standard Methods of Fire Tests of Door Assemblies.
- d. 257, Standard on Fire Test for Window and Glass Block Assemblies.
- 8. Underwriters Laboratories, Inc. (UL):
 - a. 9, Standard for Fire Tests of Window Assemblies.
 - b. 10B, Standard for Fire Tests of Door Assemblies.
 - c. 263, Standard for Fire Tests of Building Construction and Materials.

1.3 DEFINITIONS

- A. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 2. Installer and applicator are synonymous.
- B. Safety Glazing: Glazing meeting the requirements of the building code and CPSC 16 CFR 1201.
- C. Other terms as identified in CPSC 16 CFR 1201.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Certification that glass has been tested and approved for use in fire resistance rated doors or walls.
 - 1) Copies of all test criteria.
 - 2. Certification that insulating glass units meet requirements of IGCC and are certified by IGCC to ASTM E2190.
- B. Samples:
 - 1. One 12 x 12 inches sample of each type, color, and thickness specified.
 - a. Samples are not required for clear monolithic glass.
- C. Informational Submittals:
 - 1. Warranty.

1.5 WARRANTY

- A. Provide manufacturer's written 10 year warranty to cover deterioration of glass, glass units, coatings and ceramic frit.
 - 1. Insulating glass units shall be warranted against failure of hermetic seal resulting in fogging or film formation on the interior glass surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Glass:
 - a. Guardian Glass by Guardian Industries.
 - b. Insulite Glass Co., Inc.
 - c. NSG/Pilkington.
 - d. Oldcastle Building Envelope.

- e. Vitro Architectural Glass.
- f. Viracon.
- 2. Gaskets, glazing compounds, setting blocks, spacers, sealant, sealant tape, etc., as recommended by glass manufacturer, glass unit fabricator.
 - a. Provide materials as required by NFPA for use in fire-rated units.

2.2 MATERIALS

- A. General:
 - 1. ASTM C1036.
 - a. Clear glass: Type I, Class 1, Quality Q3.
 - 2. Thickness: 1/4 inches, unless noted otherwise.
- B. Heat Strengthened and Fully Tempered Glass: ASTM C1048.
 - 1. General use: Kind HS.
 - 2. Safety glazing: Kind FT.
 - a. Meet requirements of ANSI Z97.1 and CSPC 16 CFR 1201.
 - 3. Condition:
 - a. Clear or tinted vision glass: Condition A.
 - b. Spandrel Glass (ceramic coated): Condition B.
 - c. Coated vision glass: Condition C.
 - 1) ASTM C1376, Kind CV or CO.

2.3 MANUFACTURED UNITS

- A. Insulating Glass Units:
 - 1. ASTM E2190, Class A.
 - 2. Two lites of glass separated by a hermetically sealed air space.
 - a. Spacer: Stainless steel "warm edge" spacer.
 - 1) Thickness: 1/2 inches.
 - 2) Color: Black.
 - b. Perimeter Sealant: Silicone.
 - 1) Color: Black.

2.4 ACCESSORIES

- A. Glazing Compounds:
 - 1. Non-sag, non-stain type.
 - 2. Pigmented to match frame units not requiring painting.
 - 3. Compatible with adjacent surfaces.
 - 4. One- or two-part polyurethane or silicone sealant for use in setting glass.
 - a. Provide glazing compounds which will not be affected by chemicals stored in rooms where glazing compounds are used.
- B. Sealant Tape: Butyl rubber sealant tape or ribbon having a continuous neoprene shim.
- C. Gaskets:
 - 1. Flexible neoprene.
 - a. ASTM C864.
 - b. Provide gaskets which will not be affected by chemicals stored in rooms where gaskets are used.

2. Extruded of profile and hardness required to receive glass and provide a watertight installation.
 3. Provide gaskets in accordance with NFPA in fire resistance rated glazing.
- D. Setting Blocks and Spacers:
1. Neoprene or EPDM, compatible with sealants used.
 - a. ASTM C864.
- E. Compressible Filler Stock: Closed cell polyethylene or polyethylene jacketed polyurethane foam.
- F. Shims, Clips, Screws and Other Miscellaneous Items: As required by condition.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with recommendations of manufacturer, GANA Glazing Manual and IGMA TM-3000.
- B. Install setting blocks in adhesive or sealant.
- C. Install spacers inside and out, of proper size and spacing, for all glass sizes larger than 50 united inches, except where gaskets are used for glazing.
- D. Provide 1/8 inches minimum bite of spacers on glass.
- E. Spacer thickness to equal sealant width.
- F. Prevent sealant exudation from glazing channels of insulating glass which is more than 1/2 inches thick; colored, heat absorbing, coated or laminated glass sizes larger than 75 united inches; and other glass more than 9/32 inches thick or larger than 125 united inches.
 1. Leave void at heel (or install filler) at jambs and head.
 2. Do not leave void (or install filler) at sill.
- G. Miter cut and bond gasket ends together at corners.
- H. Immediately after installation, attach crossed streamers to framing held away from glass.
- I. Use polysulfide-based glazing sealants in window assembly and as perimeter sealant around frames in areas which may be exposed to chlorine gas or chlorine liquid splash or spillage.
 1. See Specification Sections 07 92 13 and 07 92 16 for sealants.

3.2 FIELD QUALITY CONTROL

- A. Do not install glass with edge damage.
- B. Do not apply anything to surfaces of glass.
- C. Remove and replace damaged glass.

3.3 CLEANING

- A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.
- B. Wash and polish glass on both faces not more than seven days prior to acceptance of work in each area.
 1. Comply with glass manufacturer's recommendations.

3.4 SCHEDULES

A. General:

1. Provide safety glazing for all applications where required by the building code and CPSC 16 CFR 1201.
2. Provide heat strengthened glazing for all general use applications where safety glazing is not required.

B. Glass Type GL-1: Monolithic Glass.

1. Thickness: 1/4".
2. Kind: FT.
3. Color: Clear.

C. Glass Type IG-1: Insulating Low-E Bird-safe Units.

1. Exterior lite: 1/4 inches with Viracon print #2824, 6% coverage, and Viracon VNE1-63 on #2 surface.
 - a. Color: Clear.
2. 1/2 inches [dehydrated] [argon filled] air space.
3. Interior lite: 1/4 inches clear.
4. Performance Requirements:
 - a. Transmittance:
 - 1) Visible light: 62%.
 - 2) Solar energy: 24%
 - 3) UV: 5%
 - b. Reflectance:
 - 1) Exterior: 10%.
 - 2) Interior: 10%.
 - 3) Solar: 37%.
 - c. U-Value
 - 1) Winter: 0.2
 - 2) Summer: 0.17
 - d. Shading Coefficient: [0.32.
 - e. Relative Heat Gain: 66 BTU/(hr x sq ft).
 - f. Solar Heat Gain Coefficient (SHGC): 0.28.
5. Viracon VNE1-63.

D. Glass Type IG-2: Insulating Translucent Units:

1. Exterior lite: 1/4 inches..
 - a. Color: Clear.
2. 1/2 inches air space.
3. Interior lite: 1/4 inches Clear with V1093 Simulated Sandblast on the #3 surface.
4. Performance Requirements:
 - a. Transmittance:
 - 1) Visible light: 56%.
 - 2) Solar energy: 46%.
 - 3) UV: 16%.

- b. Reflectance:
 - 1) Exterior: 32%.
 - 2) Interior: [33%.
 - 3) Solar: 20%.
- c. U-Value
 - 1) Winter: [0.47.
 - 2) Summer: 0.49.
- d. Shading Coefficient: 0.68
- e. Relative Heat Gain: 143.
- f. Solar Heat Gain Coefficient (SHGC): 0.59.

END OF SECTION

SECTION 08 91 00
ARCHITECTURAL LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Architectural Louvers, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Air Movement and Control Association (AMCA) certification.
- B. Aluminum Extrusions: Comply with ASTM B221
- C. Provide Architectural Louvers engineered to support dead, live, and lateral, wind or seismic, loads indicated.
 - 1. Comply with Section 01 71 21, Specialty Engineering Requirements.
 - 2. Include headers and reinforcing members around openings.
 - 3. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate location on building and overall dimensions.
 - 2. Include perimeter details showing interface to structure and connections specific to application.
- B. Product Data:
 - 1. Performance data bearing AMCA certified ratings for air flow, water penetration, free area, and other listed criteria specified.
- C. Samples:
 - 1. Finishes.
- D. Project Information:
 - 1. Structural calculations for Architectural Louvers indicating design conforms to specified design criteria, sealed by the Specialty Structural Engineer.
 - a. Submit concurrent with Shop Drawings.
- E. Contract Closeout Information:
 - 1. Maintenance information.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Architectural Louvers:
 - 1. Base:
 - a. Airolite.
 - 2. Optional:
 - a. Air Flow Company, Inc.
 - b. Construction Specialties.
 - c. Industrial Louvers, Inc.
 - d. Ruskin Manufacturing.
 - e. Greenheck.

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

A. Design Loads:

1. Design Architectural Louvers and anchorage to meet Design Loads.
 - a. Wind loads: Use the most restrictive of the following:
 - 1) Wind pressures as required per local building code based on wind speed, exposure factor and importance factor noted in the Structural Drawings.
 - a) Wind pressures defined by Building Code as locally adopted and amended.
 - 2) 20 psf 950 Pa minimum.
 - b. Deflection values: Use the most restrictive of the following:
 - 1) Limit deflection to values specified for Uniform Design Load Test.
 - 2) Limit deflection to comply with Building Code as locally adopted and amended.
 - 3) Limit deflection to L/175 or 3/4 inches 19 mm maximum.
2. Thermal Expansion and Structural Movement:
 - a. Expansion and contraction, caused by changes in surface temperature equal to Delta T.
 - 1) Delta T for this project: 200 deg F 93 deg C.
 - 2) Thermal contraction/expansion in this range shall not cause buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects over this temperature range.
 - 3) Operating windows and doors shall function normally over this temperature range.

B. Drainage:

1. Design Architectural Louvers to intercept, collect, contain, and drain water which may infiltrate system to exterior.

2.3 MATERIALS

A. Frame and Blade Material: 6063-T5, Extruded aluminum.

B. Anodic Finish:

1. Color: Black Anodized as specified in Section 08 41 13, "Low-Rise Aluminum Storefront."
2. Quality: 0.7 mil coating complying with AA-M12C22A41.

C. Bird screen:

1. 1/2 inches 13 mm square mesh, 0.053 inches 1.3 mm (16 GA) aluminum.
2. Install in manufacturer's standard folded frame.

D. Sealant: See Section 07 92 13.

E. Fabrication:

1. Gang louver units together, where necessary or indicated to makeup overall sizes required.
2. Fabricate anchors, reinforcing, and required ancillary items of compatible material.
3. Clip Angles: Structural grade aluminum.

- F. Accessories:
1. Fasteners: Aluminum or stainless steel.
 - a. Provide types, gages and lengths to suit unit installation conditions.
 2. Anchors and Inserts:
 - a. Non-ferrous metal or hot-dip galvanized anchors and inserts for installation and elsewhere as required for corrosion resistance.
 - b. Use stainless steel or lead expansion bolt devices for drilled-in place anchors.
 - c. Furnish inserts, as required, to be set into concrete or masonry work.

2.4 ARCHITECTUAL LOUVERS

- A. 4 inches 100 mm Deep Architectural Louvers (Drainable Blade-type):
1. Fixed, storm resistant, drainable with horizontal and vertical gutter system.
 - a. Horizontal continuous blade appearance, Concealed intermediate verticals.
 2. Performance per AMCA 500-L-99:
 - a. Maximum pressure drop: 0.24 inches 25 Pa at 900 fpm 4.6 m/s.
 - b. Minimum free area: 44 percent.
 - c. Performance at beginning point of water penetration:
 - 1) Free Area Velocity: 1,056 fpm 4.82 m/s.
 - 2) Maximum Intake Volume: 8788 cfm 3.65 cubic m/s.
 3. Louver Blade Angle: 43 Degrees.
 4. Frame Depth: 4 inches 100 mm thick.
 5. Minimum Wall Thicknesses, Frames and Blades: 0.081 inches 2 mm thick.
 6. Unit Size: As indicated.
 7. Base Product: K6774 by Airolite.

PART 3 - INSTALLATION

3.1 EXAMINATION

- A. Verify suitability of openings to accept units.
- B. Correct unsatisfactory conditions.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Install anchoring and bracing accessories as required.
- C. Install blank off panels at unused portions of louvers.
- D. Install bird screens.
- E. Seal perimeter joints watertight.

END OF SECTION

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Non-Structural Metal Framing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 REFERENCES

- A. The American Iron and Steel Institute (AISI):
 - 1. AISI S220 North American Standard for Cold-Formed Steel Framing – Nonstructural Members.
- B. ASTM International (ASTM):
 - 1. ASTM C635 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 - 2. ASTM C645 Standard Specification for Nonstructural Steel Framing Members.
 - 3. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 4. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - 5. ASTM A1003 Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic-Coated for Cold-Formed Framing Members.
- C. Gypsum Association (GA):
 - 1. GA-216 Application and Finishing of Gypsum Panel Products.
 - 2. GA-234 Control Joints for Fire-Resistance Rated Systems.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Sizes and spacing of typical framing members and opening framing.
 - 2. Show locations and sizes of atypical framing members, wall framing sections, and opening elevations.
 - 3. Methods of fastening framing members to each other and to supporting systems.
 - 4. Details of vertical deflection connections to structures.
 - 5. Locations and spacing of lateral bracing and structural bracing systems.
 - 6. Accessory products required for complete installation.
- B. Product Data:
 - 1. Manufacturer's specifications for each type of material and accessory.
 - a. Where fire resistance classification is indicated, submit copies of nationally recognized testing laboratory listings of products proposed for use.
 - 2. Where EQ coatings are used, submit copies of nationally recognized testing laboratory results showing conformance with ASTM A653 and AISI S220.
 - a. Include data required to show specification compliance.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Member of Certified Steel Stud Association (CSSA), Steel Framing Industry Association (SFIA), or Steel Stud Manufacturers Association (SSMA).

B. Code-Compliance Certification of Studs and Tracks:

1. Provide documentation that framing members are certified according to the product-certification program of [the Certified Steel Stud Association] [the Steel Framing Industry Association] [or] [the Steel Stud Manufacturers Association].

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Non-Structural Metal Framing:

1. Base:

- a. ClarkDietrich Building Systems

2. Optional:

- a. CEMCO Steel Framing and Metal Lath
- b. Custom Stud Inc.
- c. Marino/WARE
- d. MBA Metal Framing
- e. MRI Steel Framing LLC.
- f. Telling Industries
- g. The Steel Network

B. Isolation Strip Material:

1. Base:

- a. Reflectix, Inc.

2. Optional:

- a. Saint-Gobain

C. Knee Wall Brace:

1. Base:

- a. Pittcon Industries

2. Optional:

- a. ClarkDietrich Building Systems

D. Interlocking Grid Support Systems for Gypsum Board Ceilings:

1. Base:

- a. USG Corporation

2. Optional:

- a. Armstrong
- b. Chicago Metallic

E. Other manufacturers desiring approval comply with Section 01 61 00.

1. Substitutions must comply with sustainable design requirements. See Section 01 81 13.

F. Products proposed for use in fire-rated assemblies:

1. Approved by nationally recognized testing laboratory.

2.2 DESIGN CRITERIA

- A. Select steel studs in accordance with manufacturer's standard load tables and following design pressures and maximum deflections:

Performance Criteria		
Use Condition ²	Design Pressure	Maximum Deflection
Wall enclosing stairs, elevator hoistways, and other vertical shafts	10 pounds/SF 480 Pa	L/240
Wall enclosing vestibules, ground floor lobbies, and similar spaces subject to intermittent exposure to exterior wind conditions	15 pounds/SF 720 Pa	L/240
Walls scheduled with Tile Backer Board, Moisture-Resistant, Impact-Resistant, or Abuse-Resistant Gypsum Wallboard	5 pounds/SF 240 Pa	L/360
Walls scheduled to receive Tile, lath and plaster, or veneer plaster. ¹		L/360
Typical Interior Walls/Partitions (those not listed above)	5 pounds/SF 240 Pa	L/240
Interior Ceilings, Soffits and Bulkheads	5 pounds/SF 240 Pa	L/360

Footnotes

- Limit deflection to L/360 where wall cladding on either face is any of the following: Ceramic Tile, Stone Tile, Porcelain Tile, Thin Brick, Lath & Plaster, Simulated Masonry, Adhered Stone, Veneer Plaster, and similar brittle finishes which are prone to movement induced cracking.
- Where elements meet multiple conditions; Use most stringent Deflection and Design Pressure values.

2.3 MATERIALS

- A. Metal Studs and Floor Tracks:
- C-shaped, roll formed studs and tracks conforming to ASTM C645.
 - Steel design standard: 33KSI 227 MPa.
 - Coatings:
 - G60 Z180 galvanized
 - Provide metal framing members that have a minimum recycled content of 35%.
 - Stud and track depths: As indicated by wall type.
 - Minimum flange width: 1-1/4-inch 6 mm.
 - Minimum thickness: 30 mil (20 GA) 0.752, except as follows:
 - Increase member thickness to comply with performance criteria.
 - Decrease member thickness to minimum 18 mil (25 GA) 0.46 mm studs at following condition:
 - Where walls do not extend to overhead structural deck and supporting diagonal bracing or horizontal stiffeners are used.
 - In lieu of increased member thickness, design may employ diagonal braces above ceiling to reduce overall span.
 - Coordinate locations with building services items.
 - Do not employ studs with member thickness less than allowed by fire resistance rated assemblies.
 - High strength 50 ksi 345 MPa or 70 ksi 483 MPa studs shall comply with design criteria of equivalent thickness standard 33 ksi 227 MPa studs listed.
 - At walls designated STC 40 and above, use only studs with physical characteristics of studs used in documented STC testing.
 - Base product: ProSTUD Drywall Framing by ClarkDietrich.

- B. Head of Wall Accessories:
1. Configure to accommodate deflection of superstructure without inducing axial loading on partition wall.
 2. Maintain structural integrity, fire and smoke-resistance, and sound control as required by each wall.
 3. Slotted top deflection track:
 - a. Deep leg, vertically slotted track.
 - b. Cold-formed sheet steel; galvanized; G60.
 - c. Thickness: 30 mil (20 GA) 0.752 mm minimum.
 - d. Width: As required for stud sizes indicated.
 - e. Depth: Minimum 2-1/2-inch 63 mm down-standing legs with 1/4-inch 6 mm wide by 1-1/2-inch 38 mm high slots spaced 1 inch 25 mm on center.
 - f. Base product: MaxTrak by ClarkDietrich.
 4. Z-bars, cold formed channels, and clips:
 - a. Accommodate thickness of spray-applied fire-resistive materials.
 5. UL-listed fire-resistant components tested for compliance with requirements indicated.
 6. Firestopping Materials:
 - a. Sealants, sprays, intumescent strips and forming materials.
 - b. Coordinate with sealants specified in Section 07 84 00 and Section 07 92 16.
 - c. Intumescent applications:
 - 1) Factory or field applied.
 - d. Base product: BlazeFrame by ClarkDietrich.
- C. Furring Channels:
1. Hat shaped sections.
 2. Galvanized: G40 or certified equivalent.
 3. Sizes: 7/8 inch 22 mm and 1-1/2 inch 38 mm, as indicated.
 4. Minimum Thickness: 30 mil (20 GA) 0.752 mm; Use heavier gauge as dictated by conditions.
 5. Base product: Furring Channel/ Hat Channel by ClarkDietrich.
- D. Accessory Items:
1. Wire Ties:
 - a. Minimum thickness: 43 mil (18 GA) 1.09 mm soft annealed, galvanized.
 2. Track Fasteners:
 - a. Power driven type, to withstand minimum 190 pounds 86 kg shear when driven.
 3. Backing
 - a. General:
 - 1) See Drawings for applications of backing types listed and further details.
 - 2) Use heavier gauge as necessary for items to be supported.

- 3) Comply with manufacturer's backing requirements if capacity exceeds types listed.
- b. Flat Plate (Type A):
 - 1) Flat, sheet metal stock per ASTM A1008.
 - 2) G40 galvanized or certified equivalent.
 - 3) Thickness: 50 mil (18 GA) 1.27 mm minimum.
 - 4) Use for wall cabinets and other wall-mounted accessories requiring blocking.
- c. Metal Backing (Type B):
 - 1) C-shaped modified track runners.
 - 2) G40 galvanized or certified equivalent.
 - 3) Backing height: 6 inches 150 mm minimum.
 - 4) Flange width: 1-1/4-inch 32 mm minimum.
 - 5) Thickness: 30 mil (20 GA) 0.95 mm minimum.
 - 6) May be installed continuously across multiple stud spaces.
 - 7) Use where no other type of backing is designated.
4. Knee Wall Brace:
 - a. Steel tube and baseplate bolted to concrete floor slab with tube projecting vertically; concealed within framed walls to provide structural stability for knee walls.
 - b. Design components compatible with wall type.
 - c. Material: Cold-rolled steel tube and base plate, fully welded.
 - d. Overall height: Wall height less 2 inches 50 mm.
 - e. Spacing as recommended by manufacturer.
 - f. Base product: SKB Series by Pittcon Industries.
- E. Support Systems for Gypsum Ceilings:
 1. Interlocking Grid Systems:
 - a. ASTM C635, direct-hung system composed of T-Shaped framing members designed to carry load of screw-applied gypsum ceiling board.
 - b. Tabs on Cross-Tees to interlock into slots in Main Runners where intersections occur.
 - c. Base Product: Drywall Suspension System by USG Corporation.
 2. Track and Channel Systems:
 - a. ASTM C645 roll-formed steel with G60 galvanized coating.
 - b. Thickness: 30 mil (20 GA) 0.752 mm minimum; Use heavier gauge as dictated by conditions.
 - c. Carrying channels:
 - 1) Size: 1-1/2-inch 38 mm.
 - d. Furring channels:
 - 1) Sizes: 7/8-inch and 1-1/2-inch 22 mm x 38 mm, as indicated.
 3. Stud-Framed Ceiling/Soffit Systems:
 - a. C-shaped studs or joists; roll-formed.
 - b. Galvanized: G60.

- c. Frame member depth: 3-5/8-inch 92 mm minimum, unless otherwise indicated.
 - 1) Use wider stud sections if ceiling span and support requires.
 - d. Flange width: 1-1/4-inch 32 mm minimum.
 - e. Stud thickness: 33 mil 0.838 mm minimum.
- 4. Tie Wire:
 - a. ASTM A641, Class 1 zinc coating, soft temper.
 - b. Diameter, single strand: 62 mil (14 GA) 1.575 mm minimum.
 - c. Diameter, double strand: 42 mil (18 GA) 1.067 mm minimum.
- 5. Wire Hangers:
 - a. ASTM A641, Class 1 zinc coating, soft temper.
 - b. Diameter: 97 mils (12 GA) 2.46 mm minimum.
- 6. Anchors in Concrete:
 - a. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E488 or ASTM E1512 as applicable.
 - b. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.
 - c. Material: Carbon-steel components zinc plated to comply with ASTM-B633, Class Fe/Zn 5 for Class SC 1 service condition.
- 7. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structure and conditions under which system will be installed.
- B. Correct conditions detrimental to proper installation.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Layout and install metal framing accurate to dimensions indicated in drawings.
- B. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.
 - 1. Gypsum Board Assemblies: Comply with additional requirements in ASTM C840 relative to framing installation.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, wall stops, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- F. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- G. Extend framing full height to structural supports.
 - 1. Exception: Where partitions are indicated to terminate at, or just above, suspended ceilings.
 - 2. Continue framing around ducts and similar items which penetrate partitions.

- H. Position studs vertically engaging floor track and head of wall deflection track.
 - 1. Align stud knockouts to facilitate running of wires and conduit.
- I. Space studs maximum 16 inches 400 mm on center.
- J. Provide additional studs at corners, partition intersections and terminations of partitions, and at each side of control joints.
- K. Positively anchor studs to floor tracks with self-tapping pan head screws, or stud clinching tool per ASTM C754.
- L. Anchor studs to deflection track with wafer head screws on both flanges of each stud.
 - 1. Maintain deflection gap between top of stud and top of slotted track.
 - 2. Install screws at centerline of slot and secure allowing vertical movement.
- M. Anchor fire rated partitions as required by fire resistance design, and firestopping design.
- N. Where partitions abut vertical structural elements, provide perimeter relief per Gypsum Association GA-600 Strain Relief System details.
- O. Head-of-Wall:
 - 1. Provide slotted top track for walls extended to structure.
 - 2. Configure to resist lateral loads while accommodating deflection of overhead building superstructure without inducing axial loading on partition framing.
 - 3. Secure deflection track to structure in accordance with industry standards and regulatory requirements.
 - 4. Secure at corners and at ends.
 - 5. Cut vertical studs 5/8-inch 16 mm short to create a deflection gap when installed into top track.
 - a. Secure vertical studs to top track with framing screw at each stud, screwing through track slots for positive stud connection.
 - 6. Secure Gypsum Wallboard to vertical studs; do not secure Gypsum Wallboard to top track directly.
 - 7. Prepare wall for installation of seals, firestopping, or both:
 - a. Non-fire rated partitions including Smoke Partitions: Prepare for Acoustical Sealant specified in Section 07 92 16.
- P. Furring Channels:
 - 1. Attach furring channel systems directly to parent walls.
 - 2. Install channels at maximum 16 inches 400 mm OC.
 - 3. Provide additional framing at openings, cutouts, corners, and control joints.
 - 4. Space fasteners not more than 24 inches 610 mm OC, staggered on opposite flanges of furring channels.
- Q. Stud Wall Isolation Strip:
 - 1. Install per manufacturer's instructions.

3.3 FRAMING AT OPENINGS

- A. Control Joints (CJ):
 - 1. Install additional stud, maximum 1/2 inch 13 mm from jamb studs.
 - 2. Do not fasten extra stud to track or jamb stud.
 - 3. Refer to specification Section 09 29 00 for control joint locations.
- B. Prefabricated headers, jambs, and sill framing systems option:
 - 1. Proprietary opening framing systems may be used as an alternative to conventionally fabricated framing.

2. Pre-approved Products:
 - a. HDS Framing System by ClarkDietrich.
 - b. Quick Frame Rough Opening System by Marino/ Ware.
- C. Door Openings:
 1. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section for cripple studs at head and secure to jamb studs. Screw into web of jamb stud.
 2. Unless indicated otherwise, extend jamb studs through suspended ceilings and secure laterally to overhead structure.
 3. Jamb Studs:
 - a. Minimum thickness of jamb studs: 30 mil (20 GA) 0.752 mm at openings.
 - b. Install two studs at each jamb, toe-to-toe unless otherwise indicated.
 - 1) Securely attach first stud to frame.
 - 2) Fill cavity between studs with acoustic batt insulation where required by acoustical rating of wall.
 - 3) Join second stud to first stud on each face with 30 mil (20 GA) 0.752 mm screw attached steel straps at 42 inches 1070 mm on center maximum.
 4. Headers:
 - a. Openings less than 4 feet 6 inches 1.37 M wide:
 - 1) Cut-to-length section of floor runner above and below wall openings.
 - 2) Cut flanges and bend webs at ends.
 - 3) Overlap and screw attach jamb studs to frames.
 - b. Openings over 4 feet 6 inches 1.37 M wide:
 - 1) Cut-to-length, horizontal box beam studs above and below wall openings.
 - 2) Design for actual span and loading.
 - c. Incorporate miscellaneous steel members, specified in Section 05 50 00, and wood blocking, specified in Section 06 10 00, where indicated.
 5. Control Joints at head of jambs:
 - a. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch 13 mm clearance from jamb stud to allow for installation of control joint in finished assembly.
 - b. Gypsum Wallboard control joints as specified in Section 09 29 00.
- D. Other Framed Openings:
 1. Frame openings other than door openings the same as required for door openings, unless otherwise indicated.
 2. Cripple Studs:
 - a. Install cut-to-length intermediate vertical studs above and below openings.
 - b. Spacing: As indicated for typical full-length studs.
 - c. Match stud framing below sills of openings to framing installed above opening.

3. Incorporate miscellaneous steel members, specified in Section 05 50 00, and wood blocking, specified in Section 06 10 00, where indicated.

3.4 WALL BACKING AND BLOCKING

- A. Metal Wall Backing: Provide in-wall metal wall backing reinforcement where following items are mounted to interior walls and interior face of exterior walls:
 1. Crash rails, chair rails, wall bumpers, and similar wall protection devices.
 2. Contractor or Owner furnished equipment indicated to be wall mounted.
 3. Toilet accessories that do not include proprietary backing devices.
 4. Toilet partitions and lockers.
 5. Markerboards, tackboards, and chalkboards.
 6. Other wall-mounted items where backing is indicated by details or specification.
- B. Verify metal stud framing has been installed to support wall-mounted items specified in Section 05 50 00.
- C. Coordinate mounting height, location, and coverage with item to be supported.
- D. Determine material width according to item to be supported.
- E. Provide in-wall metal wall backing material to interior metal stud walls specified herein and Exterior stud walls specified in Section 05 40 00.
- F. Attachment: Minimum 2 - #10 sheet metal screws at each stud.

3.5 CEILING FRAMING

- A. Install in compliance with manufacturer's recommendations.
- B. Provide required items to support and trim out neatly, flush or recessed mechanical and electrical items.
- C. Frame openings in ceiling support system to accommodate access panels and similar openings and penetrations.
 1. Completely frame openings with closed channel side of stud facing opening for support of recessed mechanical and electrical items.

3.6 CEILING SUPPORT SYSTEMS

- A. Install suspension system components in sizes and spacing indicated on Drawings, but not less than required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where abutting or penetrated by building structure.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and secure fasteners appropriate for substrate.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and secure fasteners appropriate for structure and hanger.
 5. Attachments to Structural Insulated Panels require neoprene or other washers to prevent moisture penetration of the deck. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Grid Suspension Systems:
1. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces.
 2. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
 3. Install suspension systems that are level to within 1/8-inch 3 mm in 12 feet 3.66 M measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
 4. Coordinate support requirements for in-ceiling devices with capacity of ceiling grid system.

END OF SECTION

SECTION 09 29 00 GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Gypsum Wallboard in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Related Requirements: Include, but are not necessarily limited to:
 - 1. Section 09 22 16 – Non-Structural Metal Framing.
 - 2. Section 09 30 00 – Tiling.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C475 Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 2. ASTM C840 Application and Finishing of Gypsum Board.
 - 3. ASTM C841 Installation of Interior Lathing and Furring.
 - 4. ASTM C954 Steel Drill Screws for Application of Gypsum Panel Products or Metal Plaster Bases.
 - 5. ASTM C1002 Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases.
 - 6. ASTM C1047 Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - 7. ASTM C1396 Standard Specification for Gypsum Board.
 - 8. ASTM C1629 Abuse-Resistant Non-decorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
 - 9. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 10. ASTM E84 Surface-Burning Characteristics of Building Materials.
 - 11. ASTM E90 Sound Transmission Testing.
 - 12. ASTM E119 Fire Tests of Building Construction.
 - 13. ASTM E413 Classification for Rating Sound Insulation.
 - 14. ASTM F2547 Standard Test Method for Determining the Attenuation Properties in a Primary X-ray Beam of Materials Used to Protect Against Radiation Generated During the Use of X-ray Equipment
- B. Gypsum Association (GA):
 - 1. GA-216 Application and Finishing of Gypsum Panel Products.
 - 2. GA-234 Control Joints for Fire-Resistance Rated Systems.
 - 3. GA-238 Guidelines for Prevention of Mold Growth on Gypsum Board.
- C. Fire Resistant Rated Assemblies:
 - 1. For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
 - 2. Provide materials listed by UL, or other approved testing laboratory, for construction and rating type indicated.

D. STC Rated Assemblies:

1. Provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

1.3 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications for each type of material and accessory.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch (300-mm-) length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size sample for each textured finish indicated and on same backing indicated for Work.

C. Certifications:

1. Certification Letter: Submit letter on Contractor's letter head signed by Contractor indicating that all materials incorporated into this Project comply with requirements specified in this Specification or are accepted equivalent products.

1.4 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 square feet (9 square meters) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Gypsum Wallboard:

1. Base:
 - a. Georgia Pacific (GP).
2. Optional:
 - a. American Gypsum.
 - b. CertainTeed.
 - c. Continental Building Products.
 - d. National Gypsum Company (NGC).
 - e. Pabco Gypsum.
 - f. United States Gypsum (USG).

B. Drywall Trim Accessories:

1. Base:
 - a. United States Gypsum (USG)

- 2. Optional:
 - a. CertainTeed.
 - b. ClarkDietrich.
 - c. Phillips Manufacturing.
 - d. Structus Building Technologies.
- C. Specialty Drywall Trim:
 - 1. Base:
 - a. Pittcon Industries.
 - 2. Optional:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
- D. Foam Tape:
 - 1. Base:
 - a. Norseal.
 - b. Gasket Dynamics.
- E. Sound Attenuation Batts (SAB):
 - 1. Base:
 - a. Owens-Corning.
- F. Preformed Acoustical Seal for Wall Boxes:
 - 1. Base:
 - a. STC Architectural Products.
- G. Pressure Sensitive Fire Tape:
 - 1. Base:
 - a. E-Z Taping System.
- H. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Furnish in maximum available lengths, consistent with installation requirements.
 - 1. Long Edge: Tapered.
 - 2. Short Ends: Square.
- B. Upgrade listed types to fire rated equivalent products when used in fire rated assemblies.
- C. Provide listed GWB products to mold and moisture resistant types, where wallboard is installed in Electrical, Communication Rooms, Mechanical shafts, Stair Shafts, and similar locations where wallboard is installed prior to building being weathertight.
- D. Exterior Gypsum Sheathing: Specified in Section 06 16 43.
- E. Framing and suspension systems for Gypsum Board Ceilings: Specified in Section 09 22 16.
- F. Thermal Insulation: Specified in Section 07 21 00 and other Division 07 sections.
- G. Interior face of exterior walls and rooms where moisture or high humidity is present:
 - 1. Mold and moisture resistant gypsum panels (MRGWB).
 - 2. Gypsum panels, with glass mat facer per ASTM C1658.
 - 3. Thickness: 5/8 inches 15 mm.
 - 4. Mold resistance score: 10 per ASTM D3273.

5. Apply continuously to interior face of exterior stud walls prior to framing interior partitions and ceilings.
 6. Where MR wallboard is scheduled in fire rated walls, provide approved fire resistive products with comparable moisture resistance.
 7. Base product:
 - a. DensArmor Plus Interior Panel and DensArmor Plus Fireguard Interior Panel Fireguard by Georgia Pacific.
- H. Interior Partitions and Ceilings:
1. Gypsum panels - Type X (GWB-1):
 - a. ASTM C1396.
 - b. Thickness: 5/8 inches 15 mm.
 - c. Type X core.
 - d. Use: ceilings, back-of-house partitions; public area partitions above 8'-0" from finish floor.
 - e. Base product:
 - 1) ToughRock Fireguard X Gypsum Wallboard by Georgia Pacific.
 2. Gypsum panels – Mold and moisture resistant (MRGWB):
 - a. Gypsum panels with paper facer per ASTM C1396.
 - b. Thickness: 5/8 inches 15 mm.
 - c. Mold resistance score: 10 per ASTM D3273.
 - d. Base Product: ToughRock Mold-Guard and ToughRock Mold-Guard Fireguard X by Georgia Pacific.
 3. Tile Backer Board (TBB):
 - a. Moisture resistant treated gypsum core, glass mats on both sides, and acrylic water barrier or water-resistant gypsum coating on finished side.
 - b. Provide TBB at walls of showers, tub rooms, toilet rooms, and similar walls where tile is scheduled.
 - c. Thickness: 5/8 inches 15 mm type X at rated walls.
 - d. Mold resistance score: 10 per ASTM D3273.
 - e. Base Products:
 - 1) Non-Rated Walls: DensShield Tile Backer by Georgia Pacific.
 - f. Include Level 5 finish at non-tiled portions.
 4. Abuse Resistant Gypsum Wallboard (ARGWB):
 - a. Thickness: 5/8 inches.
 - b. Type X core.
 - c. Tested in accordance with ASTM C1629.
 - 1) Surface Abrasion: Level 2.
 - 2) Surface Indentation: Level 1.
 - 3) Soft Body Impact: Level 1.
 - d. Upgrade metal studs to 20 GA minimum where used with ARGWB.
 - e. All public-area interior partitions from finish floor to 8'-0" above finish floor.
 - f. Base product:
 - 1) ToughRock Abuse Resistant Gypsum Board by Georgia Pacific.

- I. Trim:
 - 1. Interior Trim:
 - a. Material: Galvanized or aluminum coated steel sheet, rolled zinc, paper faced galvanized steel sheet, or paper faced structural laminate.
 - b. Material for wet areas: Composite.
 - c. Shapes:
 - 1) Corner bead.
 - 2) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 3) L-Bead: L-shaped; exposed long flange receives joint compound.
 - 4) U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - 5) Control joint.
 - 6) Curved Edge Corner bead: With notched or flexible flanges.
 - 7) Other items as indicated.
 - 2. Specialty trim:
 - a. Profiles and dimensions indicated.
 - b. Material: 6063-T5 Aluminum.
 - c. Finish: Class II anodic finish.
 - d. Flanges to be embedded: Corrosion resistant primer compatible with joint compound and finish materials indicated.
- J. Joint Treatment Materials:
 - 1. Use product types recommended by wallboard manufacturer for each condition.
 - 2. Materials compatible with other compounds applied previously or on successive coats.
 - 3. Provide dust control products in occupied areas or adjacent to occupied areas.
 - 4. Joint tape:
 - a. Interior gypsum wallboard: Paper.
 - b. Tile backing panels: As recommended by panel manufacturer.
 - 5. Joint compounds for interior gypsum wallboard:
 - a. Setting type joint compound:
 - 1) Filling open joints and voids.
 - 2) Embedding tape and first coat over joints, fasteners, and trim flanges.
 - 6. Lightweight setting type joint compound:
 - a. Second coat.
 - b. Final, skim coat on surfaces receiving a Level 5 finish.
 - c. Drying type all-purpose joint compound:
 - 1) Second and third coats.
 - 2) Final, skim coat, on surfaces receiving a Level 5 finish.
 - d. Spray applied coating compound:
 - 1) Final, skim coat, on surfaces receiving a Level 5 finish.

7. Joint compounds for moisture resistant gypsum wallboard:
 - a. Setting type joint compound:
 - 1) Filling open joints and voids.
 - 2) Embedding tape and first coat over joints, fasteners, and trim flanges.
 - b. Lightweight setting type joint compound:
 - 1) Second and third coats.
 - 2) Final, skim coat on surfaces receiving a Level 5 finish.
- K. Acoustical Materials:
 1. Provide where indicated.
 2. Minimum nominal thickness: As required to achieve STC indicated for wall systems.
 3. Density: As required to achieve STC indicated for wall systems.
 4. Sound attenuation batts (SAB):
 - a. Glass or mineral fiber.
 - b. Commercial sound blanket, ASTM C665, Type I, unfaced, produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - c. Surface burning characteristics per ASTM E84:
 - 1) Maximum flame spread: 25.
 - 2) Maximum smoke developed: 50.
 - d. Acoustically rated assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
 - e. Batt insulation products shall contain no added formaldehyde, including urea formaldehyde, phenol formaldehyde, and urea-extended phenol formaldehyde.
 - f. Fiberglass base product: Sound Attenuation Batt Insulation by Owens-Corning.
 - g. Mineral wool base product: Thermafiber SAFB FF by Owens-Corning.
 5. Preformed acoustical seal for wall boxes:
 - a. Box Seal by STC Sound Control
 - b. Molded neoprene, durometer A-40 complying with ASTM D2000.
 - c. Formed to fit the electrical device, outlet, and service boxes.
 - d. STC improvement: 6 dB in accordance with ASTM E90.
 6. Provide at electrical and service box penetrations in sound rated walls.
- L. Interior joint sealants, including acoustical sealants:
 1. See Section 07 92 16.
- M. Fasteners:
 1. Bugle head screws: ASTM C1002 for use with maximum 22 GA 0.76 mm metal stud framing.
 2. Self-tapping bugle head screws: ASTM C954 for use with minimum 20 GA metal framing.
 3. Type S for gypsum wallboard to metal; Type G for gypsum wallboard to gypsum wallboard.
 4. Screws used with backer boards: As recommended by panel manufacturer.

- N. Laminating Adhesive:
 - 1. Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- O. Foam Tape:
 - 1. EPDM 1/2 x 1/4 inches 13 x 6 mm: With pressure sensitive adhesive; Cellular rubber by Gasket Dynamics.
- P. Backing for Control Joints:
 - 1. Fire rated board.
- Q. Support straps:
 - 1. Galvanized steel sheet for retaining and bracing in length and width indicated or as required for adequate support of assembly.
 - 2. Minimum Base-Metal Thickness: 20 gauge.
- R. Sealer for Moisture Resistant Gypsum Wallboard:
 - 1. Manufacturer's standard compound.
 - 2. Use at joints, cut edges, and screw penetrations.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine supporting structure and conditions prior to wallboard installation.
- B. Correct unsatisfactory conditions.
- C. Start of installation constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Remove loose materials and vacuum cavity of gypsum dust prior to enclosing stud space.
- C. Install wallboard vertically with edges over metal stud framing members and similar framing support members.
- D. Bring boards into contact but do not force into place.
- E. Stagger edge joints on opposite side of partition so they occur on different framing members.
- F. Stagger joints in multi-layer applications not less than one support from previous layer.
- G. Install wallboard over metal framing studs and similar framing support members at interior face of exterior walls full height from floor to structure above.
- H. Wallboard installation prior to building being weathertight:
 - 1. Replace scheduled GWB products to their mold-resistant counterparts.
 - a. Products proposed are subject to Engineer approval.
 - 2. Exposure time shall be limited by manufacturer requirements.
- I. Sound Insulation:
 - 1. Install sound insulation in walls from floor to structure above, wherever sound rated walls are indicated.
 - 2. Install in thicknesses and densities necessary to achieve sound rating.
 - 3. Fill cavities where studs are installed nested or toe-to-toe.

4. Pack spaces around electric boxes and other penetrations to maintain full sound rating.
 - a. Fill small voids that remain with Acoustical Sealant.
 5. Where walls either are not finished on both sides or where insulation does not fill the cavity depth, supplementary galvanized steel support straps must be provided to hold product in place at 24 inches on center or at spacing as indicated by the insulation manufacturer's written installation instructions.
- J. Preformed Acoustical Seal for Wall Boxes:
1. Place preformed seal over exposed outlet box flush with wall surface with device protruding through preformed or precut opening in seal.
 2. Secure in place with outlet cover plate.
- K. Pressure Sensitive Fire Tape:
1. Where allowed: Install approved pressure sensitive fire tape to above-ceiling wallboard joints in fire rated walls.
 2. Exception: Utilize conventional mud and tape where fire tape is not permitted by UL wall design or by local authorities.
- L. Curved Partitions:
1. Space studs or furring to prevent flat areas between framing at curved surfaces.
- M. Wall Reveals:
1. Install reveal wall channels and/or aluminum framing as recommended by manufacturer.
- N. Screw Placement:
1. Proceed with attachment from board center toward ends and edges.
 2. Space maximum 8 inches 200 mm OC at edges and 12 inches 300 mm OC in field of board.
 - a. Use closer screw spacing if required by UL.
 - b. Fasten wallboard to each stud where multiple studs are installed at door jambs.
 3. Secure wallboard to vertical studs; do not secure to top track directly.
 - a. Follow top track manufacturer's screw pattern requirements.
 - b. Install additional framing if required.
 - c. Top track is specified in Section 09 22 16.
 4. Set screws between 3/8 inches and 1/2 inches 10 mm and 13 mm from edges.
 5. Drive screws so head rests in slight dimple without cutting face paper or fracturing core.
- O. Access Panels and Doors:
1. Locate where required by Section 23 05 00 and Section 26 00 10, or as indicated.
 2. See Section 08 31 16.

3.3 INSTALLATION - TRIM ACCESSORIES

- A. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Interior Trim:
1. Install in following locations:
 2. Corner Bead: Use at outside corners.

3. J-Bead or LC-Bead: Use at exposed panel edges.
 4. L-Bead: Use where wallboard abuts dissimilar surfaces and where indicated.
 - C. Specialty Trim:
 1. Install in locations indicated.
- 3.4 INSTALLATION - CEILING
- A. Install in compliance with manufacturer's recommendations.
 - B. Stagger abutting end joints of adjacent panels' not less than one framing member.
 - C. During cold or damp weather, insulate before installing gypsum board on a ceiling with a vapor barrier.
- 3.5 CONTROL JOINTS
- A. General:
 1. Install Control Joints in locations indicated and as described in this article and in specific locations approved by Engineer for visual effect.
 2. Install suitable backing material to maintain required rating where Control Joints occur in fire or sound rated assemblies.
 - B. Partitions:
 1. Extend control joints continuous full height of partition or wall.
 2. Provide vertical control joints on both wall faces which align with door frames, window frames, and similar opening as follows:
 - a. Single Doors and Cased Opening:
 - 1) Locate Control Joints at both jambs, from head of opening to top of partition.
 - b. Pair doors:
 - 1) Locate Control Joints at both jambs, from head of opening to top of partition.
 - 2) Exception: Control Joints are not required where partition forms a cross-corridor condition.
 - c. Doors with adjacent sidelights:
 - 1) Locate Control Joints at both jambs from head of opening to top of partition, and, from sill to floor at sidelight jambs.
 - d. Punched windows less than 30 feet 9 M in width:
 - 1) Both jambs from head of opening to top of partition, and from sill edge to floor.
 3. Provide additional vertical Control Joints, spaced no more than 30 feet apart from each other, from other opening related Control Joints, or from corners.
 4. Provide horizontal control joints at partitions which are more than one story in height:
 - a. Locate horizontal Control Joints where partitions bypass each intermediate floor.
 - b. Align control joint with floor line, unless otherwise indicated.

- C. Ceilings:
 - 1. Use Control Joints to subdivide ceilings/soffits as indicated, and within the following limits:
 - a. Ceilings with perimeter relief:
 - 1) Subdivide so no area exceeds 2500 SQ FT 232 m², and no area has a length which exceeds 50 feet 15 M.
 - a) Exception where ceiling occurs at exterior: Subdivide so that no area exceeds 900 SQ FT 83 m², and no area has a length which exceeds 30 feet.
 - b. Ceilings without perimeter relief:
 - 1) Subdivide so that no area exceeds 900 SQ FT, and no area has a length which exceeds 30 feet 9 M.
 - c. Locate control joints at transitions between areas of different shapes.
- D. Soffits:
 - 1. Use control joints to subdivide ceilings/soffits as indicated, and within the following limits:
 - a. Locate Control Joints at transitions between areas of different shapes.
 - b. Continue lines of soffit Control Joints vertically to top of fascia.
 - c. Subdivide exterior applications so no area exceeds 900 SQ FT 83 m², and no area has a length which exceeds 30 feet 9 M.

3.6 WALLBOARD FINISHING

- A. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
- B. Pre-fill rounded or beveled edges, open joints, voids, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Where bead abuts exterior metal window frames or other metal components, separate from other material by use of foam tape.
- E. Remove residual joint compound from adjacent surfaces.
- F. Apply Joint Compound and Tape in accordance with fire rated design.
 - 1. Apply joint treatment compound in accordance with manufacturer's directions.
 - 2. Fill joints, screw heads, and internal corners with compound.
 - 3. Extend joint system vertically from floor to extent described as follows:
 - a. Fire Walls, Barriers, and Partitions: Extend to full height of wall.
 - b. Smoke Barriers and Partitions: Extend to full height of wall.
 - c. Interior face of exterior wall (non-rated): Extend to full height of wall.
 - d. Other interior partitions (non-rated): Extend to 6 inches 150 mm above ceiling.
 - 4. Refer to Drawings for indication of partition heights.
- G. Level 4 Finish:
 - 1. After drying, sand or otherwise smooth final coat of compound as needed to eliminate high spots or excess compound to leave smooth, even, and level surface.
 - 2. Draw down final coat of compound to a smooth even plane.

3. Locations:
 - a. Wallboard scheduled to be finished with Gloss Level 1 (flat), Level 2 (velvet), or Level 3 (eggshell) paint, glazed coating, textured coating, or wall covering.
 - b. Where above listed surfaces are to be finished with textured decorative treatments, wall covering, paneling, or wall guard.
 - c. Remaining locations, unless noted otherwise.
- H. Level 5 Finish:
 1. Trowel skim coat of joint compound leaving a thin film covering the entire surface, in accordance with manufacturer's recommendations.
 2. Make surfaces free of tool marks and ridges.
 3. Locations:
 - a. Exposed ceiling, soffit, or wall areas abutting window mullions, skylights, or receiving direct indoor lighting.
 - b. Hallways or corridors more than 20 feet 6 M long and unbroken by doorways or windows.
 - c. Lobbies, vestibules, other areas open to the public.
 - d. Multi-story spaces.
 - e. Wall board scheduled to be finished with Gloss Level 4 (satin), Level 5 (semi-gloss), Level 6 (gloss), Level 7 (high gloss), paint, glazed coating, textured coating, or wall covering.
 - f. Surfaces using MRGWB or other wallboard types with a glass mat facer on finished side.
- I. Glass Mat, Water Resistant Backing Panels:
 1. Finish according to manufacturer's written instructions.
- J. Cementitious Backer Units:
 1. Finish according to manufacturer's written instructions.
- K. Repairs:
 1. After painter has applied primer to wallboard surfaces, repair and refinish defective areas.
 2. If wallboard is damaged, or surfaces are roughened, repair or replace.

3.7 PROTECTION

- A. Protect installed wallboard from water damage during construction.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- D. Prior to finishing, walls shall be inspected for visible mold growth.
 1. Replace affected portions.

END OF SECTION

SECTION 09 30 00
TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Tile, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 RELATED SECTIONS

- A. Section 07 92 16 "Interior Joint Sealants."
- B. Section 09 29 00 "Gypsum Board" for Tile Backer Board used in tile locations.
- C. Section 09 66 23 "Thin-Set Epoxy Terrazzo" for cast and precast wall bases used with tile wall coverings.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Minimum ten (10) years of experience in manufacture of tile, setting and grout materials.
- B. Installer Qualifications:
 - 1. Specializing in tile work having minimum of five (5) years successful documented experience with work comparable to that required for this Project.
- C. Single Source Responsibility:
 - 1. Obtain each type and color tile material required from single source.
 - 2. Provide compatible materials for tile system.
- D. Certifications:
 - 1. Submit Master Grade Certificate for each type of ceramic, quarry, and paver tile in accordance with requirements of ANSI A137.1.
 - 2. Submit manufacturer's certifications that mortars, adhesives, and grouts are suitable for intended use.
- E. Tile Council of North America (TCNA):
 - 1. Handbook for Ceramic, Glass and Stone Tile Installation, latest edition.
- F. Ceramic Tile Institute of America (CTIOA).
- G. ASTM International (ASTM):
 - 1. ASTM C373 Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products
 - 2. ASTM C485 Standard Test Method for Measuring Warpage of Ceramic Tile
 - 3. ASTM C623 Standard Test Method for Young's Modulus, Shear Modulus, and Poisson's Ratio for Glass and Glass-Ceramics by Resonance.
 - 4. ASTM C627 Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using Robinson-Type Floor Tester
 - 5. ASTM C630 Standard Test Method for Resistance of Ceramic Tile to Chemical Substances
 - 6. ASTM C648 Standard Test Method for Breaking Strength of Ceramic Tile
 - 7. ASTM C1026 Standard Test Method for Measuring the Resistance of Ceramic and Glass Tile to Freeze-Thaw Cycling

8. ASTM C1027 Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
 9. ASTM C1378 Standard Test Method for Determination of Resistance to Staining
 10. E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 11. ASTM E413 Classification for Rating Sound Insulation Class
 12. ASTM E989 Standard Classification for Determination of Single-Number Metrics for Impact Noise
- H. American National Standards Institute (ANSI):
1. ANSI A108.5 Installation of Ceramic tile with Dry-Set Portland Cement or Latex-Portland Cement.
 2. ANSI A108.10 Installation of Grout in Tilework.
 3. ANSI A108.13 Installation of Membranes for Thin-Set Ceramic Tile.
 4. ANSI A108.17 Installation of Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone.
 5. ANSI A118.1 Standard Dry-Set Cement Mortars.
 6. ANSI A118.3 Chemical Resistant, Water-Cleanable, Tile-Setting and-Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.
 7. ANSI A118.4 Modified Dry-Set Cement Mortar.
 8. ANSI A118.7 High Performance Cement Grouts.
 9. ANSI A118.10 Load-Bearing, Bonded Waterproofing Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
 10. ANSI A118.12 Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation.
 11. ANSI A118.15 Improved Modified Dry-Set Cement Mortars.
 12. ANSI A136.1 Organic Adhesives for Installation of Ceramic Tile.
 13. ANSI A137.1 Standard Specification for Ceramic Tile.
 14. ANSI A137.3 Standard Specification for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs.

1.4 SUBMITTALS

- A. Product Data:
1. For each type of material and accessory.
- B. Shop Drawings:
1. Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, movement joints, thresholds, ceramic accessories, and setting methods and details.
- C. Samples:
1. Three samples of each tile specified in Drawing Finish Schedule.
 2. Grout: Submit manufacturer's full range of standard and designated color samples for each type for Engineer's selection.
 3. Trim: Submit sample of each type and color.
 4. Transition and Edge Protection Profiles: Submit sample of each type and color.

- D. Project Information:
 - 1. Installation methods.
 - 2. Manufacturer's Certificate: For each shipment, type and composition of tile provide a Master Grade Certificate signed by manufacturer and installer certifying products meet or exceed specified requirements of ANSI A137.1-2012.
- E. Contract Closeout Information:
 - 1. Maintenance Data:
 - a. Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
 - b. See Section 01 78 23.

1.5 EXTRA MATERIAL

- A. Provide 25 SQ FT of each type, color or size specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Porcelain Accent Wall Tile:
 - 1. Base:
 - a. See Interior Finish Legend in Drawings.
- B. Large Format Porcelain Panels:
 - 1. Base:
 - a. See Interior Finish Legend in Drawings.
- C. Accessories:
 - 1. Base:
 - a. Schluter Systems.
 - 2. Option:
 - a. Profilitec.
- D. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

- A. Tile:
 - 1. Ceramic Tile: Comply with ANSI A137.1 American National Standard Specifications for Ceramic Tile for types, compositions, and grades of tile indicated.
 - 2. Porcelain Tile: Comply with ANSI A137.3 American National Tile Standard Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs for types, compositions, and grades of tile indicated.
 - 3. Furnish tile complying with Standard Grade requirements unless otherwise indicated.
 - 4. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- B. Colors, Textures, and Patterns:
 - 1. Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with following requirements:
 - a. See Drawing Interior Finish Legend.

- C. Factory Mounting:
 - 1. Provide back face or edge mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.
 - 2. Do not use back mounted or edge mounted tile assemblies for swimming pools, exterior applications or wet areas.
- D. Grout Release:
 - 1. Factory applied temporary protective coating.
 - 2. Provide where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
 - 3. Do not coat unexposed tile surfaces.

2.3 MATERIALS

- A. Porcelain Tile:
 - 1. Acceptable Manufacturer: As specified in Drawing Interior Finish Legend.
 - 2. Porcelain Tile: Porcelain based, impervious unglazed ceramic, through body color.
 - 3. Water Absorption: Less than 0.1% maximum, ASTM C373.
 - 4. Finish: Matte.
- B. Porcelain Panels:
 - 1. Acceptable Manufacturer:
 - a. As specified in Drawing Interior Finish Legend.
 - 2. Sintered compact based, impervious unglazed ceramic, through body color.
 - 3. Water absorption:
 - a. Less than 0.1% maximum, per ISO 10545-3.
 - 4. Thickness:
 - a. As indicated in Drawings.
 - 5. Panel Size:
 - a. As indicated in Drawing Interior Finish Legend.
 - 6. Color/Finish:
 - a. As indicated in Drawing Interior Finish Legend.
 - 7. Anti-slip property per DIN 51330:
 - a. R9.
 - 8. Static friction coefficient per ASTM C1028:
 - a. Dry: 0.76 – 0.94.
 - b. Wet: 0.43 – 0.67.
- C. Trim:
 - 1. Provide necessary caps, stops, returns, trimmers and other shapes to complete installation.
 - 2. Color and finish to match adjacent tile unless shown otherwise.
 - 3. Trim: Refer to Architectural Details.
 - a. Straight Base: Bullnose top edge. Align joints and set on top of floor tile.
 - b. Cove Base: Bullnose top edge. Align joints and set flush with floor tile.
 - c. Cove Base: Square top edge. Align joints and set flush with floor tile.

D. Mortar – Thick Set

1. Portland Cement Mortar with Latex Additive:

- a. Portland Cement: ASTM C150, Type I, from one source only, non-staining and non-air-entraining.
- b. Supplemental cementitious materials derived from coal fired power plant wastes shall not have a mercury content greater than 5.5ppb.
- c. Fly ash shall not be a byproduct of municipal solid waste incinerators
- d. Mortar Sand: ASTM C144, free of deleterious materials, well graded.
- e. Setting Bed Sand: ASTM C136, 100% passing No. 4 sieve.
- f. Latex Additive:
 - 1) Description: Latex additive serving as replacement for gaging water, for use with site mixed portland cement mortar.
 - 2) Quantity: As recommended by latex additive manufacturer to produce workable consistency.
 - 3) Acceptable Products:
 - a) CustomFloat Bedding Mortar by Custom Building Products.
 - b) 3701 Mortar Admix by Laticrete.
 - c) Planicrete AC by Mapei.

E. Mortar – Thin Set:

1. Portland Cement with Latex Additive:

- a. Latex additive and site mixed Cement mortar.
- b. Comply with ANSI-A118.4.
- c. Acceptable Products:
 - 1) CustomCrete Latex Mortar Admix with site mixed mortar by Custom Building Products.
 - 2) Planicrete AC with 4:1 Mud Bed Mix by Mapei.

F. Acrylic Latex Adhesive:

- 1. Flexible, high-performance, factory prepared, Class C2 dry-set mortar with flexible acrylic latex additive..
- 2. Comply with ANSI A118.4E, ANSI A118.11 and ANSI a118.15E bond strength requirements.
- 3. VOC content no greater than 65 g/L.
- 4. Adhesives shall contain no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled "Chemicals Known to the State to Cause Cancer" or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
- 5. Acceptable products:
 - a. 100% Solids Epoxy Mortar by Custom Building Products.
 - b. Latapoxy 300 Epoxy Adhesive by Laticrete.
 - c. Kerapoxy 410 Chemical Resistant Epoxy Mortar by Mapei.

G. Latex Modified Grout:

- 1. Description: Latex-modified, factory blended, mildew resistant, sanded, grout consisting of cement, graded quartz and additives; comply with ANSI A118.7.

2. Latex Additive: Type as recommended by latex mortar manufacturer.
3. Acceptable Products:
 - a. Polyblend Sanded Tile Grout by Custom Building Products.
 - b. Sattilo Grout Mix with Acrylic Mortar Admix 1:1 with water by Custom Building Products.
 - c. 500 Series Sanded Grout Mixed with 1776 Grout Admix Plus by Laticrete.
 - d. Ultracolor Plus FA polymer-modified sanded grout by Mapei.
- H. Polymer Modified Sanded Grout:
 1. Compressive Strength: 3000 psi 20.7 MPa at 24 hours.
 2. Color: To be selected
 3. Color: As specified in Drawing Finish Schedule.
 4. Acceptable Products:
 - a. Polyblend Sanded Tile Grout by Custom Building Products.
 - b. 1500 Series Tri-Poly Fortified Sanded Grout by Laticrete.
 - c. Ultracolor Plus FA by Mapei.
- I. Waterproofing Membrane:
 1. Description: Trowel applied elastomeric compound.
 2. Acceptable Products:
 - a. Mapelastic 315 by Mapei.
 3. Accessories:
 - a. Preformed fiberglass mesh coving, inside and outside corners, and drain fittings.
 - b. Preformed expansion joint flashing.
- J. Crack Isolation Membrane:
 1. Description: Trowel applied elastomeric compound.
 2. Acceptable Products:
 - a. Mapelastic 315 by Mapei.
- K. Accessories:
 1. Fasteners: Corrosion resistant type required by board manufacturer for securing units.
 2. Joint Reinforcement Tape: As recommended by board manufacturer.
 3. Vapor Retarder:
 - a. Comply with ASTM D4397.
 - b. Thickness and maximum permeance rating:
 - 1) 4.0 mils, 0.19 perms 10.87 ng/s/m²/Pa.
 - c. Vapor retarder tape:
 - 1) For sealing joints and penetrations in vapor retarder.
 - 2) Pressure sensitive type recommended by manufacturer.
- L. Reinforcing Mesh:
 1. Size: 2 inches x 2 inches 50 mm x 50 mm weave of 16/16 wire size.
 2. Fabric: Welded, galvanized.

- M. Joint Sealant:
1. Two component polyurethane sealant, ASTM C920, Type M, self leveling, for horizontal joints, Type II, non sag, for vertical joints as specified in Section 07 92 16.
 2. Color: Match grout.
 3. Sealant:
 - a. Chemically compatible with tile, mortar, and grout.
 - b. Physically and chemically capable to withstand local environmental conditions.
- N. Joint Backing:
1. Closed cell foam polyethylene.
- O. Prefabricated Sealant Joint:
1. Prefabricated aluminum joint with two part, chemically curing non-sag polyurethane sealant.
 2. Height as required by tile by 8 feet 2.44 M lengths.
 3. Aluminum: Clear anodized.
 4. Sealant: Match grout.
 5. PolyBlend Ceramic Tile Caulk by Custom Building Products or Mapesil T by Mapei.
- P. Expansion and Control Joints for Thin-set and/or Thickset Applications:
1. Main Material:
 - a. Roll-formed stainless steel
 - b. Extruded aluminum
 - c. Extruded rigid PVC
 2. Profiles joined by soft CPE movement joint material, with integral perforated anchoring legs for setting joint into setting bed.
 3. Height: As required to suit application.
 4. Color: As selected by Architect.
 5. Schluter - DILEX-KS
- Q. Corner Joints:
1. Extruded rigid coved wall corner, with integral perforated anchoring legs.
 2. Floor leg height: As required to suit application.
 3. Wall leg height: As required to suit application.
 4. Material: Aluminum.
 5. Schluter - DILEX-AHK
- R. Decorative Wall Corner Trim:
1. Wide profile, decorative outside wall corner trim, with integral perforated anchoring leg.
 2. Height: As required to suit application.
 3. Material:
 - a. Aluminum.
 4. Acceptable Products:
 - a) Schluter – RONDEC

- S. Edge and Transition Strips:
 - 1. Edge strips, 1/8 inches 3 mm wide at top edge; height as indicated.
 - 2. Height: As required to suit application.
 - 3. Finish:
 - a. Clear-satin anodized aluminum.
 - 4. Schluter - SCHIENE AE
- T. Setting Buttons:
 - 1. Plastic buttons of thickness required for joint size indicated to maintain uniform joint width.
- U. Penetrating Sealers:
 - 1. Water-based sealer capable of repelling dirt, oil and stains from tile and grout surfaces.
 - 2. Low odor, pH-neutral and non-abrasive.
 - 3. Vapor open, non-film forming.
 - 4. Stain Resistance per Ceramic Tile Institute CTI-072: Excellent.
 - 5. Compatible with tile types scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.
- B. Verify concrete floor surfaces are suitable for tile installation.
 - 1. Firm, dry, clean and free of oily or waxy films, mortar and soil.
 - 2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile installed.
 - 3. Verify limits of moisture and alkalinity are within levels tolerated by Tile manufacturer and setting materials manufacturer.
 - 4. Verify areas to receive tile installed by thin bed method have wood float finish, are true within 1/4 inches in 10 feet 6 mm in 3 M and are pitched to drains where required.
- C. Correct unsatisfactory conditions and proceed with installation only after substrate deficiencies have been corrected and surfaces are acceptable.
- D. Start of work constitutes acceptance of surfaces, and waiver of claim that surfaces are unsuitable.

3.2 PREPARATION

- A. Prepare surfaces in accordance with manufacturers' instructions for setting materials or additives used.
- B. Acid based cleaners are not permitted.
- C. Completely remove curing compounds or other substances that would interfere with proper bond of setting materials.
- D. Do not seal substrate unless required by manufacturer.
- E. Prime substrate when required by manufacturer.

- F. Factory Blending:
 - 1. Blend tile in factory and package accordingly so tile are uniform in color range as those throughout packaging and match approved samples.
 - 2. If not factory blended, return to manufacturer or blend tiles at project site before installing.
- G. Field Applied Grout Release product, Temporary Protective Coating:
 - 1. Petroleum paraffin wax or proprietary grout release formulation.
 - 2. Provide where specified or required to prevent adhesion or staining of exposed tile surfaces by grout.
 - 3. Precoat exposed surfaces of tile with continuous film of temporary protective coating.
 - 4. Do not coat unexposed tile surfaces.

3.3 INSTALLATION

- A. Membrane:
 - 1. Install membrane with products or methods approved in writing by membrane manufacturer.
 - 2. Flash membrane to cure prior to setting tile.
 - 3. Do not allow construction traffic on membrane.
- B. Waterproofing:
 - 1. Install waterproofing in accordance with manufacturer's instructions.
 - 2. Return waterproofing vertically at adjacent walls in accordance with manufacturer details, to minimum height of 4 inches 100 mm.
 - 3. Flood test waterproof membranes after fully cured. See ASTM D5957 or reference the Manufacturer's published procedure.
 - 4. Field Quality Control water test when required.
- C. Tile Installation, General:
 - 1. Install tile materials in accordance with ANSI A137.1-2012, ANSI A137.2, ANSI and TCNA specifications, and TCNA Handbook for Ceramic Tile Installation, with exception of more stringent requirements of manufacturer or these Specifications.
 - 2. Cut and fit tile tight to penetrations, protrusions and vertical interruptions and seal.
 - a. See Section 07 92 16.
 - 3. Form corners and bases neatly.
 - 4. Install ceramic cove base in accordance with TCNA "Flush" style.
 - a. TCNA "Thin-Lip" style installation is not allowed.
 - 5. Work tile joints uniform in width, subject to variance in tolerance allowed in tile size.
 - 6. Ensure nominal grout centerlines are straight.
 - 7. Make joint watertight, without voids, cracks, excess mortar, or grout.
 - 8. Prepare surface, fit, set, bond, grout and clean in accordance with applicable requirements of ANSI standards and Tile Council of North America.
 - 9. Where accent tiles are of a lesser thickness than surrounding field tiles, increase bedding thickness as required to achieve flush alignment between finished faces of accent tiles and adjacent field tiles.

- D. Layout:
1. Lay out work to pattern indicated so full tile or joint is centered on each wall.
 - a. Lay out tile to minimize cutting and to avoid tile less than half size.
 2. Continue pattern through openings.
 3. For heights stated in feet and inches, use courses of full tile to produce nearest attainable heights without cutting tile.
 4. Align joints in tile in both directions.
 5. Align joints between wall, floor and base tile.
 6. Make joints between sheets of tile same width as joints within sheet.
 7. File edges of cut tile smooth and even.
 8. Cut and fit tile at penetrations through tile.
 9. Grind edges of tile abutting built-in items.
 10. Fit tile at outlets, piping and other penetrations so plates, collars, or covers overlap tile.
 11. Extend tile work into recesses and under or behind equipment and fixtures, to form complete covering without interruption, except as otherwise indicated.
 12. Accurately form intersections and returns.
 13. Form internal corners and external corners square.
- E. Thin Set Method, Floors and Walls:
1. Apply mortar or adhesive with notched trowel using scraping motion to work material into contact with surface to be covered.
 - a. Maintain 90% coverage on back of tile and fully bed corners.
 2. Apply only as much mortar or adhesive as can be covered within time recommended by mortar or adhesive manufacturer.
 3. When installing large tiles, ceramics or mosaics, trowel small quantity of mortar or adhesive onto back of each tile or sheet of tiles.
 4. Set tiles in place and level surface of tile.
 5. Align tile to show uniform joints and set until firm.
 6. Clean excess mortar or adhesive from surface of tile while mortar is fresh.
 7. Sound tile after setting. Replace hollow sounding tiles.
- F. Grouting:
1. Allow tiles to set before grouting.
 2. Install in accordance with grout manufacturer's recommendations and ANSI A108.10.
 3. Clean excess grout from surface as work progresses.
 4. Cure after grouting by covering with kraft or construction paper for 72 hours.
 5. Install sealant in vertical wall joints at interior corners.
- G. Movement Joints:
1. Comply with TCNA EJ171.
 2. Coordinate with Drawings.
 3. Locate movement joints where indicated.

4. Where not indicated, locate movement joints directly over following substrate conditions:
 - a. Changes in substrate material.
 - b. Over control joints, expansion joints and seismic joints in substrate.
 - c. Over construction joints in substrate.
 - d. At junctures where floors meet walls and other restraining elements such as curbs, columns, bases, and wall corners.
 - e. At other locations recommended by TCNA EJ171 Movement Joint requirements.
 5. Locate additional movement joints per following:
 - a. Exterior: 12 feet 3.66 M.
 - b. Interior: 25 feet 7.6 M.
 - c. Interior, where exposed to direct sunlight or moisture: 12 feet 3.66 M.
 6. Joint Width: In accordance with TCNA EJ171.
 7. Rake or cut control joints through setting bed to supporting slab or structure.
 8. Maintain joints free of mortar.
 9. Fill joints with self-leveling polyurethane sealant and backing material.
 - a. See Section 07 92 16.
 10. Provide sealant material at items penetrating tile work, unless otherwise indicated.
 11. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
 - a. Seal tile to outlets, piping and other penetrations.
 12. Fill joints around water closets with white silicone sealant.
 - a. See Section 07 92 16.
 13. Use manufacturer's expansion joint flashing when covering expansion joints with waterproof or crack isolation membranes.
- H. Penetrating Sealer:
1. Surface Preparation:
 - a. Verify tile and grout are fully cured.
 - b. Verify surfaces are dry, clean and free of waxes, sealers and finishes.
 - c. Test product in obscure area to produce desirable results.
 2. Apply Penetrating Sealer to tiled surfaces, unless otherwise noted.
 - a. Application of penetrating sealer is not necessary where epoxy grouts are used.
 - b. Apply in accordance with Manufacturer's instructions.
 3. Test after 2 hours by applying drops of water on surface.
 - a. If water penetrates, apply an additional coat of sealer.
 4. Remove visible residue within 60 minutes after application.

3.4 CLEANING

- A. Perform cleaning while mortar is fresh before hardening on surfaces.
- B. Wash tile diagonally across joints.
- C. Polish with clean dry cloth.

- D. Remove grout haze following recommendation of mortar additive manufacturer.
- E. Remove residual waxes or grout release agent, temporary protective coatings, by method recommended by coating manufacturer.
 - 1. Confirm acceptability with brick and grout manufacturer.
 - 2. Trap and remove coating to prevent it from clogging floor drains.

3.5 PROTECTION AND REPAIR

- A. Replace broken, cracked, chipped, stained, or damaged tile.

3.6 INSTALLATION METHODS

END OF SECTION

SECTION 09 51 00 ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Acoustical Ceiling Systems (ACT) in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A641/A641M Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 2. ASTM B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 3. ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panels Ceilings.
 - 4. ASTM C636/C636M Standard Specification for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 5. ASTM E488/E488M Standard Test Methods for Strength of Anchors in Concrete Elements.
 - 6. ASTM E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions
 - 7. ASTM E1190 Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members
- B. Site Classification and Seismic Design Categories as defined in the International Building Code.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications for each type of material and accessory.
- B. Samples:
 - 1. Three samples of each type of tile listed in Drawing Interior Finish Legend
- C. Contract Closeout Information:
 - 1. Maintenance data.
 - a. See Section 01 78 23.

1.4 EXTRA MATERIAL

- A. Verify with Owner quantity, if any, of "attic stock required per project for maintenance purposed."
 - 1. Provide extra stock from same production run as material installed on project.
 - 2. Package with protective covering, and level extra stock with manufacturer's name, pattern, color, project name, and date.
- B. See Section 01 78 43.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Steel Suspension Systems:
 - 1. Base:
 - a. Armstrong World Industries.
 - 2. Optional:
 - a. USG Corporation
 - b. Rockfon
- B. Aluminum Suspension Systems, non-gasketed:
 - 1. Base:
 - a. Armstrong World Industries
 - 2. Optional:
 - a. USG Corporation
 - b. Rockfon
- C. Acoustical Ceiling Tile:
 - 1. Base:
 - a. As noted for individual types in Drawing Interior Finish Legend.
- D. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Acoustic Suspension Systems:
 - 1. Heavy duty systems, ASTM C635.
 - 2. Main runner jointing by spliced, interlocking ends, tab locks, pin locks, or other suitable connections.
 - 3. Cross runners interlocking with main runners.
 - 4. Include components and accessories necessary resist seismic loads and dead loads of items such as light fixtures and air diffusers.
 - 5. Hanger Wire:
 - a. Pre-stretched, with a yield stress load of at least 5 times design load, but not less than 0.106 inches (12 GA) 2.7 mm.
 - b. Utilize continuous lengths, without kinks and splices.
 - c. Galvanized Steel:
 - 1) Galvanized, soft annealed steel wire conforming to ASTM A641/A641m.

- d. Stainless Steel:
 - 1) Type 304, soft annealed steel wire conforming to ASTM A641/A641M.
 - 2) Use where aluminum ceiling grid is specified.
- 6. Attachment Devices:
 - a. Anchors in Concrete:
 - 1) Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E488/A488M or ASTM E1512.
 - 2) Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.
 - 3) Material: Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 for Class SC 1 service condition.
 - b. Power-Actuated Fasteners in Concrete:
 - 1) Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E1190.
- 7. Suspension System Types:
 - a. CG-1: Exposed grid, non-rated:
 - 1) Description: Galvanized, double web steel, main and cross runners.
 - 2) Face width: 15/16 inches 24 mm.
 - 3) Base Product:
 - a) Prelude XL, by Armstrong.
 - 4) Finish on exposed surfaces: Smooth, flat white.
- B. Acoustical Ceiling Tile:
 - 1. Scheduled finishes to be factory applied.
 - 2. Class A incombustible units.
 - 3. Fire rated units (when used): UL labeled.
 - 4. Edges uniformly fabricated, true, square.
 - 5. Sizes as required to fit scheduled suspension system.
 - 6. Standard tile/panel size: See Reflected Ceiling Plan.
 - 7. Concealed spline style: Edges kerfed for splines.
 - 8. Aluminum facing: Minimum 0.010 inches 0.25 mm thick aluminum sheet with white baked enamel or vinyl coating.
 - 9. Foil facing: Enhanced aluminum foil with white vinyl coating.
 - 10. Adhesive applied style: Adhesive as recommended by manufacturer.
 - 11. Fiberglass Ceiling Tile:
 - a. Base:
 - 1) Optima by Armstrong.
 - b. Surface Texture: Smooth.

- c. Surface Finish: Factory applied acrylic latex paint
 - d. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.90.
 - e. Noise Reduction Coefficient (NRC): 0.90.
 - f. Lay-in style: Minimum 1 inch 25 mm thick.
- C. Diffusers and Grilles:
 - 1. See Division 23.
 - D. Light Fixtures:
 - 1. See Section 26 51 13 "Building Lighting."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate to accept installation.
- B. Examine installation site for irregularities having effect on quality and execution of work.
- C. Consult other trades involved before start of ceiling work, to determine areas of potential interference
- D. Do not start installation until interferences have been resolved.
- E. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Coordinate ceiling layout with sprinkler head spacing and work penetrating acoustical ceiling systems.
- B. Tolerances:
 - 1. Comply with ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 2. Deviation from level plane: 1/8 inches in 10 feet 3 mm in 3 M with no load applied maximum.
 - 3. Bow: 1/32 inches in 2 feet 0.8 mm in 610 mm maximum.
 - 4. Camber: 1/32 inches in 2 feet 0.8 mm in 610 mm maximum.
 - 5. Twist: 1 degree in 2 feet 1 degree in 610 mm maximum.

3.3 INSTALLATION

- A. Suspension System:
 - 1. Install suspension system in accordance with manufacturers' instructions.
 - 2. Grid layout:
 - a. See Reflected Ceiling Plans.
 - b. Install grid based on electrical lighting fixture layout indicated in Electrical Drawings, unless otherwise indicated,
 - c. Acoustical panel dimension at perimeter walls: Not less than 6 inches 150 mm.
 - d. In case of conflict notify Engineer.
 - 3. Install grid square with room and with grid or acoustical panel center lines coinciding with center lines of room, each direction.
 - 4. Intersections between main tees and cross tees:
 - a. Butt cut and notch as required.

5. Wall angles:
 - a. Install wall angles or moldings where ceilings meet walls, partitions, vertical elements, and other types of ceilings or ceiling fixtures.
 - 1) Secure angles to wall construction at stud locations.
 - a) Maximum spacing from terminal ends: 3 inches 76 mm.
 - b) Draw fasteners tight against vertical surfaces.
 - 2) Level tolerance: not more than 1 inch 1000.
 - 3) Miter cut inside and outside corners.
 - 4) Install with leg supporting bottom flange of runners.
6. Hanger wires:
 - a. Provide hangers and inserts necessary to support ceiling suspension systems and ceiling dead loads.
 - b. Coordinate location and alignment with work of other trades.
 - c. Install hanger wires plumb to main tees and cross tees.
 - 1) Do not suspend any part of suspension system from ducts, pipes, conduit, cable tray or equipment.
 - 2) Provide supplementary rough suspension system where necessary to support ceilings beneath pipes, ducts, equipment, cable trays.
 - 3) Splay hangers no greater than 30 degrees from vertical to avoid obstructions or other conditions that prevent plumb, vertical installation.
 - 4) Offset horizontal forces by bracing or counter-splaying.
 - d. Space hangers to prevent eccentric deflection and rotation due to loads from items in or on ceiling
 - 1) Provide supplemental hangers to support lighting fixtures and within 6 inches 150 mm from end of main runners and fixtures which exceed manufacturer's published load data.
 - 2) Do not bear runners on walls or partitions.
7. Main runners:
 - a. Utilize wall angles to align and receive terminal ends of main tees without transferring load to wall angle.
 - b. Space main tees as indicated to receive lay-in panels and fixtures.
 - c. Support terminal ends of main tees by wires located within 6 inches 150 mm from boundary walls.
8. Cross runners:
 - a. Space cross tees as indicated to receive lay-in panels and fixtures.
 - 1) Install cross runners with positive interlock.
 - b. Utilize wall angles to align and receive terminal ends of cross tees without transferring load to wall angle.
 - c. Support terminal ends of cross tees by wires located within 6 inches 150 mm from boundary walls.
9. Leave suspension system ready to accept installation of acoustic materials.

B. Lay-In Items:

1. Install acoustic materials in accordance with manufacturer's instructions.
2. Place lay-in panels, fixtures, diffusers, grilles, and similar items in manner not compromising suspension system performance.
3. Field cut materials to fit grid.
4. Tegular and similar tiles with articulated edges:
 - a. Cut edges to match profile of factory edges and paint to match.
5. Ceiling paint:
 - a. Touch-up minor surface scratches and blemishes.
 - b. Cover field cut edges exposed to view.
 - c. Armstrong SuperCoat Ceiling Panel Touch-up Paint.

3.4 CLEANING AND REPAIR

- A. Perform cleaning of soiled units and replacement of defective or damaged units.

END OF SECTION

SECTION 09 66 23
THIN-SET EPOXY TERRAZZO

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Thin-Set Epoxy Terrazzo, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Joint treatments, edge conditions and layout.
 - a. Details of anchorage and special features.
- B. Product Data:
 - 1. Written certification of compliance with NTMA requirements.
 - 2. Manufacturer's installation instructions and certificate indicating that materials are in compliance with specifications.
 - 3. Manufacturer's written approval of installer.
- C. Samples:
 - 1. Three samples 6 inches 150 mm square of each material specified in Drawing Interior Finish Legend.
 - 2. Samples of pattern and color of terrazzo for review of color, pattern, and texture.
- D. Contract Closeout Information:
 - 1. Maintenance data:
 - a. See Section 01 78 23.

1.3 QUALITY ASSURANCE

- A. Contractor's Qualifications:
 - 1. Installation must be by a manufacturer-certified applicator with skilled mechanics having not less than 3 years of satisfactory experience in the installation of the type of system as specified in this section.
 - 2. Installer certified in writing by the manufacturer of the Thin-set Epoxy Terrazzo Flooring System.
 - 3. Current contractor member in good standing with the National Terrazzo Mosaic Association (NTMA).
- B. Source Quality Control: Obtain materials from same source manufacturer.
- C. Comply with recommendations of National Terrazzo and Mosaic Association, (NTMA).

1.4 WARRANTY

- A. Provide one year written warranty on materials and installation from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Synthetic Matrix Terrazzo:
 - 1. Base:
 - a. Sherwin-Williams High Performance Flooring.

2. Optional:
 - a. Dex-O-Tex
 - b. Terrazzo & Marble Supply Companies
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

- A. Physical Properties:

Minimum Physical Properties		
Property	Test Method	Required Value
Hardness, at 24 hours, Shore D	ASTM D2240	85/65
Compressive Strength	ASTM D695	10,000 psi
Tensile Strength	ASTM D638	3000 psi
Water Absorption	ASTM D570	0.10 percent
Adhesion	ACI-503R	300 psi, 100 percent concrete failure
Abrasion Resistance	ASTM D4060 CS-17 Wheel	70-90 milligrams lost
Flammability	ASTM D635	Self-extinguishing over concrete
Flexural Strength	ASTM D790	4500 psi
Impact Resistance	MIL-D-3134, Sec. 4.7.3	16 ft-lbs without cracking, delamination, or chipping
Resistance to Elevated Temperatures	MIL-D-3134J	No slip or flow at required temperature of 158 deg F
Slip Resistance	ANSI 137.1	Compliant

2.3 MATERIALS

- A. Synthetic Matrix Terrazzo Flooring System:
 1. Factory-mixed, thermosetting, epoxy resin and hardener, mineral filler, and pigment. 100 percent non-volatile, complying with or exceeding NTMA requirements and as herein specified.
 2. Integral Cove Base:
 - a. Form integral coved base with top bead and divider strip.
 - b. Cove: 1 inch 25 mm radius.
 - c. Height: 4 inches 100 mm.
 - d.
 - e. Horizontal: maximum of 2 inches 50 mm from wall to divider strip.
 3. Finished Terrazzo Thickness:
 - a. 3/8 inches 10 mm.
 - b. Base Product: Resufloor Terrazzo TG by Sherwin-Williams High Performance Flooring.
 4. Optional:
 - a. Cheminert Terrazzo by Dex-O-Tex.
 - b. Thin-Set Epoxy Terrazzo by Terroxy Resin Systems.
 5. Membrane and sealer components shall have a VOC content no greater than 100 g/L.

- B. Binder Resin:
1. Base Product: 3520 Epoxy Terrazzo Matrix by General Polymers.
 2. Binder Resin shall have a VOC content no greater than 50 g/L.
- C. Aggregate:
1. Natural, sound, crushed marble chips, color, and grading to match Engineer's approved sample. Refer to Interior Finish Legend in Drawings.
 2. Colors as selected by Engineer. from NTMA Catalog, latest edition.
 - a. Up to three different colors of chips may be selected for each color of terrazzo.
 3. Use maximum size aggregate, within limits of workability for flooring thickness indicated.
- D. Crack and Joint Filler:
1. Epoxy base.
 - a. Base Manufacturer: Sherwin-Williams High Performance Flooring.
- E. Crack Isolation Membrane:
1. High solids flexible epoxy membrane and fiberglass scrim.
 - a. Base Product: Resufloor 3556 Membrane with fiberglass scrim by Sherwin-Williams High Performance Flooring.
- F. Finishing Grout / Filler:
1. Compound with filler and pigments, as recommended by matrix manufacturer.
 2. Base Product: 5270 Epoxy Filler by Sherwin-Williams High Performance Flooring.
- G. Finish Sealer:
1. Compound furnished or approved by matrix manufacturer.
 2. Base Product: Acrydur Aqua 4401 by Sherwin-Williams High Performance Flooring.
- H. Divider Strips:
1. Style: As required for type and thickness of terrazzo.
 2. Material and Thickness:
 - a. Non-conductive terrazzo:
 - 1) Material: White alloy zinc or aluminum.
 - 2) Size:
 - a) 14 GA 1.6 mm by depth matching the thickness of terrazzo.
- I. Accessory Strips:
1. Provide Cove Base Beads, Cove Divider Strips, and other items necessary to install work.
 2. Material: Match floor divider strips.
- J. Adhesives and Sealants:
1. Types as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces for defects, irregularities and conditions under which flooring is to be installed.

- B. Verify substrates are free of materials that may affect adhesion.
- C. Identify cracks and other surface defects which need repair prior to application of floor system.
- D. Inspect substrate for markers, paint and similar materials used for layout by others and take remedial action as necessary to remove layout line work to prevent bleed-through.
- E. Verify floors are level or meet indicated slope.
- F. Do not proceed with installation until unsatisfactory conditions have been corrected.
- G. Installation indicates acceptance of substrates and responsibility for performance.

3.2 PREPARATION

- A. Evaluate substrate condition, including substrate moisture transmission, quantity and severity of cracking, and the extent of repairs needed.
- B. Prepare cracks, construction joints, control joints and other non-moving joints with specified products in accordance with manufacturer's recommendations.
- C. Expansion joints and similar moving joints:
 - 1. Terrazzo System to terminate at the edge of isolation and expansion joints.

3.3 INSTALLATION

- A. Apply each component of Thin-set Epoxy Terrazzo Flooring System in compliance with manufacturer's written installation instructions and strictly adhere to mixing and installation methods, recoat windows, cure times and environmental restrictions.
- B. Prime in accordance with manufacturer's instructions.
- C. Install divider and accessory strips in adhesive without voids below strips.
- D. Align cove divider strips with floor divider strips.
- E. Place matrix and aggregates.
- F. Ensure that fluids from grinding operation do not react with metal strips to stain adjacent surfaces.
- G. Finish Sealer:
 - 1. Seal surface with finish sealer after thoroughly curing and cleaning.
 - a. Wash surfaces with a neutral cleaner.
 - b. Rinse with clean water and allow surface to dry.
 - c. Apply sealer in accordance with sealer manufacturer's directions.
- H. Surface Finishing:
 - 1. Discuss desired finish polish with Owner based on anticipated maintenance routine and equipment.

3.4 PROTECTION

- A. Protect flooring from damage and wear during other phases of the construction operation, using temporary coverings as recommended by the manufacturer, if required. Remove temporary covering just prior to final inspection.

3.5 CLEANING

- A. Clean flooring prior to final inspection, using materials and procedures as recommended by flooring manufacturer.

END OF SECTION

SECTION 09 67 81
CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Floor Sealer (CFS-ND), as indicated, in accordance with provisions of the Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - 2. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Contract Closeout Information:
 - 1. Maintenance data:
 - a. See Section 01 78 23.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications:
 - 1. Licensee of or approved in writing by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Concrete Floor Sealer – Normal Duty (CFS-ND):
 - 1. Base:
 - a. L&M Construction Chemicals, Laticrete International, Inc.
 - 2. Optional:
 - a. Dayton Superior
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Concrete Floor Sealer – Normal Duty (CFS-ND):
 - 1. Water-based, low VOC, acrylic copolymer solutions that cure, seal and dustproof concrete with minimal yellowing.
 - 2. Conform to ASTM C1315, Type I, Class A.
 - 3. VOC compliant.
 - 4. Meet local air quality regulations.
 - 5. Minimum Solids Content: 30 percent by volume.
 - 6. Primer: As recommended by manufacturer.
 - 7. Base Product:
 - a. L&M Dress & Seal 30 by Laticrete International, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Cure concrete minimum of 28 days.
- B. Verify concrete is free of fins, ridges, voids and suitable to accept installation.
- C. Examine surfaces to receive curing compound. Notify Engineer if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.
- D. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Verify curing agents used are compatible with coating system or completely remove.
- B. Remove dirt, dust, oil, grease, asphalt and foreign matter.
- C. Patch holes or voids.
- D. Rout out cracks exceeding 1/16 inches 1.5 mm wide and caulk.
- E. Caulk non-moving joints up to 1 inch 25 mm wide with suitable backer and sealant.
- F. Do not caulk or overcoat joints where movement exceeds 25% or joints over 1 inch 25 mm wide.
- G. Protect adjacent surfaces not designated to receive curing compound.

3.3 INSTALLATION

- A. Do not apply to surfaces scheduled to receive cementitious coatings or toppings, such as concrete, terrazzo, polyester or epoxy coatings.
- B. Apply in accordance with manufacturer's recommendations; minimum 2 coats.
 - 1. Apply first coat at not over 400 square feet/gal 9.8 m²/L.
 - 2. Apply subsequent coat not over 400 square feet/gal 9.8 m²/L.
- C. Allow no traffic on sealed surface for 72 hours after application.

3.4 PATCHING AND CLEANING

- A. Patch areas which fail to match adjacent work.
- B. Broom clean surface after completion of work.

END OF SECTION

SECTION 09 79 11
WOOD INTERIOR WALL AND CEILING PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for wood veneer laminate panels and attachment system for walls and ceilings, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 RELATED SECTIONS

- A. Section 06 10 00 "Rough Carpentry."
- B. Section 09 22 16 "Non-Structural Metal Framing."
- C. Section 09 81 13 "Acoustic Board Insulation" for acoustic batts for ceiling panels.
- D. Section 26 51 13 "Building Lighting."

1.3 REFERENCE STANDARDS

- A. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a
- B. ASTM D6007 - Formaldehyde emission testing

1.4 SUBMITTALS

- A. Product Data: See Section 01 33 00 – SUBMITTAL PROCEDURES for additional requirements
- B. Product Data: Submit manufacturer's product data, including sub-framing system and accessories.
- C. Shop Drawings: Show panel attachment system, spacing and member type, panel layout, fastener spacing, corner and transition details.
- D. Samples: Submit two samples of each finish/color and perforation pattern of wall and/or ceiling panels.
- E. Installation Instructions: Refer to Manufacturer's technical guide for instructions including surface preparation, installation procedures and cleaning and care.
- F. Contract Closeout Information:
 - 1. Maintenance data:
 - a. See Section 01 78 23.

1.5 MOCK-UP

- A. Construct system mock-up. Size of mock up to include two full ceiling panels and two full wall panels.
- B. Mock-up may remain as part of the Work upon acceptance.

1.6 DELIVERY, STORAGE, CONDITIONING, AND HANDLING

- A. Transportation:
 - 1. Transport panels horizontally and strapped down to avoid sliding across one another.
 - 2. Protect edges and corners.
 - 3. Maintain in original protective packaging until use.

B. Storage:

1. Refer to manufacturer's current technical guide for information.
2. Panels must be stored in a clean, dry and well-ventilated place, sheltered from the weather and extremes of temperature. External environments are unacceptable for storage.
3. Panels must be placed in a horizontal position and always in the original packaging.
4. The storage temperature must be between 50-77°F with a Relative Humidity between 30-70%.
5. If any panel needs repackaging, use only the original packaging material.
6. All material must be placed (still in its original packaging) in the center of the room or area in which it is to be installed, at least 72 hours prior to installation. Product should remain in its original packaging until immediately prior to installation.
7. Do not lean or store any packaging in direct contact with walls, leaving a minimum space of 24" around all sides.
8. Stack packaging horizontally (on a minimum of 4 equidistant battens) to ensure air flow around the crates / boxes. The packaging must rest on a flat surface, to prevent deflection/deformation of the panels.
9. The room environment before and during the installation must be maintained between 59-80°F, with the relative humidity between 40% and 65%.
10. To avoid deformations, fissures or other permanent damage to the material, the environment after installation must be maintained between 59-80°F, with the relative humidity between 40% and 65%.
11. If necessary, use auxiliary humidification/dehumidification devices to ensure these values are achieved.
12. If the above requirements are not strictly followed, irreversible damage to the material may occur.

1.7 WARRANTY

- A. See Section 01 78 36 "Warranties" for additional warranty requirements.
- B. Provide Manufacturer's 10-year Warranty covering finish, proprietary connection system, and face lamination.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Wood veneer wall and ceiling panels:
 1. Parklex Prodema.
 2. Optional:
 - a. Architectural Components Group.
 - b. Armstrong.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Prefinished Wall Panels:
 1. Basis of design: "NaturPanel-W S" by Parklex Prodema, Type S. Refer to Interior Finish Legend.
 2. Panel components:

High pressure laminate with natural timber veneer adhered to a birch plywood core with high pressure laminate balancer (backer).

3. Size: 48 inches x 96 inches maximum.
 4. Size and Thickness: As indicated on Drawings.
 5. Color and texture: As indicated on Drawings.
 6. Edge: square.
 7. Fire Classification: ASTM E84, Class C.
- B. Prefinished Ceiling Panels:
1. Basis of design: "NaturHardPanel-W" by Parklex Prodema, Type S. Refer to Interior Finish Legend.
 2. Panel components:
 - 1) High pressure laminate core with a natural timber veneer protected with a moisture resistant overlay.
 3. Size: 48 inches x 96 inches maximum. Size as indicated on Drawings.
 4. Color and texture; As indicated on Drawings.
 5. Edge: square
 6. Fire Classification: ASTM E84, Class C.
 7. Perforation pattern: as indicated on Drawings.
 8. Install ceiling panels with an acoustic board insulation overlay.

2.3 ACCESSORIES

- A. Wall and Ceiling panel attachment: Manufacturer's interior hanging hook system.
1. Panel screws
 2. Interior hooks
 3. Interior hanging rail

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine substrate and framing members for alignment
- B. Notify Engineer of conditions that would adversely affect installation.
- C. Do not begin surface preparation or installation until unacceptable conditions are corrected.
- D. Securely install wall framing or furring system plumb and square, and correctly spaced to accommodate panel system.
- E. Installation indicates acceptance of conditions and responsibility for performance.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
 1. Anchor panels securely to walls with screws and aluminum furring strips.
 2. Allow for panel expansion and contraction.
- B. Clean stains and excess adhesive from boards following manufacturer's instructions.
 1. Do not use abrasive cleaning cloths or sponges, or harsh solvents such as trichloroethylene-perc, ammonia or any other carpet cleaning products, acidic products or paint and grease solvents on any surface to clean boards.
- C. If panels are damaged during construction or correction period, contact Manufacturer for instructions on repair or replacement.

END OF SECTION

SECTION 09 81 13
ACOUSTIC BOARD INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Acoustic Board Insulation System - Fiberglass, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience on projects of similar size and complexity.
- B. ASTM International (ASTM):
 - 1. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 2. ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulations
 - 3. ASTM C1104/C1104M Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation ASTM C1338 Fungi Resistance.
 - 4. ASTM C303 Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation
 - 5. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
 - 6. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials

1.3 RELATED SECTIONS

- A. Section 09 79 11 "Wood Interior Wall and Ceiling Panels"

1.4 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's literature indicating material in compliance with specifications.
- B. Samples:
 - 1. Two, 6 inches x 6 inches pieces of each board type specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acoustic Board Insulation:
 - 1. Base:
 - a. Owens Corning
 - 2. Optional:
 - a. Knauf Insulation
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

- A. Compressive Strength:
 - 1. 10% deformation: 25LB/SF.
 - 2. 20% deformation: 90LB/SF.
- B. Water Vapor Sorption:
 - 1. Less than 3% by weight at 120 degrees F, 95% relative humidity.

- C. Surface Burning Characteristics:
 - 1. Class I/Class A.
 - 2. Flame Spread: less than 25.
 - 3. Smoke Developed: less than 50.
- D. Acoustical panel assembly, designed, manufactured, fabricated and installed to provide 1.00 Noise Reduction Coefficient (NRC) rating.

2.3 MATERIALS

- A. Acoustical Boards:
 - 1. Square edge.
 - 2. Inorganic glass fibers.
 - 3. Dimensionally stable.
 - 4. Mildew resistant.
 - 5. Non-corrosive.
 - 6. Thickness:
 - a. 2 inches
 - 7. Size:
 - a. 48 inches x 96 inches
 - 8. Color:
 - a. Black.
 - 9. SelectSound Black Acoustic Board by Owens Corning.
- B. Miscellaneous Components:
 - 1. Provide fasteners, adhesives and items necessary for complete installation.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities and dampness affecting quality and execution of work.
- B. Do not proceed with installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install in accordance with manufacturer recommendations.
- B. Cut insulation to fit around penetrations, including outlets, junction boxes and irregularities.
- C. Provide supplemental support where insulation does not fill cavity depth.
- D. Prepare surfaces prior to installation of adhesive and impaling pin installation.
- E. Locate pins to ensure tight fit.
- F. Provide pin tips where exposed.

3.3 CLEANING, PROTECTION AND REPAIRS

- A. Protect installed work from damage including temperature, humidity and dust.
- B. Touch up any minor finish damage.
- C. Remove and replace work which cannot be successfully cleaned or repaired.

END OF SECTION

SECTION 09 91 13 EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Exterior Painting, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Definitions:
 - 1. "Paint" and "painting" refer to applied coatings.
 - 2. Mechanical work and equipment: Work included in Mechanical Specification Divisions.
 - 3. Electrical work and equipment: Work included in Electrical Specification Divisions.
- B. Work Included:
 - 1. Exterior surfaces scheduled to be painted, unless indicated to be painted under other sections.
 - 2. Mechanical and electrical work:
 - a. Exterior equipment and items not completely factory finished.
- C. Surfaces not to be painted:
 - 1. Colored, split-face, patterned, ground-face, glazed, and other concrete masonry units with integral architectural finish.
 - 2. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.
 - 3. Moving parts of valves, operating units, mechanical and electrical parts, such as valve and damper operators, sending devices, motor and fan shafts.
 - 4. Code labels, such as UL, FM that are Mylar or flat, non-embossed, plates.
 - a. Embossed plates and labels stamped into frames will be painted, label and information on label to be readily visible and convenient for identification by authority having jurisdiction.
 - 5. Equipment identification or rating plates.
 - 6. Items having complete factory finish with exception of:
 - a. Exterior mechanical equipment.
 - b. Exterior electrical equipment.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data for each paint type to be applied indicating conformance to specifications.
- B. Samples:
 - 1. Manufacturer's full palette of colors for selection by Engineer.
 - 2. Provide three 8-1/2 inches x 11 inches samples of each color and finish selected.
 - 3. MPI Gloss samples.
- C. Contract Closeout Information:
 - 1. Maintenance data:
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide paint as product of one manufacturer as far as possible.
- B. Paint, stain, and coating systems listed are Sherwin Williams unless noted otherwise.
 - 1. Use comparable performance and aesthetic requirements for Paints by Optional manufacturers.
- C. Paints:
 - 1. Base:
 - a. Sherwin-Williams.
 - 2. Optional:
 - a. Benjamin Moore.
 - b. PPG Paints.
- D. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Paints and Stain Systems:
 - 1. Paint, stain, and coating systems listed are Sherwin-Williams unless noted otherwise.
 - 2. Colors:
 - a. PT-3: Sherwin Williams SW7007 "Ceiling Bright White," Satin gloss.
 - b. PT-4: Sherwin Williams SW9166 "Drift of Mist," Satin gloss.
 - c. PT-5: Match color selected for exterior trim and roofing.. See Section 07 61 13 "Standing Seam Metal Roofing."
 - 3. Gloss range: As indicated for the Paint Systems, when measured in accordance with ASTM D523:
 - a. Flat: Below 15, at 85-degrees.
 - b. Eggshell: Between 5 and 20, at 60-degrees.
 - c. Satin: Between 15 and 35, at 60-degrees.
 - d. Gloss: More than 65, at 60-degrees.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces for defects and correct to prevent unsatisfactory results.
- B. Verify compatibility of intermediate and topcoat finishes applied over surfaces primed by others.
- C. Commencement of work constitutes acceptance of surfaces and responsibility for performance.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Clean substrates of substances that could affect appearance or impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
 - 2. Remove mildew and neutralize surface.

- C. Prior to painting, test surfaces with moisture meter.
 - 1. Paint when moisture is within paint manufacturer's acceptable limits.
- D. Wood:
 - 1. Immediately before applying finish:
 - a. Sand surfaces with 180 grit or finer sandpaper, as necessary to accomplish the following:
 - 1) Smooth surface texture.
 - 2) Prepare grain to receive finish.
 - b. Remove dust.
 - 2. Opaque Finishes:
 - a. After priming coat has dried, seal knots, pitch and resinous sapwood.
- E. Ferrous Metal and Hollow Metal:
 - 1. Follow requirements of SSPC SP1 and SP3.
 - a. Except where higher prep levels are indicated.
 - 2. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
 - 3. Touch up damaged shop coats.
 - 4. For surfaces with touched up shop coat, omit first coat.
 - 5. Hollow metal frame joints at intersections of Rabbets, Stops, and Soffit Joints:
 - a. Neatly fill corner seam with painter's caulk (in field) prior to painting.
- F. Galvanized Metal and Non-anodized Aluminum:
 - 1. Follow requirements of SSPC SP1.
 - 2. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.
- G. Gypsum Wallboard:
 - 1. Repair minor irregularities left by finishers.
 - 2. Exercise care to avoid raising nap of paper.
 - 3. Apply prime coat.
 - 4. Notify gypsum wallboard finisher to repair and refinish areas which indicate defects after application of primer.
 - 5. Re-prime refinished areas.
 - 6. Obtain engineer's approval of finish for surfaces to receive high build glazed coatings.

3.3 APPLICATION

- A. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items, or provide ample in place protection.
- B. Touch up abraded areas of shop prime coats, suction or hot spots in plaster, gypsum wallboard, concrete block, and concrete before painting.
- C. Provide coverage to hide.
 - 1. Evenly spread and smoothly flow on for full, smooth cover.
 - 2. Apply additional coats where undercoats show until paint film is of uniform finish and color.
- D. Back prime wood trim with penetrating sealer.
- E. Apply additional coats in accordance with manufacturer's instructions.

- F. Upon completion of painting, replace removed items and remove protection.
- G. Finish colors not indicated shall be selected by Engineer from paint manufacturer's standard colors.

3.4 PROTECTION AND CLEANUP

- A. Provide WET PAINT signs.
- B. Protect adjacent work from damage by painting and finishing work.
- C. Remove temporary protective wrappings, after completion of operations.
- D. Clean, repair or replace, and repaint damaged work.

3.5 EXTERIOR PAINT SYSTEMS

- A. Direct-Applied Exterior Finish System (DEFS) Soffits:
 - 1. Latex, Gloss Level 4, Satin:
 - a. Sherwin-Williams:
 - 1) Prime coat: Loxon Concrete and Masonry Primer.
 - 2) Intermediate coat: Duration Exterior Acrylic Latex, Satin.
 - 3) Topcoat: Duration Exterior Acrylic Latex, Satin.
- B. Exterior Metal Doors, Frames and Miscellaneous Metals - Ferrous, Primed, Zinc-coated, and Aluminum:
 - 1. Water based urethane, Gloss Level 4, Semi-Gloss:
 - a. Sherwin-Williams:
 - 1) Prime coat: Pro Industrial Pro-Cryl Universal Acrylic Primer.
 - 2) Intermediate coat: Water based Acrolon 100 Urethane, Semi-Gloss.
 - 3) Topcoat: Acrolon 100 Urethane, Semi-Gloss.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Interior Painting, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Definitions:
 - 1. "Paint" and "painting" refer to applied coatings.
 - 2. Finished room or space: Room or space indicated to receive a finish as indicated in architectural and interior drawings. .
 - 3. Mechanical work: Work included in Mechanical Specification Divisions.
 - 4. Electrical work: Work included in Electrical Specification Divisions.
- B. Work Included:
 - 1. Interior surfaces in finished rooms or spaces, unless indicated not to be painted or indicated to be painted under other sections.
 - 2. Mechanical and electrical work:
 - a. Interior mechanical and electrical equipment not completely factory finished.
 - b. In finished rooms and spaces: Exposed ductwork, piping, insulated piping, conduit, busways, raceways, and associated accessories.
 - c. Where duct surfaces are visible through grilles or diffusers, paint visible surfaces of ducts flat black.
- C. Surfaces Not to be Painted:
 - 1. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.
 - 2. Moving parts of valves, operating units, motor and fan shafts, sending devices or mechanical and electrical parts such as valve and damper operators.
 - 3. Code labels, such as UL, FM that are mylar or flat, non-embossed plates.
 - a. Embossed plates and labels stamped into frames are to be painted.
 - b. Information shall be readily visible and convenient for identification by authority having jurisdiction.
 - 4. Equipment identification or rating plates.
- D. Factory Finishing of Wood Items Specified Elsewhere:
 - 1. Flush Wood Doors: See Section 08 14 16.
- E. ASTM International (ASTM):
 - 1. ASTM D2486 Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints.
 - 2. ASTM D2805 Standard Test Method for Hiding Power of Paints by Reflectometry.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data for each paint system specified.

- B. Samples:
 - 1. Three 8 1/2 inches x 11 inches samples of each color and finish as noted in Drawing Finish Schedule.
 - 2. Gloss samples.
- C. Contract Closeout Information:
 - 1. Maintenance data:
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Paints:
 - 1. Base:
 - a. Sherwin-Williams
 - 2. Optional:
 - a. Benjamin Moore
 - b. PPG Paints
 - c. Pratt & Lambert
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Manufacturers listed as noted in Drawing Interior Finish Legend are for color reference only.
- B. Provide paint products from one manufacturer as far as possible.
- C. Paints and Stain Systems:
 - 1. Paint, stain, and coating systems are by Sherwin-Williams unless noted otherwise.
 - 2. Interior Paints shall not contain cadmium or lead.
- D. Colors:
 - 1. As noted in Drawing Interior Legend and as indicated in Section 23 05 53.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces for defects and correct to prevent unsatisfactory results.
- B. Verify compatibility of intermediate and topcoat finishes applied over surfaces primed by others.
- C. Commencement of work constitutes acceptance of surfaces and responsibility for performance.
- D. Do not paint items having complete factory finish with exception of items noted in Drawing Finish Schedule and as indicated in Section 23 05 53.

3.2 PREPARATION

- A. Verify surfaces are clean, dry and free of foreign materials which will affect adhesion or appearance.
- B. Remove mildew and neutralize surface.
- C. Eliminate efflorescence before painting.
- D. Prior to painting, test surfaces with moisture meter.
 - 1. Paint when moisture is within paint manufacturer's acceptable limits.

- E. Wood:
 - 1. Sand surfaces receiving finish with 180-grit, or finer sandpaper.
 - a. Remove fingerprints and marks.
 - b. Produce smooth texture.
 - c. Prepare grain to receive finish.
 - 2. Remove dust.
 - 3. Opaque Finishes:
 - a. Back prime wood trim with penetrating sealer.
 - b. Seal knots, pitch and resinous sapwood.
 - 4. Stain and Clear Finishes:
 - a. Treat wood with compatible washcoat prior to stain application.
 - b. Putty nail holes and minor defects, to match finish wood color.
- F. Ferrous Metal and Hollow Metal:
 - 1. Follow requirements of SSPC SP1 and SP3 except where higher preparation levels are indicated.
 - 2. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
 - 3. Touch up damaged shop coats.
 - 4. Caulk hollow metal frame joints, corner seams, intersections of rabbets, stops, and soffit joints prior to painting.
- G. Galvanized Metal and Non-anodized Aluminum:
 - 1. Follow requirements of SSPC SP1 except where higher preparation levels are indicated.
 - 2. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.
- H. Gypsum Wallboard:
 - 1. Repair minor irregularities.
 - 2. Avoid raising nap of paper.
 - 3. Apply prime coat.
 - 4. Correct areas showing defects after application of primer.
 - 5. Re-prime refinished areas.
- I. Concrete and Masonry:
 - 1. Repair minor defects.
 - 2. Remove oil from concrete.
 - 3. Block Filler:
 - a. Minimum Nominal Thickness: 10 mil 0.25 mm DFT.
 - 1) Comply with manufacturer's recommended coverage rates for conditions encountered.
 - b. Provide complete cover with recommended coating system.
 - c. Fill pinholes and minor surface defects.
 - d. Apply by brush, roller, or sprayer.
 - 1) Back-roll spray applied filler with roller or squeegee.

3.3 APPLICATION

- A. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items, or provide ample in place protection.
- B. Touch up abraded areas of shop prime coats, suction or hot spots in plaster, gypsum wallboard, concrete block, and concrete before painting.
- C. Provide coverage to hide.
 - 1. Evenly spread and smoothly flow on for full, smooth cover.
 - 2. Apply additional coats where undercoats show until paint film is of uniform finish and color.
- D. Back prime wood trim with penetrating sealer.
- E. Apply additional coats in accordance with manufacturer's instructions.
- F. Finish closets and semi-exposed surfaces to match nearest adjoining surfaces.
 - 1. Include surfaces behind grills.
- G. Upon completion of painting, replace removed items and remove protection.

3.4 PROTECTION AND CLEANUP

- A. Provide WET PAINT signs.
- B. Protect adjacent work from damage by painting and finishing work.
- C. Remove temporary protective wrappings, after completion of operations.
- D. Clean, repair or replace, and repaint damaged work.

3.5 INTERIOR PAINT SYSTEMS

- A. Gypsum Wallboard and Plaster Surfaces, Walls:
 - 1. Latex (PNTL), Gloss Level 3, Eggshell:
 - a. Sherwin-Williams:
 - 1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.
 - 2) Intermediate coat: ProMar 200 Zero VOC Interior Latex Eg-Shel.
 - 3) Topcoat: ProMar 200 Zero VOC Interior Latex Eg-Shel.
 - 2. Epoxy (PNTE), Gloss Level 3, Eggshell:
 - a. Sherwin-Williams:
 - 1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.
 - 2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Eg-Shel.
 - 3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Eg-Shel.
- B. Gypsum Wallboard - Ceilings and Interior Soffits:
 - 1. Latex (PNTL), Gloss Level 1, Flat:
 - a. Sherwin-Williams:
 - 1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.
 - 2) Intermediate coat: ProMar 200 Zero VOC Interior Latex, Flat
 - 3) Topcoat: ProMar 200 Zero VOC Interior Latex, Flat.

- 2. Epoxy (PNTE), Gloss Level 3, Eggshell:
 - a. Sherwin-Williams:
 - 1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.
 - 2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Eg-Shel.
 - 3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Eg-Shel.
- C. Metal Stairs, Handrails, Guardrails and Miscellaneous Metals - Ferrous, Primed, Zinc-coated, and Aluminum:
 - 1. Waterborne epoxy, Gloss Level 6, Gloss:
 - a. Sherwin-Williams:
 - 1) Prime coat: Pro Industrial Pro-Cryl Universal Primer.
 - 2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
 - 3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
- D. Duct Surfaces Visible Through Grilles or Diffusers:
 - 1. Interior Latex Gloss Level 1 Flat:
 - a. Sherwin-Williams:
 - 1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.
 - 2) Topcoat: ProMar 200 Interior Latex, Flat.
 - a) Color: Black.
- E. Metal Doors and Frames:
 - 1. Waterborne epoxy, Gloss Level 5 Semi-gloss:
 - a. Sherwin-Williams:
 - 1) Prime coat: Pro Industrial Pro-Cryl Universal Primer.
 - 2) Intermediate coat: Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-Gloss.
 - 3) Topcoat: Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-Gloss.

END OF SECTION

SECTION 10 21 12
METAL TOILET PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Metal Toilet Partitions, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ANSI/BHMA:
 - a. A156.18, Materials and Finishes.
 - 2. ASTM:
 - a. A480, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - b. B456, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - 3. U.S. Department of Justice:
 - a. ADA Standards for Accessible Design, current addition.
 - 4. ICC/ANSI:
 - a. ICC/ANSI 117.1 Accessible and Usable Buildings and Facilities.

1.3 RELATED SECTIONS

- A. Section 05 50 00 "Metal Fabrications" for concealed support framing for floor-to-ceiling anchored partitions.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Prepare detail drawings for all applications including:
 - a. Room layout.
 - b. Component sizes and dimensions.
 - c. Attachment details and coordination with adjacent work.
- B. Product Data:
 - 1. Product data sheets and details for Metal Toilet Partitions, components and accessories.
 - 2. Product literature for hardware.
- C. Samples:
 - 1. Three 8 1/2 inches x 11 inches samples of each color and finish as noted in Drawing Finish Schedule.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Metal Toilet Partitions:
 - 1. Base:
 - a. Accurate or Global Partitions by American Specialties Inc.

2. Optional:
 - a. Bradley.
 - b. General Partitions Manufacturing Corporation.
 - c. Hadrian.
 - d. Metpar Corporation.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Metal Toilet Partitions:
 1. Type 304 stainless steel sheet formed over panel core material.
 2. Stainless steel finish: ASTM A480/A480M No. 4 satin, directional polish on exposed faces. Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.
 3. Panel core material:
 - a. Double-faced, impregnated, kraft paper honeycomb.
 - b. Vermin and moisture resistant.
 - c. Sound deadened.
 4. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections are not acceptable.
 5. Component Thicknesses:
 - a. Pilasters: 1-1/4 inches.
 - b. Doors, Panels and Urinal Screens: 1 inch.
 6. Panel Height: 58 inches high.
 - a. Mounting Height: 12 inches AFF to bottom of panel; 70 inches AFF to top.
 7. Stall Dimensions: As indicated on Drawings.
 8. Minimum sheet steel thicknesses:
 - a. Pilasters: 20 GA.
 - b. Panels and screens: 22 GA.
 - c. Doors: 22 GA.
- B. Doors:
 1. For 32 inches or wider standard stalls: Minimum 26 inches wide.
 2. For standard stalls less than 32 inches wide: Minimum 24 inches wide.
 3. For accessible stalls:
 - a. Minimum 32 inches clear opening.
 - b. Self-closing.
- C. Pilasters:
 1. Adjustable hanger, leveling bolts, or both.
 2. Floor-mounted / Overhead-braced:
 - a. Secure pilaster to floor with minimum of 2 lead expansion shields and anchor screws.

- b. Overhead brace:
 - 1) Continuous anti-grip aluminum tube, minimum 1/8 inches wall thickness, clear anodized.
 - 2) Install brace at 82 inches AFF.
 - c. Securely attach brace to top of each pilaster and to wall.
 - d. Provide shoes at each pilaster.
 - D. Urinal Screens:
 - 1. Wall Hung:
 - a. Size:
 - 1) 18 inches x 48 inches.
 - b. Same construction and finish as toilet compartments.
 - c. Continuous, double-flanged wall bracket.
 - E. Pilaster Shoes:
 - 1. AISI Type 302/304 18-8 stainless steel.
 - 2. 20 GA, 3 inches high.
 - F. Stirrup Brackets:
 - 1. Manufacturer's heavy duty design for attaching panels to walls and pilasters.
 - 2. Chromium plated brass or Type 302 stainless steel.
 - G. Operational Hardware:
 - 1. Material: Chrome plated brass or stainless steel.
 - 2. Universal Knob/Lever:
 - a. Concealed in door.
 - b. ADA compliant.
 - c. Emergency Access.
 - 3. Strike:
 - a. Wrap around type strike/keeper designed to properly receive and hold latch.
 - b. Integral bumper.
 - 4. Door pull:
 - a. ADA compliant.
 - H. Bumper Coat Hook:
 - 1. Rubber tipped combination bumper and coat hook.
 - 2. Provide one for each compartment.
 - I. Pivot Hinges:
 - 1. Cam action, self-closing, inset into cut-out in door.
 - 2. Top Pivot: 1/2 inches nylon pin.
 - 3. Bottom Pivot: 3/16 inches Stainless Steel pin.
 - 4. Body Material: Chromium plated brass or stainless steel
 - 5. Adjustable to permit doors to rest position at any angle within a 270 degrees arc.
 - J. Toilet Tissue Holders and related Accessories:
 - 1. See Section 10 28 13.

- K. Anchorages and fasteners:
 - 1. Exposed fasteners:
 - a. Tamper-resistant, stainless steel or brass.
 - b. Finish: match hardware
 - 2. Concealed anchors:
 - a. Hot dip galvanized steel.
 - b. ASTM A385

2.3 FABRICATION

- A. Verify dimensions in field prior to fabrication.
- B. Pre-assemble units in shop to greatest extent possible. No field cutting of panels allowed.
- C. Pressure laminate face sheets to core material.
 - 1. Seal edges with continuous locking strip.
 - 2. Miter, weld, and grind corners smooth or cap with manufacturer's standard stainless steel edge and corner fittings.
- D. Provide concealed reinforcement for installation of hardware, fittings, brackets, and accessories.
- E. Reinforce panels for attachment of grab bars.
- F. Finishing:
 - 1. Clean surfaces of processing compounds and contaminants.
 - 2. Pretreat with a phosphate coating.
 - 3. Apply rust inhibiting primer.
 - 4. Apply thermosetting powder coat in accordance with paint manufacturer's instructions to provide minimum 1.5 mil dry film thickness.
- G. Exposed Metal and Hardware Finishes:
 - 1. Stainless steel:
 - a. ASTM A480, bright polished finish No. 4; or
 - b. ANSI/BHMA A156.18, Code 629; to match US32.
 - 2. On brass, bronze, and steel:
 - a. ASTM B456, SC-2 bright chromium plated over nickel plating; or
 - b. ANSI/BHMA A156.18, Code 625 on brass and bronze, Code 651 on steel; to match US26.
 - 3. Aluminum:
 - a. AA-M12C22A31 clear satin anodized; or
 - b. ANSI/BHMA A156.18, Code 628; to match US28.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate to accept installation.
- B. Verify that adequate Wall Backing has been installed.
 - 1. Metal Wall Backing: Specified in Section 09 22 16.
 - 2. Coordinate and direct installation at locations required for Toilet Partitions and accessories.

- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install in a rigid, straight, plumb and level manner, to indicated layout.
- B. Clearances:
 - 1. Between pilasters and panels: Maximum 1/2 inches.
 - 2. Between panels and walls: Maximum 1 inch.
 - 3. Between doors and pilasters: Maximum 3/16 inches.
 - 4. Between floor and bottom of panels: 12 inches.
- C. Secure to walls with minimum of 2 stirrup brackets near top and bottom of panel.
 - 1. Locate brackets so holes occur in masonry or tile joints.
 - 2. Use manufacturer's recommended anchoring devices, as indicated on shop drawings.
- D. Floor Mounted / Overhead Braced Partitions:
 - 1. Secure pilasters to floor.
 - 2. Level, plumb, and tighten.
 - 3. Secure overhead brace with minimum of two fasteners per pilaster.
 - 4. Set tops of closed doors parallel with overhead brace.
- E. Urinal Screens:
 - 1. Provide wall channels, wall plates and studs as recommended by manufacturer to suit wall construction.
 - 2. Set units in accordance with manufacturer's instructions to support units and resist impact.

3.3 ADJUST AND CLEAN

- A. Adjust and lubricate hardware for proper operation after installation.
 - 1. Set hinges on in-swing doors to hold unlatched doors open approximately 30 degrees.
 - 2. Set hinges on out-swing doors to return to fully closed position.
- B. Protect until time of acceptance by Owner.
- C. Replace damaged work as directed.
- D. Perform final adjustments just prior to final inspection.
- E. Clean exposed surfaces, hardware, fittings, and accessories and touch up minor scratches and other imperfections using materials and methods recommended by manufacturer.

END OF SECTION

SECTION 10 28 13
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Toilet and Bath Accessories in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Provide accessories from one manufacturer as far as practicable.
- B. ASTM A240/A240M Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip
- C. U.S. Department of Justice:
 - 1. ADA Standards for Accessible Design.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's standard literature indicating systems and products specified.
- B. Contract Closeout Information:
 - 1. Maintenance data.
 - a. See Section 01 78 23.
 - 2. Letter stating that extra material has been delivered.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Toilet and Bath Accessories:
 - 1. Base:
 - a. American Specialties, Inc. (ASI)
 - b. As noted for specific items.
 - 2. Optional:
 - a. Bobrick Washroom Equipment
 - b. Bradley
 - c. GAMCO, a Division of Bobrick
 - d. Seachrome
 - e. Tubular Specialties Manufacturing (TSM)
 - f. A & J Washroom Accessories
 - g. Brey-Krause Manufacturing
- B. Electric Hand Dryers:
 - 1. Base:
 - a. American Specialties, Inc. (ASI)
 - 2. Optional:
 - a. Bobrick Washroom Equipment
 - b. Bradley
 - c. American Dryer

- d. Excel Dryer
 - e. Dyson
- C. Other manufacturers of a complete line of stainless steel accessories desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Type 304, 18-8 stainless steel per ASTM A240/A240M, unless noted otherwise.
 - 1. Finish: Satin #4 on exposed surfaces.
- B. Corrosion resistant fasteners and attachment devices, and other fittings necessary to assure function and operation of accessories.
- C. See drawings for items, quantities, and locations required.
- D. Locks:
 - 1. Tumbler locks keyed alike.

2.3 TOILET ACCESSORIES

- A. Toilet Tissue Dispensers:
 - 1. TA2:
 - a. Double Roll Tissue Dispenser.
 - b. Cast aluminum with ABS thermoplastic spindle.
 - c. Model 0264-1A by ASI.
 - d. Non-controlled delivery.
- B. Sanitary Disposal:
 - 1. TA5:
 - a. Model 0852 by ASI.
 - b. Surface mounted.
- C. Paper Towel Dispensers:
 - 1. TA7:
 - a. Model 0210 by ASI
 - b. Surface mounted
 - c. Capacity: 400 C-fold or 525 multi-fold towels
- D. Waste Receptacles:
 - 1. TA8:
 - a. Model 0828 by ASI.
 - b. Surface mounted.
- E. Soap Dispensers:
 - 1. TA9A
 - a. Automatic multi-feed soap dispensing system with central soap tank.
 - 1) Model B-820 by Bobrick, Inc. or equal as approved by Engineer.
 - 2) Counter-mounted dispenser.
 - 3) Soap type: foam, B-820-248 foam soap dispenser.
 - 4) Power: provide AC adapter for tank and dispenser operation.
 - 5) Central soap tank located in plumbing chase adjacent to restroom.
 - 6) Tank pump and sensors

2. TA9V:
 - a. Model 0347 by ASI.
 - b. All-purpose valve.
 - c. Surface mounted.
 - d. Locate right side of mirror.
 - e. Center over sink on side wall.
 - f. Mount with spout at 42 inches AFF.
- F. Mop Broom Rack:
 1. TA10:
 - a. Model 1308-3 by ASI.
 - b. Three rubber cam mop holders and four stainless steel hooks.
 - c. 34 inches wide with 8-inch deep shelf above.
 - d. Surface mounted.
 - e. Mount with top at 48 inches AFF.
- G. Mirrors:
 1. TA13:
 - a. Model 0600 by ASI.
 - b. Polished stainless steel framed mirror.
 - c. 18 inches wide by 36 inches high.
- H. Electric Hand Dryers:
 1. TA25:
 - a. Model 0185-93 by ASI.
 - b. Automatic ON by infrared sensor when hands are placed in sensor zone.
 - c. Housing:
 - 1) One-piece, seamless, 16 GA metal cover.
 - 2) Material: Type 304 stainless steel cover with No. 4 finish
 - d. Performance:
 - 1) Minimum 186 cubic feetM of heated air.
 - 2) Maximum Drying time: 25 seconds.
 - 3) Output Temperature Range: 149 degrees F +/- 5 degrees F @ 77 degrees F ambient.
 - e. Unit rating: 1600-2000 Watt.
 - 1) 1500 Watt nichrome wire heating element.
 - f. Sound level: 70 dB maximum
- I. Grab Bars:
 1. General:
 - a. Base Products: 3800 Series by American Specialties.
 - b. Bar Diameter: 1-1/2-inch OD.
 - c. Concealed mounting.

- d. Include anchoring devices to withstand minimum concentrated load of 250 pounds typical and 800 pounds at bariatric locations.
 - e. Include 3800M spacer to keep grab bar parallel to wall faces at offset conditions.
 - 2. TA33V:
 - a. 18-inch vertical grab bar.
 - 3. TA36:
 - a. 36-inch horizontal grab bar.
 - 4. TA37:
 - a. 42-inch horizontal grab bar.
- J. Sharp Dispenser:
 - 1. TA40
 - a. Model Bradley Corporation Needle Disposal Cabinet. 989-11

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrate to accept installation.
- B. Coordinate and direct installation of backing where required for toilet accessories.
- C. Verify that adequate wall backing has been installed.
 - 1. Coordinate and direct installation backing where required for toilet accessories.
 - 2. Utilize proprietary backing devices where available.
 - 3. At remaining locations, provide metal backing per Section 09 22 16.
- D. Correct deficiencies before proceeding to install accessories.
- E. Where item is mounted on or in a toilet partition, coordinate interior reinforcing location with partition manufacturer.
- F. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions.
 - 1. Install plumb, level, and rigidly anchored to substrates.
- B. Where drawings or schedule require barrier-free accessibility, install accessories in accordance with applicable regulations.
- C. Coordinate accessory locations to fit spaces.
- D. Coordinate items to avoid mounting conflicts.
- E. Mount items with theft-resistant fasteners.
- F. Seal grab bar mounting plate to shower walls with silicone sealant or gasket prior to installation of bar.

3.3 ADJUSTING AND CLEANING

- A. Protect accessories from damage due to construction.
 - 1. Remove protective coverings when no longer required.
- B. Test accessories and adjust for proper operation.
- C. Clean exposed surfaces.

END OF SECTION

SECTION 10 51 13 METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Metal Lockers, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. U.S. Department of Justice:
 - 1. ADA Standards for Accessible Design.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Shop Drawings:
 - 1. Drawings including room layout, elevations, component sizes and dimensions.
 - 2. Attachment details and coordination with adjacent work.
 - 3. Standard details of component construction.
- C. Samples:
 - 1. Full range of colors for selection.
- D. Project Closeout Information:
 - 1. Maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Standard Metal Lockers:
 - 1. Basis of design:
 - a. "70000 Series Standard Metal Gear Locker" by Salsbury Industries.
 - 2. Optional:
 - a.
 - b. Penco Products. Republic Storage Systems.
 - c. Lyon Metal Products.
 - d. List Industries.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Metal Wall Backing:
 - 1. See Section 09 22 16.
- B. Sheet Steel:
 - 1. Cold rolled for doors and door frames.
 - 2. Cold rolled or annealed for other parts.
 - 3. Free from surface imperfections.
- C. Fasteners:
 - 1. Zinc plated steel, including washers.
 - 2. Exposed bolt heads, slot-less type.

3. Provide lock washers for nuts on moving parts.
 4. Do not expose bolts or rivet heads on fronts of lockers or frames.
- D. Frames:
1. Minimum 0.06 inches (16 GA) channels or 0.09 inches (14 GA) angles with corners electrically welded to form a solid, one piece structure.
 2. Door stops at door openings.
 3. Rubber silencer at each latch hook location.
 4. Horizontal members between doors of multiple-tier lockers for rigidity.
 5. Extend vertical members to floor to form 6 inches legs.
 6. Provide adjusting devices at legs to permit leveling.
 7. Provide flush metal panels to fill between legs.
- E. Backs and Sides:
1. Minimum 0.024 inches (24 GA) steel.
 2. Flange backs on vertical edges and sides where they inter-member with backs, making double flanged rear corners.
- F. Exposed Locker Ends:
1. Minimum 0.06 inches (16 GA).
- G. Tops, Bottoms and Shelves:
1. Minimum 0.024 inches (24 GA) steel, flanged on all sides.
- H. Sloping Tops:
1. Continuous sloped, minimum 0.036 inches (20 GA) steel.
 2. Provide end closure pieces, corner and other fillers.
 3. Miter corner filler pieces.
- I. Doors:
1. One piece, 0.06 inches (16 GA) steel, flanged at edges if greater than 20 inches high or 12 inches wide.
 2. Reinforce inside of doors with minimum 0.036 inches (20 GA) vertical or horizontal steel channel as required by configuration.
 3. Door swing: 180 degrees.
 4. Stamped louvered vents in door faces.
 - a. Single tier lockers: Minimum 6 louver openings top and bottom of each door.
- J. Door Hinges:
1. Heavy duty, steel, full loop, 5-knuckle, tight pin.
 2. Minimum 0.074 inches (14 GA) thick, 2 inches high.
 3. Minimum 3 hinges per door 48 inches high and over.
- K. Base Closure:
1. Minimum 0.048 inches (18 GA) steel continuous recessed base.
 2. 4 inches high.
 3. Cover entire front and exposed ends of lockers.
 4. Flange bottoms inward for stiffening.
 5. Factory finish base to match lockers.

- L. Recessed Locker Trim:
 - 1. Minimum 0.048 inches (18 GA) steel.
 - 2. Provide at jambs and head of recessed lockers.
 - 3. 2 inches or 3 inches wide as necessary.
 - 4. Factory finish to match lockers.
 - 5. Secure to lockers with concealed fastening clips.
- M. Latching:
 - 1. ADA compliant handle.
 - 2. Rubber silencer at each latch hook.
 - 3. 3 point latching for single tier lockers.
 - 4. Friction catch for box lockers.
- N. Lock Type:
 - 1. Padlock Tabs:
 - a. Latch pull with hole to accept padlock.
 - b. Padlock provided by Owner/ Others.
- O. Accessories:
 - 1. Full-height lockers:
 - a. Provide one double prong hook at center of shelf or ceiling of locker.
 - 2. Provide shelf at lockers.
- P. Number Plates:
 - 1. Manufacturer's etched or stamped, non-ferrous metal number plates.
 - 2. Three digit numerals minimum 1/2 inches high.
 - 3. Sequence numbers as directed by Engineer.
 - 4. Attach plates centered, near top of each locker door, with two fasteners of same finish as number plate.
 - 5. No manufacturer's name allowed.
- Q. Sealant:
 - 1. Specified in Section 07 92 16.
- R. Color:
 - 1. To be selected by Engineer from manufacturer's full line.
- S. Locker Benches:
 - 1. Accessible fixed bench:
 - a. Pedestal:
 - 1) Minimum three per bench.
 - 2) 0.123 inches (10 GA) steel tubing 1-1/4 inches OD.
 - 3) Floor flanges and top anchors.
 - b. Bench seat:
 - 1) Laminated hardwood board 1-1/4 inches thick.
 - 2) Edges and corners rounded, and sanded.
 - 3) Seat depth: 20 inches.

- 4) Seat height: 18 inches.
 - 5) Length:
 - a) 72 inches.
 - c. Finish:
 - 1) Manufacturer's standard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
- B. Ensure that adequate wall backing has been installed.
- C. Correct unsatisfactory conditions.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lockers plumb, level, rigid, and flush, in accordance with the manufacturer's instructions.
- B. Conceal fasteners wherever possible.
- C. Install trim, filler, closure and metal base pieces with concealed fasteners to provide flush, hairline joint against adjacent surfaces.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean, lubricate, and adjust hardware.
 - 1. Adjust doors and latches to operate easily without binding.
 - 2. Verify that integral locking devices operate properly.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint.
 - 1. Do not permit use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory finished appearance.
 - 1. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

SECTION 12 05 01
FURNITURE AND FURNISHINGS - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Furniture and Furnishings in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Business and Institutional Furniture Manufacturers Association (BIFMA):
 - 1. BIFMA Product Safety and Performance Standards and Guidelines
- B. State of California Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation:
 - 1. TB 117-2013 Requirements, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture
- C. Furniture and furnishings found to be not in accordance with specifications and approved submittals will be rejected.
- D. Contractor replace rejected furniture and furnishings at no cost to Owner.
- E. Although not indicated, Work includes providing supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, complete and functional installation.
- F. Contractor is solely responsible for coordination of scope of Work for its own forces, and of Subcontractors and suppliers, and to complete Work, whether performed by the Contractor or a Subcontractor.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Shop Drawings:
 - 1. Provide Shop Drawing of custom furniture.
- C. Samples:
 - 1. Sample of fabric and finishes selected.
 - a. Clearly mark each sample with the following information:
 - 1) Furniture item code.
 - 2) Manufacturer.
 - 3) Finish and/or fabric code type.
- D. Contract Closeout Information:
 - 1. Maintenance data.
 - a. See Section 01 78 23.
 - b. Manufacturer's data on flame retardants used on polyurethane foams.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Description:
 - 1. Furnish labor, materials, tools, equipment, work and services for delivery, unloading, unpacking, assembly, staging and other handling of furniture and furnishings.
 - 2. Owner provide final placement and installation of furniture and furnishings.

- B. Job Conditions:
 - 1. Comply with applicable codes.
 - 2. Accomplish work to avoid damages to Project premises and to furniture and furnishings.
- C. Product Delivery:
 - 1. By manufacturer's normal means.
 - 2. In manufacturer's original labeled containers, or blanket wrapped.
 - 3. Contractor responsible for acceptance at Site.
 - 4. Schedule deliveries to avoid delaying work.
 - 5. Coordinate deliveries with the Owner's schedule.
- D. Product handling, staging and installation - general:
 - 1. For unloading, receiving and other handling of furniture and furnishings, use methods to avoid damage to items and structure.
 - 2. Protect furniture and furnishings items from weather damage.
 - 3. Handle items to avoid contamination from other sources.
 - 4. Place only in authorized areas as determined by Owner on Project site.
 - 5. Unpack items.
 - 6. Remove and dispose of debris.
 - 7. Inspect items for damage and correctness as soon as possible after delivery. Reorder so as to avoid delays.
 - 8. Replace, or repair to new condition, each damaged item.
 - 9. Use of repaired items in Project is subject to approval by Owner and Engineer.
 - 10. After unpacking furniture and furnishings, protect from dust accumulation by covering items with non-staining dust covers until final placement.
- E. Clean Up:
 - 1. Dispose of excess material and debris off site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. As indicated for each individual specification.
- B. Where no manufacturer is indicated, manufacturer to comply with requirements of specification.
- C. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Provide furniture and furnishings of each specialty type (as designated by Furniture Specification) by one manufacturer, except as may otherwise be indicated within specification.
- B. Furniture Specifications:
 - 1. See specification by item for individual specified items. Any discrepancies or questions shall be brought to the attention of the Engineer.
 - 2. No flame retardants are to be added to upholstery foam.
- C. Locking:
 - 1. Furniture, whether or not indicated, shall be lockable.
 - 2. Items located within the same room shall be keyed alike.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project site relative to adequacy of facilities available for delivery, unloading, unpacking, staging and other handling of items.
- B. Do not start work until unsatisfactory conditions have been corrected.
- C. Start of work constitutes acceptance of responsibility for performance.

3.2 ORDERING

- A. Order materials required promptly after receipt of signed contract or letter of intent, and provide the Engineer with dated copies of purchase orders at same time order has been placed.
- B. Provide the Engineer with dated copies of manufacturers acknowledgements of orders upon receipt.
- C. Supply fabric samples of C.O.M.'s and verify quantities of C.O.M.'s.

3.3 INSTALLATION

- A. Coordinate the receiving, handling, storage, delivery and installation with Owner's schedule.
- B. Inquiries regarding delivery and installation requirement dates shall be direct to Owner.
- C. Follow manufacturer's printed instructions and drawings for additional assembly required on site for furniture and furnishings
- D. Work shall be performed with skilled installers.
- E. If the Contractor proposes to use a subcontractor to provide the installation service, proposed subcontractor and qualifications shall be submitted with the Contractor's bid.
- F. If the proposed subcontractor is approved by Owner and Engineer, Contractor shall, upon request, submit written evidence that a contract exists between Contractor and Installer.
- G. Test and adjust furniture and furnishing items for satisfactory operation.
- H. Location requirements and furniture code items are indicated on Furniture Floor Plans, I-Sheets.
- I. Each individual item shall have a manufacturer's tag with model numbers, Engineer's furniture code, and the room number in which the item is to be placed.
- J. Verify local conditions, corridor, elevators and stair clearances to allow installation of large items.
- K. Items determined to be too large to negotiate and fit shall be manufactured in sections and assembled at site.
- L. Areas should be field verified before ordering to make sure that furniture will fit.
- M. Take precaution to protect the building from damage during installation.
- N. Damage deemed the responsibility of the Contractor shall be repaired or replaced at no cost to the Owner.
- O. Verify quantities on the drawings and report any discrepancies to the Engineer.

3.4 CLEANUP

- A. Periodically and upon completion of installation, remove waste, dirt, wrappings, and excess materials, tools and equipment, and thoroughly clean.
- B. Furniture and furnishings shall be left in show room condition and ready for use.

END OF SECTION

SECTION 12 36 63
SOLID SURFACE FABRICATIONS (SSF)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Solid Surface Fabrications, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Applicable standards:
 - 1. International Association of Plumbing and Mechanical Officials (IAPMO)
 - a. IAPMO Z124 Plastic Plumbing Fixtures.
 - 2. ASTM International:
 - 3. National Electrical Manufacturers Association (NEMA).
 - a. NSF International.
 - 1) NSF/ANSI Standard 51 for food zone - all food types.
 - 4. Manufacturer's certification of fabricator and installer.
- B. Installer Qualifications:
 - 1. Successfully installed at least five projects within the past four years, utilizing systems, materials and techniques as specified or required by product manufacturer.
- C. Manufacturer Certification of Fabricator and Installer:
 - 1. Certified by manufacturer.
 - 2. Submit prior to Shop Drawings.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Show location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components.
 - 2. Show full size details, edge details, thermoforming requirements, attachments, etc.
 - 3. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement.
 - 4. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in surface.
 - 5. Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Product Data:
 - 1. Manufacturer's product data sheets, details and installation instructions for Solid Surface Fabrications, components, and accessories.
- C. Samples:
 - 1. For each SSF color selected:
 - a. Minimum 6 inches x 6 inches sample in specified gloss.
 - b. Cut sample and seam together for representation of inconspicuous seam.
 - c. Indicate full range of color and pattern variation.

2. Sealant colors for selection.
 3. Approved samples will be retained as a standard for work.
- D. Project Information:
1. Manufacturer's current certification of Fabricator and Installer prior to submittal of Shop Drawings.
- E. Contract Closeout Information:
1. Warranty.
 2. Maintenance data.
 - a. See Section 01 78 23.

1.4 WARRANTY

- A. Manufacturer's ten (10) year warranty including colorfastness and material defects.
1. Warranty shall provide material and labor to repair or replace defective materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Solid Surface Fabrications (SSF):
1. Base:
 - a. Corian by DuPont.
 - b. Refer to Interior Finish Legend.
 2. Optional:
 - a. Avonite by Aristech Acrylics LLC.
 - b. Hi-Macs by LG Decorative Surfaces.
 - c. Wilsonart Solid Surface.
- B. Sealant:
1. Base:
 - a. Color Rite.
 2. Optional:
 - a. As approved by SSF manufacturer.
- C. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Solid Surface Materials:
1. Cast, non-porous, homogeneous, acrylic polymer composition with additional fire retardant fillers and pigments.
 - a. Prime product may not be coated, laminated or of composite construction.
 2. Defects with depth less than 0.010 inches shall be considered superficial.
 - a. Repair superficial damage by sanding and/or polishing.
 - b. Components with more severe defects shall be rejected.
 3. Physical properties:

Minimum Physical Properties		
Property	Method	Value
Tensile Strength	ASTM D638	5500 psi
Flexural Strength	ASTM D790	10 ksi
Hardness	Rockwell M Scale ASTM D785	Greater than 85
	Barcol Impressor ASTM D2583	55
Thermal Expansion	ASTM D696	1.8 x 10 ⁻⁵ inches/IN/deg F
Gloss (60 –degree Gardner)	IAPMO Z124	Matte = 5; Highly Polished = 75
Light Resistance	NEMA LD 3-2000 Method 3.3	No Effect (Xenon Arc)
Wear and Cleanability	IAPMO Z124	Pass
Stain Resistance	IAPMO Z124	Pass
Fungal Resistance	ASTM G21	Does not support growth
High Temperature Resistance	NEMA LD 3-2000 Method 3.6	No change
Boiling Water Resistance	NEMA LD 3-2000 Method 3.5	No visible change
Ball Impact Resistance; 1/2 pounds Ball	NEMA LD 3-2000 Method 3.5	36 inches drop 1/4 inches sheet
		144 inches drop 1/2 inches sheet
Water Absorption	ASTM D570	0.8% for 1/4 inches sheet
		0.6% for 1/2 inches sheet
Flammability	ASTM E84 and NFPA 255	Class I / Class A
Flame Spread Index		Less than 25
Smoked Developed Index		Less than 450

B. Backing materials (build down):

1. Finished or exposed edges: SSF material.
 - a. Profiles as indicated.
2. Concealed spaces and non-exposed edges:
 - a. Moisture resistant, medium density fiberboard (MDF) panels or moisture resistant plywood.
 - 1) Use at countertops with sinks
 - 2) No added formaldehyde (NAF)
 - 3) Particleboard is not acceptable.
 - 4) Base Product: Medex by Roseburg.
 - b. Physical Properties, Based on 3/4 inches Thickness, ASTM D1037, Part A:
 - 1) Density: 48 pounds/FT³.
 - 2) Modulus of Rupture: 4,000 psi.
 - 3) Screw Holding: Required to pull 1 inch #10 sheet metal screw:
 - a) Face: 225 pounds.
 - b) Edge: 200 pounds.
 - c. Panel Thickness:
 - 1) As required for application, use a single thickness to achieve build down to cross sectional thickness.

3. Backer Sheets for knee spaces:
 - a. Plastic laminate in coordinating color
 - b. Grade 20 (VGP)
 - c. Apply to bottom side of backing material
4. Backing materials adhesive:
 - a. Construction grade adhesive recommended by SSF manufacturer for backing materials with VOC content no greater than 70 g/L.
- C. Joint Adhesive:
 1. Manufacturer's standard one- or two-part adhesive as required for inconspicuous, non-porous joint with VOC content no greater than 80 g/L.
- D. Sealant:
 1. Mildew resistant silicone sealant in colors matching components.
 2. Specifically formulated for applications indicated, including wet areas.
 3. Shore A Hardness: 25.
 4. Compatible with SSF specified.
 5. Compatible with gypsum wallboard, paint, laminates, and other materials being sealed.
 6. Sealant VOC content shall be no greater than 250g/L.
 7. Colors:
 - a. Colors to match specified SSF colors from no less than 400 standard color choices.
 - b. Number of different colors required for project shall not be limited.
 8. Base Products:
 - a. At solid colored SSF: Color-Sil by Color Rite; 100% silicone.
 - b. Where speckle colored SSF is specified: Poly-Sil by Color Rite; 100% silicone with suspended accent color particles.
 - c. Engineer to select final colors and locations during submittals phase.
- E. Conductive Foil Tape:
 1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
- F. Insulating Felt Tape:
 1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.3 SHOP FABRICATION

- A. Shop Assembly
 1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's instructions.
 2. Form joints between components using color matched Joint Adhesive in an inconspicuous manner.
 - a. Reinforce with 4 inches wide strip of SSF material.
 3. Provide factory cutouts for plumbing fittings and bath accessories as indicated.
 - a. Radius inside corners of cutouts as large as but not less than 1/4 inches.
 - b. Reinforce with SSF corner blocks to avoid stress cracking.

- c. Sand edges and corners smooth and free of chips or nicks.
 - d. Utilize heat conductive aluminum tape around drop-in stoves and other heat sources to protect SSF from thermal stress.
- 4. Rout and finish component edges with clean, sharp returns.
 - a. Rout cutouts, radii, and contours to template.
 - b. Smooth edges.
 - c. Repair or reject defective and inaccurate work.
- 5. Fabricate coved splashes where indicated.
- 6. Reinforce inside corners, narrow pieces, cantilevered overhangs, and stress points against breakage by laminating an additional thickness of SSF on concealed face.
- 7. Laminate additional thicknesses of SSF and tool edge profiles indicated.
- 8. Uniformly finish completed pieces according to SSF schedule.

2.4 FABRICATIONS

A. SSF Countertops:

- 1. Configurations as indicated on the Drawings.
- 2. Composite thickness of countertop assemblies: 1-1/4 inches unless otherwise indicated.
 - a. Nominal Thickness of SSF material: Minimum 1/2 inches unless otherwise indicated.
- 3. Radius exposed outside corners: Minimum 1-1/2 inches.
- 4. Join multiple pieces, where required, with Joint Adhesive to create inconspicuous seam.
- 5. Backer:
 - a. Configure backing material as required for application:
 - b. Ladder frame at SSF countertops supported by base cabinets:
 - 1) Form ladders from approved backing material ripped into 3- 4 inches wide strips.
 - 2) Locate main runner strips (rails) along front and back edges of countertops.
 - a) Provide clearance for shrinkage and normal expansion and contraction.
 - 3) Space front-to-back supports (stiles) to align with line where base cabinet units adjoin. Locate stiles over other wall brackets and supports.
 - 4) Where base cabinets and supports exceed in 24 inches width: Include additional intermediate stiles so that maximum spacing does not exceed 24 inches.
 - 5) Provide additional intermediate stiles at seams in SSF countertop material.
 - 6) Join the stiles to rails using screwed or glued wooden biscuit seams, serrated dowels, or rabbeted seams.
 - 7) Overhangs: Configure backer material per SSF manufacturer's guidelines according to distance overhang projects past its support.

- c. Countertops which span between supports 30 inches and wider:
 - 1) Fabricate backer from solid backing material (not stile and rail construction).
 - 2) Extend one piece, solid backer material, across entire span. Extend load bearing edges not less than 4 inches over edge of supporting cabinets (or similar support).
- d. Portions of Countertops schedule to support countertop equipment:
 - 1) Provide full backing for the entire countertop cross section for the full width of the equipment.
 - 2) Extend 4 inches (min) beyond equipment width and as required for mounting.
- 6. Backsplashes and Sidesplashes:
 - a. Provide where indicated.
 - b. Thickness: Minimum 1/2 inches (unless otherwise indicated).
 - c. Height: As indicated.
 - d. Fabricate from same material and color as top.
 - e. Backsplash Style: Integrally coved.
 - f. Sidesplash Style: Applied.
- 7. Front overhang of Tops: 1-1/2 inches, unless otherwise indicated.
- 8. Edge Treatments: As indicated on the drawings.
- 9. Polish exposed faces.
- 10. SSF color / pattern / finish: Per SSF Schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with fabricator present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Verify measurements, dimensions and drawing details before proceeding.
 - 2. Coordinate location of furring, nailers, blocking, grounds, and similar supports for attached work.
 - 3. Examine conditions under which work is to be installed.
 - 4. Correct unsatisfactory conditions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. General:
 - 1. Install components plumb, level, and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
 - 2. Provide product in the largest pieces available.
 - 3. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - a. Exposed joints/seams will not be allowed.
 - 4. Reinforce field joints with SSF strips extending a minimum of 1 to 2 inches on either side of the seam with the strip being the same thickness as the top.
 - 5. Cut and finish component edges with clean, sharp returns.

6. Rout radii and contours to template.
7. Anchor securely to base cabinets or other supports.
8. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
9. Carefully dress joints smooth, remove surface scratches and clean entire surface.
10. Install countertops with no more than 1/8 inches sag, bow or other variation from a straight line.
11. Units with sinks or lavatories shall withstand an applied vertical load of not less than 250 pounds on front edge of countertop.

B. Countertops:

1. Install plumb, level, true and straight.
 - a. Shim as necessary using concealed shims.
2. Adhere tops to base cabinets with clear silicone sealant at 10 to 12 inches apart.
3. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
 - a. Supply additional wood supports, spaced no more than 18 inches apart or as otherwise required for adequate strength.
4. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
 - a. Ensure full contact with support brackets and backing for entire support length with mechanical fastening into backing material.
 - b. Provide fasteners of appropriate length. Do not allow screws to penetrate into SSF material.
 - c. Supply additional supports or solid backing as required for adequate strength.
5. Where tops are abutted by walls at both ends:
 - a. Include 1/8 inches expansion gaps at both ends for every of 10 feet countertop.
 - b. Seal gaps with elastomeric sealant.

C. Backsplashes and Sidesplashes:

1. Integrally Coved Splashes:
 - a. Join coved items to countertops using color matched Joint Adhesive.
 - b. Adhere to walls and other substrates with clear silicone sealant.
 - c. Seal to walls and adjacent cabinets with color matched, elastomeric sealant.
2. Applied Splashes:
 - a. Join adhered items to substrate using color matched, elastomeric sealant.
 - b. Adhere to walls and other substrates with clear silicone sealant.
 - c. Seal to walls and adjacent cabinets with color matched, elastomeric sealant.

3.3 CLEANING AND PROTECTION

- A. Keep components clean during installation.
- B. Protect finished surfaces from damage.
- C. Remove adhesives, sealants, and other stains.
- D. Replace damaged work which cannot be repaired.

END OF SECTION

SECTION 12 48 13
ENTRANCE FLOOR MATS AND FRAMES (EM)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Entrance Mats (EM) in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. Obtain mats and frames from one source.
- B. Recessed Applications:
 - 1. Coordinate depression and frame installation with concrete construction to ensure recess and frame anchorage are accurate and that the base is level and flat.
 - 2. Defer frame installation until building enclosure is complete and related interior finish work is in progress.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Layout of mat and frame specified including details indicating construction relative to materials, direction of traffic, splices, spline locations, profiles, anchors and accessories.
 - a. Show proposed splice locations if required.
- B. Product Data:
 - 1. Manufacturer's specifications for each type of floor mat and frame specified.
 - 2. Manufacturer's installation instructions for each type of floor mat and frame specified.
 - 3. Certification of Slip-Resistance rating.
- C. Samples:
 - 1. Materials, finishes and colors.
- D. Contract Closeout Information:
 - 1. Warranty.
 - 2. Maintenance data.
 - a. See Section 01 78 23.

1.4 WARRANTY

- A. Manufacturer's standard two year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Entrance Mats (EM):
 - 1. Base:
 - a. Construction Specialties.
 - 2. Optional:
 - a. Babcock-Davis.
 - b. Balco Inc.
 - c. JL Industries.

- d. Mats Inc.
- e. Nystrom.
- f. Reese Enterprises.

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

Minimum Physical Properties		
Property	Test Method	Required Value
Flammability	ASTM E648	Class I
Critical Radiant Flux	ASTM E648	0.45 Watts/M ²
Dynamic Coefficient of Friction	ANSI 137.1	>0.42

2.3 ENTRANCE MATS – TYPE EM-1

A. Description:

- 1. Aluminum tread rails and inserts, joined by combination hinge and cushions.
- 2. Nominal Unit Depth: 3/4 inches.
- 3. Base Product: G8 PediTred SA Deep Pit Series with Drain Pan Frame, by Construction Specialties.
- 4. Capacity Rating: Standard rolling load performance: 1000 pounds wheel load.

B. Tread Rail Extrusions:

- 1. Material: ASTM B221 aluminum alloy 6105-T5.
- 2. Finish:
 - a. Clear Anodized.

C. Hinge/Cushion Extrusions:

- 1. Flexible EPDM.
- 2. Perforated between each tread rail for drainage.

D. Tread Inserts:

- 1. Heavy Duty Monotuft Carpet Inserts:
 - a. Complying with Carpet and Rug Institute's standard for indoor air quality.
 - b. Colorfast, solution dyed 100% nylon.
 - c. Carpet weight: 33 oz/SQ YD.
 - d. Color: To be selected by Engineer from 22 standard colors.
 - e. Fibers and monofilaments:
 - 1) Fibers including not less 100 monofilament fibers per square Inch.
 - 2) Anti-static, containing antimicrobial additive and treated with Scotchgard.
 - 3) Fusion-bonded to rigid two-ply backing and supplied in continuous splice-free lengths.

E. Perimeter Frames:

- 1. Materials: 6063-T5/T6 alloy aluminum with finishes matching those specified for visible portions of Tread Rails.
- 2. Select Frame types and profiles as appropriate for project conditions.
 - a. Refer to Drawings.

3. Include extruded vinyl fillers at leading and trailing edges in compliance with ADA.
 4. Include required fillers, inserts fasteners and other accessories.
 5. Provide a suitable protective coating where raw aluminum will contact concrete.
- F. Drains:
1. 2 inches PVC w/ stainless steel strainer.
 2. Quantity as indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide recess or other slab preparation in accordance with manufacturer's dimensions or template.
- B. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- C. Do not proceed until unsatisfactory conditions have been corrected.
- D. Check actual openings for grids by accurate field measurements before fabrication.
- E. Clean substrate prior to installation of mat.
- F. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install work of this section in accordance with manufacturer's recommendations.
- B. Level base and set mat at height recommended by manufacturer.
- C. Dissimilar Materials Protection:
 1. Where aluminum materials will be in contact with concrete or other incompatible materials: Provide a suitable protective coating.
- D. Splices:
 1. General:
 - a. Minimum Tread Rail length: 12 feet.
 2. Where Entrance Mats on project are less than 12 feet wide:
 - a. No splices will be permitted.
 3. Where Entrance Mats on project are greater than 12 feet:
 - a. Locate splices away from primary pathways.
 - b. Utilize maximum practical lengths of Tread Rails.
- E. Coordinate top of mat surfaces with bottom of doors that swing across to provide clearance between door and mat.

3.3 PROTECTION

- A. After completing required frame installation and concrete work, defer installation of Tread Rails until substantial completion of project.
 1. Provide temporary filler plywood or fiberboard in recess, and cover frames with plywood protective flooring.
 2. Maintain protection until construction traffic has ended and near substantial completion.

3.4 CLEANING

- A. Adjust and clean prior to final acceptance.
- B. Train Owner's maintenance personnel in proper cleaning/maintenance procedures.

END OF SECTION

SECTION 22 11 00
WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Water Distribution System, as indicated, in accordance with provisions of Contract Documents.
- B. Definitions:
 - 1. Unsuitable Material: Debris and/or soil material judged unsuitable by Engineer for support of slabs or other site improvements.
 - 2. Engineer: Soils Engineer employed by Owner, empowered to conduct inspections and make approvals.
 - 3. Rock Excavation: Excavation of rock material which is sufficiently solid and of such strength that it cannot be loosened or broken down in a single pass with following equipment.
 - a. Late model tractor mounted hydraulic ripper equipped with single digging point sized to use with and propelled by crawler type tractor rated at a minimum 200 net flywheel horsepower, operating in low gear.
 - b. A 3/4 cubic yard hydraulic backhoe with a rock tooth.
- C. Completely coordinate with work of other trades.

1.2 EXTRA WORK

- A. Removal and replacement of unsuitable material will be paid for as extra work.
 - 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 - 2. Recorded quantity will be basis for payment.
 - 3. Include unit price on Bid Form.
- B. Rock excavation will be paid for as extra work.
 - 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 - 2. Recorded quantity will be basis of payment.
 - 3. Include unit price on Bid Form.

1.3 QUALITY ASSURANCE

- A. Compaction Density Test:
 - 1. Standard Proctor, ASTM D698.
- B. Owner will hire an independent soils laboratory to conduct in place moisture and density tests.
 - 1. Contractor to pay for retests of material failing initial tests.
- C. Comply with NSF 61 for potable domestic water piping and components that come in contact with potable water.

1.4 SUBMITTALS

- A. Project Information:
 - 1. Manufacturer's certification for materials.

1.5 JOB CONDITIONS

- A. Verify location of existing utilities and structures and underground utilities.
- B. Protect existing utilities and structures and replace if damaged.
- C. Repair if damaged by this work.

- D. Lengths indicated on drawings are for information only.
- E. Furnish lengths as required.
- F. Perform no pipe work in fill areas until embankment or fill has been completed to at least 2 feet above top of pipe and has been properly compacted.
- G. Verification of existing utilities and structures.
 - 1. Plans indicate existing utilities as indicated on site survey.
 - 2. Verify accuracy, location and depth of each utility prior to trenching or tunneling.
 - 3. If pipe adjustment is necessary due to location of other utilities, secure approval from Engineer.
- H. Revisions to Contract Drawings.
 - 1. If it becomes necessary to change location of lines due to building construction, secure prior written approval from Engineer.
 - 2. If Contractor initiated, make approved changes without added cost to Owner.
- I. Do not change pipe sizes without securing prior written approval from Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Service lines 3 inches and smaller:
 - 1. ASTM B88 copper tubing type "K" hard drawn, with solder type bronze fittings.
- B. Valves:
 - 1. AWWA C500, gate type, with mechanical joint ends or as otherwise may be necessary; cast iron body, bronze mounted, parallel seat, double disk, non-rising stem, open left (counter clockwise), working pressure 200 psi; valves from a single manufacturer.
- C. Valve Boxes:
 - 1. Roadway type, cast iron, two (2) section, adjustable screw type, proper length and base size for depths required; word "water" cast in cover; compatible with valves.
- D. Fire Hydrants:
 - 1. AWWA C502, dry barrel type designed for 150 psi working pressure.
 - 2. Valve opening at least 5 inches in diameter.
 - 3. 6 inches bell connection.
 - 4. Two 2-1/2 inches hose connections.
 - 5. One 4-1/2 inches pumper connection.
 - 6. Outlets: American National fire hose coupling threads.
 - 7. Working parts: Bronze.
 - 8. Latest stock pattern produced by manufacturer.
 - 9. Opening counterclockwise.
- E. Corporation and Service Stops:
 - 1. Bronze with flange joint coupling, threads on inlet end conforming to AWWA C800; tested to minimum hydraulic pressure of 200 psi.
- F. Buttresses:
 - 1. Portland cement concrete, 6 bag mix.
 - 2. Minimum 28 day compressive strength: 3,000 psi.

- G. Backfill Material:
 - 1. As approved by Engineer.
 - 2. Free of rock, cobbles, roots, sod, organic matter and frozen material.
 - 3. Moisture content at time of placement:
 - a. 3% plus/minus of optimum moisture content.
 - b. Wet dry material, as required.
 - c. Dry wet material, as required.
 - d. Furnish off site material at no additional cost to Owner.

PART 3 - EXECUTION

3.1 TRENCH EXCAVATION

- A. Excavate trenches by open cut method to depth indicated and necessary to accommodate work.
 - 1. Permission may be granted for tunnel work for crossing under crosswalks, driveways or existing utility lines.
 - 2. Such tunnels are limited to 10 feet in length.
- B. Open no more than 300 linear foot of trench at one time, or less, as required by Engineer.
- C. Failure to comply may necessitate shutdown of entire project until backfilling is performed.
- D. Carry rock excavations minimum of 12 inches below indicated invert elevations.
- E. Do not excavate below indicated grades unless required to remove unsuitable material.
- F. Backfill over excavations in maximum 8 inches lifts compacted to specified density.
- G. Trench Size:
 - 1. Excavate only sufficient width to accommodate free working space.
 - 2. Cut trench walls vertically from bottom of trench to top of pipe, conduit, or utility service.
 - 3. Trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than following dimensions:

Overall Diameter of Utility Service	Excess Dimension
Less than 33 inches	16 inches
More than 33 inches	24 inches

- H. Brace and sheet trenches as soil conditions dictate. Do not remove until backfilling has progressed to a stage that no damage to piping, utility service, or conduit will result due to removal.
- I. Keep trenches free of water.

3.2 PREPARATION FOR PIPE LAYING

- A. See drawings and specific pipe material sections for embedment requirements.
- B. When discrepancy exists between those requirements and these specifications, provide type of embedment which provides greatest load factor.

- C. Types of Embedment:
1. Class A: Concrete cradle.
 - a. Load factors:
 - 1) 2.2 - Lightly Tamped.
 - 2) 2.8 - Carefully tamped.
 - 3) 3.4 - Reinforced Concrete with $p=0.4\%$.
 2. Class 4: Concrete arch type bedding.
 - a. Load factors:
 - 1) 2.8 - Plain Concrete.
 - 2) 3.4 - Reinforced Concrete with $p=0.4\%$.
 - 3) 4.8 - Reinforced Concrete with $p=1.0\%$.
 3. Class B: First-class bedding.
 - a. Shaped bottom with tamped backfill, or:
 - b. Compacted granular bedding with tamped backfill.
 - c. Load factor:
 - 1) 1.9 - Carefully compacted backfill.
 4. Class C: Ordinary bedding.
 - a. Granular bedding with tamped backfill.
 - b. Load factor:
 - 1) 1.5 - Lightly compacted backfill.
- D. Form bell holes in trenches such that only barrel of pipe is firmly supported by bedding material.

3.3 CLEANING PIPES

- A. Thoroughly clean pipes and fittings before laying.
- B. Keep clean until acceptance of Work.
- C. Thoroughly clean inside of every pipe and fitting just before lowering into trench, to remove foreign matter.
- D. Carefully lower into trench in manner to exclude foreign matter while jointing to other pipe.
- E. At close of each work day, or during period when job is not being actively pursued, tightly seal pipe ends with an expansion type stopper or other approved type of watertight seal so that no foreign substance or water may enter line.
- F. Keep seal in place until pipe laying is again resumed.
- G. Under no circumstances use pipe that has been contaminated inside with petroleum products or other liquid that will soak into cement lining or soften bituminous lining.
- H. In event that foreign matter or water enters pipe that has already been laid, immediately cease work and lay no more pipe until contamination has been removed to satisfaction of Engineer.

3.4 LAYING PIPE

- A. Use only proper and suitable tools and appliances for safe and convenient handling and laying of pipes and fittings.
- B. Carefully place pipe, fittings and valves into trench.
- C. Do not dump or roll pipe or fittings into trench.

- D. Do not allow pipe or fitting to drop against pipe or fitting already in trench.
- E. Take care to prevent damage to pipe lining and coating.
- F. Repair lining or coating damaged to satisfaction of Engineer.
- G. Install pipe so ends of pipe abut and there is no shoulder or unevenness inside main.
- H. Take special care to insure that pipes are well bedded on a solid foundation.
- I. Repair defects due to settlement at Contractor's expense.
- J. Dig bell holes large enough to ensure proper jointing.
- K. Do not allow pipe to rest on rock.
- L. Whenever a pipe or fitting requires cutting, perform work in a satisfactory manner with tools which leave smooth right angle cuts without damaging lining or pipe.
- M. Make such cuts at no added cost to Owner.
- N. Do not spring joints to effect a change in direction unless directed to do so by Engineer.
- O. Secure pipe, fittings and valves in place on concrete foundation, thrust blocks or by strapping, as indicated.
- P. Where foundation or thrust blocks are not indicated, secure pipe, fittings and valves in place as directed by Engineer.

3.5 PERMISSIBLE DEFLECTION AT JOINTS

- A. Wherever it is necessary to deflect pipe from a straight line, either in vertical or horizontal plane, amount of deflection allowed shall not exceed that required for satisfactory calking or assembly of joint.
- B. Make such necessary deflection in accordance with values and tolerances established by pipe manufacturer.

3.6 JOINTS

- A. Cast Iron or Ductile Iron Mechanical Joint Pipe:
 - 1. Rubber gasket, cast iron gland ring and T bolts with hex nuts.
 - 2. Before joint is made, insure that outside of spigot and inside of bell are entirely free of oil, tar and greasy substances to insure to tight bond.
 - 3. Make joint in accordance with manufacturers instructions.
 - 4. Tighten bolts with a torque wrench set between 50 and 60 pound.
- B. Cast Iron or Ductile Iron Push-on Joint Pipe:
 - 1. Circular rubber gasket which fits into specially designed bell or socket end of pipe and a specially prepared lubricant.
 - 2. Make joints in following manner:
 - a. Thoroughly clean gasket seat and gasket.
 - b. Wipe with a cloth and apply thin film of lubricant to inside surface of gasket which will come into contact with entering pipe.
 - c. Use only lubricant furnished with pipe.
 - d. In no case use mineral oil or petroleum base lubes.
 - e. Thoroughly clean plain end of pipe to be jointed and start it into socket so it is in contact with gasket.
 - f. Apply a thin film of lubricant to outside of plain end for about 1 inch back from end.
 - g. Complete joint by exerting sufficient force on entering pipe so that its plain end is moved past gasket until it makes contact with socket base.
 - h. Method, which does not harm pipe, may be used to hone pipe.

3.7 FITTINGS AND VALVES

- A. Place fittings, gate and air valves, blowoff connections and valves, valve and blow off vaults, air valve manholes and valve boxes along water mains as indicated or where designated by Engineer.
- B. Place in accordance with requirements as provided elsewhere in these specifications.
- C. Set fittings and valves and join to pipe in manner specified for cleaning, laying and jointing pipe.
- D. Where valves are placed on end of a pipe line place a cast iron plug secure in exposed bell before backfilling.
- E. Provide valve box for every nut operated valve and grease case enclosed operating mechanism valve.
- F. Carefully place valve box at right angle to main.
- G. Do not allow valve box to transmit shock or stress to valve; center it plumb over wrench nut of valve, with box cover flush with surface of finished pavement, or set to elevation indicated.
- H. Rest flange at bottom of top section on planks which extend 8 inches into solid ground on trench sides.
- I. Take care in tamping backfill around valve to keep box in place and firmly supported to preclude settlement.
- J. Remove and reset boxes found out of place or not firmly supported at no added cost to Owner.
- K. Determine whether valve or valves are in proper working order before and after installation.
- L. If not, notify Engineer and replace.

3.8 HYDRANTS

- A. Install hydrants in accordance with AWWA C600 or C603, as applicable, except as modified herein.
- B. Set operating nut not over 4 feet above finish grade.
- C. Thoroughly compact backfill around hydrants to grade.
- D. Make hydrant available for beneficial use.
- E. Set hydrant on slab of stone or concrete, minimum 4 inches thick and 15 x 15 inches.

3.9 CONNECTION TO EXISTING WATER SYSTEM

- A. Make connections to water system as indicated.
- B. Make connections at such hours, determined by Engineer, to cause least disturbance of water supply to existing consumers.
- C. Notify Engineer at least 3 days in advance of time Contractor desires to make connections.
- D. Make no connections without Engineer's prior approval.
- E. Include expense of making connections in bid price.

3.10 ARTIFICIAL FOUNDATION

- A. When directed, lay pipe upon an artificial foundation, consisting of gravel, sills, wedges, plank or timber, or of concrete, sized and placed as directed by Engineer.
- B. Include necessary excavation for such construction.

3.11 TESTING WATER MAINS

- A. Test completed water mains for leakage.
- B. Test sections as directed or approved by Engineer.

- C. Maximum allowable leakage not exceeding 1.0 GAL/1000 feet of pipe per hour for 16 inches pipe when tested at 150 psi.
- D. Fill length of water main under test with water and bring to test pressure of 150 psi.
- E. Operate valves in test section during test.
- F. After valves have been tested and deficiencies corrected; fill length of main under test with water, taking care to eliminate air from line.
- G. Raise pressure to test pressure by means of compressed air.
- H. Maintain at test pressure for at least 2 hour.
- I. At end of test period, again fill pipe with water from either measured receptacle or an accurately calibrated meter and determine leakage.
- J. Repair every leak which Engineer deems important, and every section of line in which leakage exceeds maximum allowable amount, whether or not trench has been filled.
- K. Replace every pipe, fitting, valve, etc., which gives evidence under test of being defective.
- L. If line indicates excessive leakage during any phase of test, retest line after correction of defects.
- M. Continue correcting defects until leaks exceeding allowable leakage have been remedied.
- N. Repair leaks and defects or otherwise remedy at no added expense to Owner and to complete satisfaction of Engineer, at whatever time that they become apparent.

3.12 STERILIZATION OF WATER MAINS

- A. Sterilize water mains as specified and directed.
- B. Perform sterilization by either of following methods:
 - 1. By introducing a chlorine gas/water mixture by means of a solution/feed chlorinating device.
 - 2. By introducing a mixture of calcium hypochlorite (comparable to commercial products known as HTH or Perchloron) and water.
- C. Prior to beginning of sterilizing operations, submit for Engineer's approval, schedule listing details of procedure to be followed.
- D. Before beginning sterilization, remove dirt and foreign matter from mains by a thorough flushing with clean water.
- E. Introduce water slowly and introduce sterilant through corporation cocks at rate 20,000 L 1 pound chlorine gas/2400 GAL of water, or at rate of 1 pound calcium hypochlorite (measured in a dry state prior to preparation of slurry) per 1,680 GAL of water.
- F. After sterilizing agent has been in pipe minimum of 3 hour, take samples and analyze.
- G. If less than 5 mg/L residual chlorine is indicated, drain pipe and repeat treatment.
- H. If more than 5 mg/L residual is indicated, drain lines to waste and refill with clear water.
- I. Take care to prevent contamination of sterilized pipe.

3.13 BACKFILLING

- A. Do not backfill until tests are performed on system, and system complies with specified requirements.
- B. Hand or pneumatic tamp backfill around and over pipe in lifts not exceeding 8 inches loose thickness.
- C. Compact to specified density.
- D. Exercise care in backfilling operations to avoid displacing pipe joints either horizontally or vertically and to avoid breaking pipe.
- E. Do not water flush or puddle to consolidate backfill.

3.14 COMPACTION

- A. Compact trench backfill in areas under paved roads, parking areas, sidewalks and other structures as directed by Engineer to at least 95% of maximum dry density.
- B. In locations where trench will not be under paved areas, compact backfill to minimum 90 percent of maximum dry density.

3.15 MAINTENANCE DURING WARRANTY PERIOD

- A. If prior to expiration of warranty period, broken pipes or defects are found in mains or in their appurtenances, remove and replace with proper material and workmanship, at no added cost to Owner.
- B. Carefully examine materials for defects prior to placing; do not place defective material.

END OF SECTION

SECTION 22 13 00
SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Sanitary Sewers, as indicated, in accordance with provisions of Contract Documents.
- B. Definitions:
 - 1. Engineer: Soils Engineer employed by Owner, empowered to conduct inspections and make approvals.
 - 2. Unsuitable Material: Debris and/or soil material judged unsuitable by Engineer for support of slabs or other site improvements.
 - 3. Rock Excavation: Excavation of rock material which is sufficiently solid and of such strength that it cannot be loosened or broken down in a single pass with following equipment.
 - a. A material shall be defined as rock if it cannot be effectively loosened or broken down by ripping by a single pass of a late model Caterpillar D-8 equipped with a standard hydraulically activated ripper tooth which is at least 36 inches-long or equivalent bulldozer equipped with the same ripper tooth.
 - b. A material shall be defined as rock if it cannot be removed by a Case 450 backhoe equipped with a standard 24 inches-wide bucket or equivalent backhoe equipped with a standard bucket.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Soil Testing and Compaction Requirements:
 - 1. See standard spec.
- B. Compaction Density Test:
 - 1. Standard Proctor, ASTM-D698.
- C. Owner will hire an independent soils laboratory to conduct in place moisture and density tests.
 - 1. Contractor pay for retests of material not passing initial tests.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Precast manhole drawings showing size and type of structure base.
- B. Product Data:
 - 1. Manufacturer catalog cuts and literature for pipe, manholes, manhole frame and covers and cleanouts.
- C. Project Information:
 - 1. Manufacturer's certification for materials.
 - 2. Report results of Leakage Tests.

1.4 JOB CONDITIONS

- A. Verify locations of existing and new underground utilities and coordinate installation with all other utility installers.
- B. Verification of Existing Utilities and Structures.
 - 1. Plans indicate existing utilities indicated on site survey.
 - 2. Verify accuracy, location and depth of each utility prior to trenching or tunneling.

3. If pipe adjustment is necessary due to location of other utilities, secure approval from Engineer.
- C. Protect existing structures and utilities from damage.
 1. Repair if damaged by this work.
- D. Lengths indicated on drawings are for information only.
 1. Furnish lengths as required.
- E. Perform no pipe work in fill areas until embankment or fill has been completed to at least 2 feet above top of pipe and has been properly compacted.
- F. Revisions to Contract Drawings:
 1. If it becomes necessary to change location of sanitary lines due to building construction, secure prior written approval from Engineer.
 2. If Contractor initiated, make approved changes without added cost to Owner.
- G. Do not change pipe sizes without securing prior written approval from Engineer.
- H. Site utility installer and building plumbing installer shall interface work 5 feet outside face of building:
 1. Building plumbing installer shall provide necessary materials (adaptors).

1.5 EXTRA WORK

- A. Removal and replacement of unsuitable material will be paid for as extra work.
 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 2. Recorded quantity will be basis for payment.
 3. Include unit price per cubic yard on Bid Form.
- B. Rock excavation will be paid for as extra work.
 1. Notify Owner's agent in time to have Engineer measure and record quantity removed.
 2. Recorded quantity will be basis for payment.
 3. Include unit price on Bid Form.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Vitrified Clay Pipe and Fittings:
 1. ASTM C700, standard or extra strength bell and spigot with ASTM C425 elastomeric compression joints.
- B. Plain Concrete Sewer Pipe and Fittings:
 1. ASTM C14, Class 1 or 2 with ASTM C443 rubber gasket joints for lines less than 12 inches diameter.
- C. Reinforced Concrete Sewer Pipe and Fittings:
 1. ASTM C76, Class I, II or III with ASTM C443 rubber gasket joints for lines 12 inches diameter and larger.
- D. Cast iron Soil Pipe and Fittings:
 1. ASTM A74 Class SV with ASTM C564 rubber gasket joints.
- E. Ductile Iron Pipe and Fittings:
 1. AWWA C150, thickness Class 50 with AWWA C111 rubber gasket joints.
 2. Pipe fittings: AWWA C110.

- F. Polyvinyl Chloride (PVC) Pipe and Fittings:
1. 4 inches through 15 inches diameter: ASTM D3034, SDR 35 with ASTM D3212 flexible elastomeric gasket joint.
 2. 4 inches through 48 inches diameter: ASTM F794 Series 46 for ribbed sewer pipe with smooth interior with ASTM D3212 flexible elastomeric gasket joint.
- G. Force Main Sewer Pipe and Fittings:
1. ASTM D2241 PVC with ASTM F477 elastomeric gaskets.
 2. AWWA C150 ductile iron thickness Class 50 with AWWA C111 rubber gasket joints.
- H. Concrete Materials:
1. Comply with requirements of Division 03.
 2. Minimum compressive strength 4000 psi at 14 days.
- I. Precast Concrete Manhole:
1. Precast concrete manhole risers, base sections and tops: ASTM C478. Base and riser shall be monolithic and top cone shall be eccentric. Diameter shall be as shown on drawings.
 2. Rubber gaskets for joints between manhole riser sections and top sections: ASTM C443.
 3. Resilient connectors for joints between manhole and entering or leaving pipes: ASTM C923.
- J. Frames and Covers:
1. ASTM A48 cast iron with minimum tensile strength of 30,000 psi and machined horizontal and vertical bearing surfaces, non-rocking type.
 2. Cover: Solid, non-ventilated with words "SANITARY SEWER" cast in cover.
 3. Frame and cover:
 - a. Minimum clear opening 23 inches.
 - b. In paved areas subject to traffic - Heavy duty type with minimum weight of 400 pounds.
 - c. In areas not subject to traffic - Medium duty type with minimum weight of 150 pounds.
- K. Manhole Steps:
1. Use at manholes under 12 feet in depth.
 2. ASTM A48, cast iron epoxy coated, nonslip surface, designed to support a concentrated load of 500 pounds.
 3. Minimum tread length 12 inches.
 4. Minimum tread width 1 inch.
- L. Ladders:
1. Use at manholes over 12 feet in depth.
 2. Ladders: ANSI A14.3 steel fixed-rail type.
 3. Ladders and accessories shall be galvanized.
 4. Rungs: Solid-section rods, fitted into punched holes in rails, welded, and ground smooth, spaced out 12 inches.
 5. All splices and connections shall have a smooth transition with original members without projections that are sharp or more extensive than required for joint strength.
 6. Rails shall be fitted with brackets at 5 feet intervals for anchorage to structure.

- M. Cleanout Covers:
 - 1. ASTM-A48, cast iron with machined bearing surfaces.
- N. Brick:
 - 1. ASTM C32, Grade-MS.
 - 2. ASTM C62, Grade-SW.
 - 3. Saturation coefficient not over 0.8.
- O. Mortar for Masonry:
 - 1. ASTM C270, Type M mortar mixed in proportions of 1 part portland cement, 1/4 part lime paste, 3 to 3-3/4 parts sand, water as required for consistency for brick work or for bedding cast iron frames in masonry.

PART 3 - EXECUTION

3.1 EXCAVATION, BACKFILL AND COMPACTION

- A. Excavate trenches to depth indicated on plans and necessary to accommodate work.
- B. Keep trenches free of water.
- C. Form bell holes in trench or bedding materials as indicated so only barrel of pipe is firmly supported by shaped subgrade or bedding.
- D. Compact bedding material under and around pipe up to spring line of pipe in lifts not exceeding 8 inches loose thickness.
- E. Compact-trench backfill evenly on both sides of pipe to top of excavation or to a depth such that pipe will not be injured by subsequent compaction used to achieve required density.
- F. Backfill and compact remainder of trench in 8 inches lifts to specified density.
- G. Exercise care in backfilling operations to avoid displacing pipe joints either horizontally or vertically and to avoid breaking pipe.
- H. Do not water flush for consolidation.
- I. Compact trench backfill in areas under paved roads, parking areas, sidewalks and other structures, to minimum 95% of specified density.
- J. Remove materials which cannot be compacted as specified.
- K. Replace with suitable material and compact.

3.2 INSTALLATION OF PIPE

- A. Lay pipelines on uniform grades between inverts.
- B. Locate structures as indicated and construct lines between them.
- C. Lay pipe upgrade beginning at lower end with bell ends of pipe upstream.
- D. Provide proper facilities for lowering pipe into trench.
- E. Do not lay pipe in water.
- F. Do not lay pipe when trench condition or weather is unsuitable for such work.
- G. Remove sections of pipe already placed found to be out of alignment, defective or damaged.
- H. Relay or replace without additional cost to Owner.
- I. Bedding:
 - 1. Lay pipe directly on shaped subgrade.
 - 2. No blocking permitted.
 - 3. Form a continuous bearing with a minimum width of bearing equal to 0.6 of outside diameter of pipe, for full length of pipe, except for portion excavated for joint.

3.3 MANHOLES

- A. Install precast concrete sections with rubber gasket joints and per manufacturers recommendations.
- B. Form flow channels at invert with concrete.
- C. Top of channel to match center of pipe.
- D. Place concrete collar around casting frame.
- E. Trim pipes flush with inside wall of manhole.
- F. Adjust new and existing rims to finished grade.

3.4 CLEANOUT STRUCTURES

- A. Construct cleanout risers of 6 inches pipe laid on angle on undisturbed natural ground.
- B. Tamp backfill around and above pipe in layers not exceeding 8 inches depth so that no settlement occurs.
- C. Lay base of cleanout on concrete block.

3.5 WYE BRANCHES

- A. Install where sewer connections are indicated or required.
- B. Cutting into piping for connections not permitted except as approved by Engineer.

3.6 FRAMES AND COVERS

- A. Unless otherwise indicated, set frames and covers with top flush with finished pavement grade or 2 inches above unpaved areas.

3.7 CONNECTIONS TO EXISTING MANHOLES

- A. Pipe connections to existing manholes shall be made that finish work will conform to essential applicable requirements specified for new manholes, including concrete work, cutting, and shaping.

3.8 BUILDING CONNECTIONS

- A. Building connections shall include lines to and connection with building waste drainage piping at a point approximately 5 feet outside building, unless otherwise indicated. Where building drain piping is not installed, terminate building connections approximately 5 feet from site of building and plug pipe end.

3.9 LEAKAGE TESTS

- A. Test lines for leakage by low pressure air testing or exfiltration tests, as appropriate:
 - 1. Low pressure air testing ASTM C828.
 - 2. Exfiltration test: Fill line to be tested with water so that a head of at least 2 feet is provided above both water table and top of pipe at upper end of pipeline to be tested. Allow filled line to stand until pipe has reached its maximum absorption, but not less than 4 hours. After absorption, head shall be re-established. Amount of water required to maintain this water level during a 2-hour test period shall be measured.
 - 3. Leakage as measured shall not exceed 250 gallons per inch diameter per mile of pipeline per day.
 - 4. When leakage exceeds maximum amount specified, satisfactory correction shall be made and retesting accomplished.

END OF SECTION

SECTION 22 31 16 WATER SOFTENER

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Water Softener, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Water softener.
- B. Contract Closeout Information:
 - 1. Owner instruction report.
 - 2. Operation and Maintenance Data.
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Water Softening System:
 - 1. Vertical pressure type ion exchanger system with regenerating equipment, complete with components required to insure proper operation.
- B. Softener Tank:
 - 1. Welded construction of quality carbon steel with dished heads, equipped with reinforced openings for piping connections.
 - 2. Provide 6 by 4 inches hand hole at top and bottom and tank supports of structural steel.
 - 3. ASME Code rated at 150 psi working pressure.
 - 4. Provide with earthquake resistant structural legs with bolt downs.
- C. Internal Distribution:
 - 1. Design underdrain system to uniformly collect softened water as well as distribute backwash laterally across entire bed.
 - 2. Header-lateral construction with minimum of 2 plastic strainers per 1 square feet of bed area.
 - 3. Furnish gravel sub-fill only, not extending above strainers.
- D. Upper Distribution System:
 - 1. Header-lateral manifold type arranged for uniform distribution of both brine solution and raw waste, as well as collection of backwash.
 - 2. Construct both upper and lower distributors of an approved non-corrosive material.
- E. Ion Exchange Resin:
 - 1. High capacity sulfonated polystyrene type requiring no chemicals other than sodium chloride to obtain specified capacity.
- F. Controls:
 - 1. Select appropriate control method from three selections below. Time clock:
 - a. Provide with one automatic pilot valve controller of multi-port design driven by synchronous motor to automatically cycle through regeneration cycle by electrical contact from automatic reset water meter.

- b. Timing of each step adjustable.
 - c. Controller capable of manual operation should electric power fail.
 - d. Operate valves hydraulically or pneumatically.
- 2. Water Monitoring:
 - a. Include progressive flow monitor, regeneration monitor, BMS integration.
- 3. Water meter:
 - a. Adjustable 115V automatic reset register with 6-inch vertical dial for each softener tank.
- 4. Lock-out device to prevent simultaneous regeneration of both tanks.
- 5. Aqua-sensor may be used to control regeneration in lieu of reset meter provided above mentioned lock-out is furnished.
- 6. Provide pressure gauges with sample cocks on inlet and outlet of each tank.
- G. Regenerating Tank:
 - 1. Rigid, molded polyethylene, or welded steel with flat bottom with bitumastic coating inside and rust inhibiting primer on exterior.
 - 2. Fresh make-up water shall flow downward through solid salt controlled by float valve in salt storage tank.
 - 3. Filter brine through 5-inch layer of graded gravel and collect by suitable collector.
 - 4. Provide automatic valve to control amount of brine draw.
 - 5. Furnish with 6-inch support legs.
 - 6. Provide necessary valves, educator and piping.
 - 7. Provide with earthquake resistant structural legs with bolt downs.

2.2 TEST KIT

- A. Provide water testing kit to make chemical tests necessary for controlling operation and adjustments of brine dosage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install complete system with piping, valves and wiring.

3.2 CLOSEOUT ACTIVITIES

3.3 START-UP

- A. Provide services of competent supervising engineer from water softener manufacturer to inspect completed installation, start water softening system and instruct operators in proper operation and maintenance of equipment.

END OF SECTION

PLUMBING FIXTURES
PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Plumbing Fixtures, as indicated, in accordance with provisions of Contract Documents.
- B. Definitions:
 - 1. Aerator: Device that mixes room air with faucet's water stream.
 - 2. Ledge mounted faucet: Faucet with body mounted on top of faucet ledge and covered by faucet housing or single escutcheon.
 - 3. Bottom-mounted faucet: Faucet with body mounted beneath faucet ledge; each penetration is covered by single escutcheon.
 - 4. Semi-cast: Fittings, return bends, and nuts are cast brass. Waste arms and wall bends are tubular.
- C. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Assemble submittals by mark number. Include sufficient information to verify compliance with descriptions.
 - 2. Where model numbers differ from descriptions, submit to meet description requirements:
 - a. Drinking fountains.
 - b. Electric water coolers.
 - c. Emergency fixtures.
 - d. Hose bibbs.
 - e. Lavatories.
 - f. Mixing valves.
 - g. Patient care modules.
 - h. Sinks.
 - i. Standpipe and supply boxes.
 - j. Urinals.
 - k. Wall hydrants.
 - l. Water closets.
 - m. Undersink protective covers.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - a. See Section 01 78 23.

1.3 QUALITY ASSURANCE

- A. Design and Installation Standards:
 - 1. ANSI Z358.1: Standard for Emergency Eyewash and Shower Equipment.
 - 2. ASSE 1016: Individual Thermostatic Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings.
 - 3. ASSE 1017: Temperature Actuated Mixing Valves for Hot Water Distribution Systems.

4. ASSE 1070: Performance Requirements for Water Temperature Limiting Devices.
 5. NSF standard: Comply with NSF 61: "Drinking Water System Components-Health Effects", for fixture materials that will be in contact with potable water.
- B. Accessibility Manufacturing and Installation Standards:
1. Americans with Disabilities Act (Public Law 101-336).
 2. ANSI-A117.1, current edition.
 3. Local authorities.
 4. State authorities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Electric Water Coolers and Drinking Fountains:
1. Base:
 - a. Halsey-Taylor.
 2. Optional:
 - a. Elkay Manufacturing.
 - b. Haws Corporation.
 - c. EBCO Manufacturing (Oasis).
 - d. Sunroc.
- B. Sensor Operated Faucets:
1. Base:
 - a. Sloan Valve.
 2. Optional:
 - a. Chicago Faucet.
 - b. Hydrotek.
- C. Single Lever Mixing Faucets:
1. Base:
 - a. American Standard Plumbing.
 2. Optional:
 - a. Chicago Faucet.
 - b. T&S Brass & Bronze Works.
- D. Two Handled Faucets:
1. Base:
 - a. American Standard Plumbing.
 2. Optional:
 - a. Chicago Faucet.
 - b. T&S Brass & Bronze Works.
 - c. Delta Commercial.
 - d. Crane Plumbing.
 - e. Eljer Plumbingware.
 - f. Kohler.

- E. Emergency Fixtures:
 - 1. Base:
 - a. Speakman.
 - 2. Optional:
 - a. Bradley.
 - b. Encon Safety Products.
 - c. Western.
 - d. Haws Corporation.
 - e. Guardian Equipment.
- F. Molded Stone, Precast Terrazzo, Fiberglass Reinforced Polyester Fixtures:
 - 1. Base:
 - a. Fiat.
 - 2. Optional:
 - a. Creative Industries Terrazzo Products.
 - b. Stern and Williams.
 - c. Swan.
 - d. Mustee & Sons, EL.
- G. Stainless Steel Fixtures:
 - 1. Base:
 - a. Elkay Manufacturing.
 - 2. Optional:
 - a. Just Manufacturing.
 - b. Southern Kitchens.
- H. Fixture Carriers:
 - 1. Base:
 - a. Wade.
 - 2. Optional:
 - a. Watts/Ancon.
 - b. Jonespec.
 - c. Josam.
 - d. J R Smith.
 - e. Zurn Industries.
- I. Hose Bibbs:
 - 1. Base:
 - a. Chicago Faucet.
 - 2. Optional:
 - a. Acorn Engineering.
 - b. Delta Commercial.
 - c. Crane Plumbing.
 - d. Croker West.
 - e. Sloan Valve.

- f. Speakman.
 - g. T&S Brass & Bronze Works.
 - h. Woodford Manufacturing.
- J. Pressure-balanced Mixing Valves:
 - 1. Base:
 - a. Symmons.
 - 2. Optional:
 - a. Chicago Faucet.
 - b. Leonard Valve.
- K. Thermostatic Mixing valves:
 - 1. Base:
 - a. Symmons.
 - 2. Optional:
 - a. Lawler Manufacturing.
 - b. Leonard Valve.
 - c. Powers.
- L. Tempering Mixing valves:
 - 1. Base:
 - a. Powers.
 - 2. Optioinal:
 - a. Watts.
 - b. Leonard.
- M. Wall and Yard Hydrants:
 - 1. Base:
 - a. Wade.
 - 2. Optional:
 - a. Watts-Ancon.
 - b. Jonespec.
 - c. Josam.
 - d. J R Smith.
 - e. Woodford Manufacturing.
 - f. Zurn Industries.
- N. Water Closet Seats:
 - 1. Base:
 - a. Beneke.
 - 2. Optional:
 - a. Bemis.
 - b. Centoco.
 - c. Church.
 - d. Olsonite.
 - e. Sperzel.

- O. Undersink Protective Covers:
 - 1. Base:
 - a. Truebro.
 - 2. Optional:
 - a. McGuire.
- P. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Construct or equip fixtures with air gap or anti-siphon devices to prevent siphoning non-potable water into potable water supply system.
- B. Dimensions:
 - 1. Dimensions are Nominal.
 - 2. Multiple dimensions:
 - a. First dimension: Side-to-side.
 - b. Second dimension: Front-to-back.
 - c. Third dimension: Top-to-bottom.
- C. Manufacture accessible fixture assemblies to meet requirements of accessibility standards.
- D. Faucets - General:
 - 1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Renewable cartridges with integral seats (or renewable seats and stems).
 - b. Materials:
 - 1) Brass, bronze, copper, stainless steel, ceramic.
 - 2) Plastic components are not acceptable.
 - c. Finish:
 - 1) Chrome.
 - d. Gooseneck spouts:
 - 1) Discharge at least 5 inches above rim of fixture.
 - e. Electric, sensor-operated faucets:
 - 1) Mount transformer and control panel in concealed but accessible location.
 - 2) Coordinate with Electrical and Casework contractors.
 - f. If mixing valve is not included in faucet description, provide a tempering, under-counter mixing valve. Mechanical mixing valves shall not be used.
 - g. Comply with NSF 61- "Drinking Water System Components – Health Effects" for fixture materials that will be in contact with potable water.
 - 2. Metering valve faucets:
 - a. Adjustable run time.
 - b. Self-closing.

E. Flow Control Devices - General:

1. Provide flow control devices with indicated maximum flow rates on listed fixtures:
 - a. Private lavatory: 2.2 gpm.
 - 1) Private lavatories shall be considered those used in patient rooms.
 - b. Public lavatory:
 - 1) Metering: 0.25 gallons per metering cycle.
 - 2) Non-metering: 0.5 gpm.
 - 3) All locations shall be considered public, except as specifically identified above for private.
 - c. Sinks: 2.2 gpm at 60 psi.
 - d. Showers: 2.5 gpm at 80 psi.
2. Material: Brass.
3. Finish: Chrome.
4. Accomplish controlled flow without aeration of water stream. Aerators are not acceptable unless specifically identified in the faucet description.
5. Flow control devices shall be disinfectable.
6. Comply with NSF 61- "Drinking Water System Components – Health Effects" for fixture materials that will be in contact with potable water.

F. Lavatory Fixtures - General:

1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Vitreous china and enameled, cast-iron fixtures:
 - 1) Color: White.
 - 2) Overflows: Integral.
 - b. Stainless steel fixtures:
 - 1) Finish: Softsatin.
 - 2) Type: 302 (18-8) or 304 (18-8).
 - 3) Thickness: 20 GA.
 - 4) Sound deadening that covers complete underside of bowl.
 - c. Provide integral faucet ledge with holes:
 - 1) Coordinate hole quantities, locations, and centering with faucet types indicated in fixture descriptions.
 - 2) Provide exact number of holes necessary.
 - a) Use of faucet hole covers is not acceptable.

G. Mixing Valves - General:

1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Materials:
 - 1) Brass, bronze, copper, stainless steel, ceramic.
 - 2) Thermostatic mixing valves:
 - a) Thermostat may contain plastic parts.
 - 3) Escutcheon may be pot metal.

- b. Finish of exposed surfaces:
 - 1) Chrome.
- c. Hot/cold color coding.
- d. Coordinate number of ports with trim indicated in fixture descriptions.
 - 1) Four-port valves:
 - a) If diverter spout is indicated in fixture description, provide built in choke.
 - b) If external diverter valve is indicated in fixture description, provide without choke.
- e. Comply with NSF 61- "Drinking Water System Components – Health Effects" for fixture materials that will be in contact with potable water.
- f. Mechanical Mixing Valves:
 - 1) Integral checks and service stops on inlets.
 - 2) Adjustment: lockable with lever.
 - 3) Connections: 3/8 inches.
 - 4) Example: Powers model PS-141-650.
- g. Tempering Type Mixing Valve:
 - 1) ASSE 1016 Type: T/P.
 - 2) Integral checks and service stops on inlets.
 - 3) Inlet screens: stainless steel.
 - 4) Adjustment: adjustable locking type.
 - 5) Connections:
 - a) 3/8 inches.
 - 6) Example:
 - a) Powers model e480.
- h. Pressure Balanced Mixing Valves:
 - 1) Renewable stainless steel piston with brass seat.
 - 2) Integral checks and service stops on inlets.
 - 3) Temperature control with built-in shut off; opens from cold to hot.
 - 4) Single lever handle.
 - 5) Adjustable, temperature-limit stops.
 - 6) "OFF-COLD-HOT" marking in block type letters minimum 7/32 inches high.
- i. Thermostatic Mixing Valves:
 - 1) ASSE 1017 compliant.
 - 2) Renewable thermostatic and pressure-balance elements.
 - 3) Compensates for changes in both temperature and pressure.
 - 4) Integral checks and service stops.
 - 5) Temperature control with built-in shut off; opens from cold to hot.
 - 6) Single lever handle.
 - 7) Adjustable, temperature-limit stops.
 - 8) "OFF-COLD-HOT" marking in block type letters minimum 7/32 inches high.

2. Mixing Valve Trim - General:
 - a. Cabinets:
 - 1) Stainless steel construction.
 - 2) Hinged doors:
 - a) Removable when in the open position.
 - b) Hinge on side.
 - 3) Size cabinets to hold valve and accessories as required in each description.
 - b. Thermometers:
 - 1) 3-1/2 inches dial.
 - 2) Hermetically sealed.
 - 3) Bimetal element.
 - 4) Range: Minus 0 to 140 deg F.
 - 5) Construction: Welded stainless steel.
 - 6) White-faced, three-color dial.
 - c. Vacuum breakers and valves:
 - 1) See "Faucets, general" in Article 2.01.
 3. Semi-cast P-traps and Continuous Wastes:
 - a. P-trap:
 - 1) Semi-cast:
 - 2) 1-1/4 or 1-1/2 inches NPS cast brass return bend with clean out.
 - 3) 17 GA x 1-1/4 or 1-1/2 inches OD copper tube tailpiece.
 - 4) Nuts: Cast brass.
 - b. Continuous Waste:
 - 1) Semi-cast:
 - 2) 1-1/2 inches NPS cast brass tee.
 - 3) 17 GA x 1-1/2 inches OD copper tube tailpieces.
 - 4) Nuts:
 - a) Cast brass.
- H. Sink Fixtures - General:
1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Vitreous china: White.
 - b. Stainless steel:
 - 1) Finish: Softsatin.
 - 2) Type: 302 (18-8) or 304 (18-8).
 - 3) Sound deadening that covers complete undersides of each bowl.
 - 4) Thickness:
 - a) Sink depth less than or equal to 10 inches: 18 GA.
 - b) Sink depth greater than 10 inches: 16 GA.

- c. Molded stone and terrazzo:
 - 1) Marble chips in reinforced Portland cement.
 - a) 7-day compressive strength:
 - (1) 3000 psi.
 - b) Exposed surfaces:
 - (1) Ground smooth, grouted and sealed to resist staining.
 - 2) Drain body opening: Integrally cast.
 - 3) Color:
 - a) As selected from manufacturer's standard line by Engineer.
- d. Enameled cast-iron:
 - 1) Color: White.
- e. Countertop sinks:
 - 1) Self-rimming.
- f. Provide integral faucet ledge with holes:
 - 1) Coordinate hole quantities, locations, and centering with the following:
 - a) Faucets and trim indicated in fixture descriptions.
 - b) Hot-water dispensers.
 - c) High-purity water faucets.
 - 2) Provide exact number of holes necessary.
 - a) Use of faucet hole covers is not acceptable.

2.3 ELECTRIC WATER COOLERS

A. Electric Water Coolers – General:

- 1. Following general conditions apply unless detailed otherwise in specific descriptions):
 - a. Self-contained, refrigeration units.
 - 1) Capacity based on 90 deg F room temperature, 80 deg F inlet-water temperature, and 50 deg F drinking-water temperature.
 - 2) Air cooled condensing units.
 - a) 115V.
 - b) Hermetically sealed compressor.
 - b. Bubbler drain-pan: Stainless steel.
 - c. Stainless steel: Type 304 with satin finish.
 - d. Chrome-plated, brass bubbler.
 - 1) Bubbler guard may be plastic and need not be chrome-plated.
 - e. Stream regulator mounted inside cabinet or in bubbler. Regulator shall maintain constant stream height while line pressure varies between 30 and 90 psi.
 - f. Certified lead free as defined by the Safe Drinking Water Act.

- B. Accessible, facing forward, dual-level:
 - 1. Fixture:
 - a. Wall hung, surface-mounted, dual-level. Self-closing push bars on front and sides. Refrigeration unit mounted in cabinet behind and below bubble drain pan.
 - b. Minimum Capacity: 7.5 gph.
 - c. Cabinet finish: Acrylic enamel on 20 GA steel.
 - 1) Color selected by Engineer.
 - 2) Halsey Taylor HAC8FSBL-Q.
 - d. Fixture carrier: Hanger-plate type.
- C. Accessible, forward facing, dual-level, recessed:
 - 1. Fixture:
 - a. Brushed stainless steel, recessed refrigeration unit, dual level extensions with oval receptors, access panel cover, rounded corners, rounded edges, designed to eliminate splashing and standing wastewater. Provide self-closing, semi-circular push bars with full 180 degree activation. Minimum capacity: 8 gph
 - 1) Halsey Taylor OVL-II SER-Q.
 - 2. Trim:
 - a. Supply: Chrome, 3/8 inches OD, soft copper tube, loose key stops, escutcheons.
 - 1) Model.
 - b. P-trap: Chrome, 1-1/4 inches or 1-1/2 inches semi-cast with cleanout, with 17 GA x 1-1/4 inches or 17 GA x 1-1/2 inches OD copper tube trap arm.

2.4 EMERGENCY FIXTURES

- A. Emergency Eye/Face Washes – General:
 - 1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Stay open valve operated by push handle.
 - b. 1/2 inches, cold-water supply.
 - c. Aerated spray.
 - d. Supply-line strainer with removable element.
 - e. Dust covers: Fall off when water flows.
 - 2. EEW-1, Emergency eye/face wash, wall mounted:
 - a. Fixture:
 - 1) Wall mounted. Stainless steel bowl. Mounting brackets. Automatic volume controls in twin spray heads. 1-1/4 inches OD tailpiece.
 - a) Example: Speakman SE-400.
 - b. Trim:
 - 1) P-trap: Chrome, 1-1/4 inches or 1-1/2 inches semi-cast with cleanout, with 17 GA x 1-1/4 inches or 17 GA x 1-1/2 inches OD copper tube trap arm.

- c. Mixing Valve, thermostatic:
 - 1) Exposed valve, Leonard TA-350.
 - 2) Operating parameters:
 - a) Flow control range: 2-10 gpm.
 - b) Output temperature range: 60-95 deg F.
 - c) HW supply temperature: 95 deg F.
 - d) Supply pressure range: 40-80 psiG.
 - e) Mixing valve bypass: cold water bypass if valve should fail.
 - 3) Mounting bracket: Wall mount.

2.5 FIXTURE CARRIERS

A. Fixture Carriers:

- 1. Application:
 - a. This paragraph describes carriers for wall hung valves and wall hung fixtures except water closets.
 - b. See Water Closet article for closet carriers.
- 2. Carriers consist of uprights, floor anchors, and fixture supports:
 - a. Fixture-support types are concealed-arm, exposed-arm, hanger-plate, and clinical-service-sink.
 - b. Include associated hardware.
- 3. Materials:
 - a. Coated cast iron.
 - b. Steel.
- 4. Weight of construction: Institutional.
- 5. Uprights: Rectangular structural steel.
- 6. Floor anchors:
 - a. Non-adjustable cast-iron floor anchors bolted to uprights; or steel-plate floor anchors integrally welded to uprights.
 - b. 4-hole anchoring to floor.
- 7. Concealed-arm fixture supports:
 - a. Header couplings:
 - 1) Vertically adjustable with horizontally adjustable cross tie.
 - 2) Integral pipe sleeves.
 - b. Secure arms to pipe sleeves with threaded or set-screw connections.
 - c. Hardware for vitreous china fixtures:
 - 1) Leveling screws for four corners of fixture.
 - 2) Non-slip devices to lock fixture into place on arms.
 - d. Hardware for cast-iron fixtures:
 - 1) Threaded eye bolts with leveling hardware.
 - e. For flat-slab fixtures requiring set out from wall, provide 2 inches chromed wall escutcheons.

8. Exposed-arm fixture supports:
 - a. Header couplings: Vertically adjustable with horizontally adjustable cross tie.
 - b. Coated with white acid-resistant enamel.
 - c. Hardware:
 - 1) Leveling screws for front two corners of fixture.
 - 2) Toggle bolts to lock fixture into place on arms.
9. Hanger-plate fixture supports:
 - a. Bolted attachment to uprights.
 - b. Drilled/slotted to match fixture.
 - c. Hardware for attaching fixture.
 - d. Provide adequate size and quantity to anchor fixture at every anchoring point on the fixture.
10. Clinical-service-sink fixture supports:
 - a. Two heavy-duty hanger plates, one with cast-iron waste-outlet coupling.
 - b. Hardware for attaching fixture and waste piping.
11. Match lengths, mounting locations, and sizes to fixture requirements.

2.6 HOSE BIBBS

- A. Hose Bibb – General:
 1. Following general conditions apply unless detailed otherwise in specific descriptions:
 - a. Material: Brass.
 - b. Finish: As indicated.
- B. HB-1, Polished Brass Hose Bibb with Vacuum Breaker:
 1. Fixture:
 - a. 1/2 inches IPS male inlet, adjustable / removable wall flange, lever handle, 3/4 inches garden hose outlet.
 - 1) Model: T&S Brass B-0718.
 2. Vacuum breaker:
 - a. Garden hose vacuum breaker, 3/4 inches female garden hose inlet & male outlet.
 - 1) Model: T&S Brass B-5550-10.
- C. HB-3, Rough Brass Sill Faucet with Vacuum Breaker:
 1. Fixture:
 - a. 3/4 inches IPS female flanged inlet, key or screwdriver controlled slot, chrome plated, vacuum breaker, 3/4 inches garden hose outlet.
 - 1) T&S Brass B-0737-RGH.
- D. HB-5, Chrome Hose Bibb:
 1. Fixture:
 - a. Single handle. 3/4 inches flanged inlet. 3/4 inches male hose outlet. Supply one or more HB's through single or multiple backflow protection device(s).
 - 1) T & S Brass B-0737-POL.

2.7 LAVATORIES

- A. L-10, Lavatory, Wall Hung, Sensor, Electric, Accessible:
 - 1. Fixture:
 - a. 21 x 18 inches, wall hung, vitreous china, backsplash, concealed arm support.
 - 1) American Standard Plumbing Lucerne 0355.012.
 - b. Fixture carrier: Concealed arm type.
 - 2. Faucet:
 - a. Electric sensor-operated, ledge mounted, 4 inches centerset faucet, integral spout, faucet mounted sensor.
 - 1) Sloan ETF-600.
 - b. Mixing valve:
 - 1) Provide tempering mixing valve with checkstops.
 - 2) Valve shall be mounted under lavatory.
 - 3. Trim:
 - a. Supplies: Chrome, 3/8 inches OD, soft copper tube, loose key stops, escutcheons.
 - b. Grid drain: Chrome, 1-1/4 inches cast brass with 17 GA x 1-1/4 inches OD copper tube tailpiece.
 - c. P-trap: Chrome, 1-1/4 inches or 1-1/2 inches semi-cast with cleanout, with 17 GA x 1-1/4 inches or 17 GA x 1-1/2 inches OD copper tube trap arm.

2.8 MIXING VALVES

- A. Exposed valve without cabinet:
 - 1. Mixing valve:
 - a. Thermostatic, exposed valve.
 - 1) Symmons 7-700A.
 - b. Operating Parameters:
 - 1) Flow control range: 0-25 gpm.
 - 2) Output temperature range: 65-115 deg F.
 - 3) HW supply temperature: 115 deg F.
 - 4) Supply pressure range: 40-80 psiG.
 - 2. Mixing-valve trim:
 - a. Volume-control and shut-off valve: In-line, flush-mounted.
 - b. Thermometer: Exposed.
 - c. Atmospheric vacuum breaker: Exposed.
 - 3. Provide wall mounting bracket.
- B. EMV-1. Electronic Mixing valve:
 - 1. Exposed valve with cabinet:
 - a. Armstrong RADA EMC-123.
 - 2. Capacity: 75 gpm maximum with no minimum system draw-off requirement.

3. Components:
 - a. 12V DC electronic temperature controllers.
 - b. Inlet and return check valves.
 - c. Inlet, system blend and return line thermometers.
 - d. Isolation valves.
 - e. 110 V UL-listed transformer enclosed in a NEMA 4X enclosure.
 - f. Low Voltage control wiring with protective conduit.
 - g. 1/12 hp circulating pump rated at 10 gpm at 15 feet of head.
 - h. System control module.
4. Temperature Controller: non-thermostatic featuring integrated circuit board technology.
5. Package:
 - a. All required installation components shall be supplied pre-plumbed and pressure-tested, mounted to an enameled steel frame terminating in five standard union connections for hot and cold supply in, blended water to the system, and system and water heater return lines.
 - b. Electronic control box shall be supplied pre-wired, terminating at a knockout for Romex or BX cable connector.
 - c. Mounting restrictions:
 - 1) Valve package with cabinet to fit within 42 inches wide recessed wall space. Refer to drawings for location and additional restrictions.
 - 2) Cabinet: Flush-mounted with lockable, hinged door.
6. Operating requirements:
 - a. Recirculated water control within plus or minus 2 deg F with minimal recirculation of 4 2 gpm.
 - b. Control of blended water drawn from the system at a point of use within plus or minus 2 deg F.
 - c. Minimum of 2 deg F recirculation system temperature loss required for effective loop control.
 - d. Visual operation "set" and "actual" temperature display for effective commissioning, adjustment and system monitoring.
 - e. Visual signal by display to show "error" mode or "out of range" system failure, coupled with output for audible alarm and/or downstream solenoid valve relay.
 - f. Integral two-way data port for PC and BMCS interface.
 - g. Automatic shutoff of hot water flow in the event of a power failure.
7. Standards compliance:
 - a. Temperature controllers compliant with:
 - 1) ASSE Standard 1017.
 - 2) CSA B125.

2.9 SINKS - MOP

A. See Article 2.01 MATERIALS – GENERAL

B. MS-1:

1. Fixture:

- a. One-piece, molded-stone, floor-mounted basin, DN80 3 inches brass or stainless steel drain body, removable dome strainer, vinyl or stainless steel bumper guards on sides not adjacent to wall.

1) Fiat MSB-2424, 24x24 inches.

2. Faucet:

- a. Wall mounted, combination service-sink fitting, two handles, fixed spout, integral vacuum breaker, 3/4 inches hose threads, adjustable wall brace, pail hook, flanged female adjustable arms with integral stops.

1) Chicago Faucet 897.

2.10 SINKS - SERVICE

A. See Article 2.01 MATERIALS - GENERAL

B. SS-1:

1. Fixture:

- a. 24 x 20 x 13 inches, wall hung, enameled cast-iron, backsplash with faucet holes, rim guards, 3 inches outlet, DN80 3 inches trap standard with inlet strainer and clean out.

1) American Standard Plumbing Akron 7695.008.

2. Faucet:

- a. Rough-chrome, backsplash-mounted, combination service-sink fitting, two handles, short, fixed spout, integral vacuum breaker, 3/4 inches hose threads, pail hook, flanged inlets, integral stops.

1) American Standard Plumbing Heritage 8341.076.

3. Trim:

- a. 3 inches chrome grid strainer and trap standard with adjustable-height floor support.

1) American Standard Plumbing 7798.030 strainer and trap.

2.11 SINKS - UTILITY

A. US-1:

1. Fixture:

- a. 24 x 20 x 14 inches, molded-stone tub, self-leveling tapered white baked enamel steel legs, 2 inches outlet.

1) Fiat FL-1.

2. Faucet:

- a. Ledge-mounted, chrome plated, 4 inches centerset, two handles, 5 inches swing spout with integral vacuum breaker and 3/4 inches hose thread connection.

1) Chicago Faucet 891 with L5VBJKCP spout.

3. Trim:

- a. Supply pipes: 3/8 inches OD, soft copper tube, loose key stops, escutcheons.

- b. Grid drain, 2 inches cast brass, 1-1/2 inches OD tailpiece.
- c. P-trap, 1-1/2 inches semi-cast with cleanout.

2.12 SPARE PARTS

- A. Provide two of each type of renewable cartridge, stem, and seat.

2.13 URINALS

- A. Urinal fixtures, general (Following general conditions apply unless detailed otherwise in specific descriptions):
 - 1. Fixture material: White vitreous china.
 - 2. Spud material: Brass.
 - 3. Floor-mounted fixtures: Provide bolt caps with retainers for exposed bolts.
 - 4. Nominal flush volume: 4 Liters per flush 1.0 GPF.
- B. U-1, concealed sensor flush valve, 120 Volt:
 - 1. Fixture:
 - a. Wall hung, blowout, 1-1/4 inches back spud, 2 inches outlet, privacy shields, integral trap.
 - 1) American Standard Plumbing Lynbrook 6605.027.
 - b. Fixture carrier: Hanger-plate type.
 - 2. Flushometer valve:
 - a. Concealed, brass with chrome finished brass exposed components, diaphragm type, integral vacuum breaker, flush connection and spud coupling for 1-1/4 inches back spud, 1 inch wheel handle back-check angle stop. Match flush volume to fixture requirements.
 - 1) Sloan 190-1.0-ES-S.
- C. U-2, Accessible, concealed sensor flush valve, 120 Volt:
 - 1. Fixture:
 - a. Wall hung, blowout, 1-1/4 inches back spud, 2 inches outlet, privacy shields, integral trap.
 - 1) American Standard Plumbing Lynbrook 6605.027.
 - b. Fixture carrier: Hanger-plate type.
 - 2. Flushometer valve:
 - a. Concealed, brass with chrome finished brass exposed components, diaphragm type, integral vacuum breaker, flush connection and spud coupling for 1-1/4 inches back spud, 1 inch wheel handle back-check angle stop. Match flush volume to fixture requirements.
 - 1) Sloan 190-1.0-ES-S.
- D. UR-20, Accessible, concealed sensor flush valve, 120 Volt, with stainless steel wall box:
 - 1. Fixture:
 - a. Wall hung, blowout, 1-1/4 inches back spud, 2 inches outlet, privacy shields, integral trap.
 - 1) American Standard Plumbing Lynbrook 6605.027. Lynbrook rough-in sheet shows a flushometer height that does not comply with accessibility standards. Mount to comply with accessibility standards.
 - b. Fixture carrier: Hanger-plate type.
 - 1) Model.

2. Flushometer valve:
 - a. Concealed, brass, diaphragm type, integral vacuum breaker, flush connection and spud coupling for 1-1/4 inches back spud, 1 inch wheel handle back-check angle stop. Match flush volume to fixture requirements. Provide with wall stainless steel wall box with stainless steel cover and vandal resistant screws.
 - 1) Sloan 190-1.0-WB-ES-S.

2.14 WALL HYDRANTS

- A. Wall hydrants, general (Following general conditions apply unless detailed otherwise in specific descriptions):
 1. Materials: Type M copper, bronze, cast brass.
 2. Finish of exposed parts: Satin nickel.
 3. Integral, self-draining vacuum breakers.
 4. Key operated volume control/stop.
 5. Automatic draining, non-freezing.
 6. Nylon seats.
 7. Modular face/box.
 8. Renewable cartridges with integral seats (or renewable seats and stems).
 9. 3/4 inches inlet.
 10. 3/4 inches hose-thread outlet.
- B. WH-1:
 1. Fixture:
 - a. Single temperature, exposed face.
 - 1) Wade W-8600.

2.15 WATER CLOSETS

- A. See Article 2.01 MATERIALS - GENERAL
- B. Fixture carriers for wall hung water closets:
 1. Carriers consist of drainage fitting, faceplate, foot supports, closet coupling, and associated hardware.
 2. Style:
 - a. Adjustable:
 - 1) Capable of being installed to accept accessible and standard-height closets at each carrier by adjusting only the face-plate position.
 - b. Floor anchored.
 3. Material: Coated cast iron.
 4. Weight of construction: Institutional.
 5. Extension:
 - a. When distance between carrier and closet exceeds manufacturer's recommended distance, provide longer closet coupling, longer fixture studs, and additional foot supports.
 6. Provide anchor foot assembly for single carriers.
 7. Closet couplings: Cast iron.

8. Hardware:
 - a. Provide hardware to assemble carrier and to mount fixture to carrier.
 - b. Match hardware to fixture requirements.
 9. Finish on exposed parts: Chrome unless indicated otherwise in fixture 8 description.
- C. Water-closet fixtures, general (Following general conditions apply unless detailed otherwise in specific descriptions):
1. Wall hung closets: Provide fixture carriers.
 2. Close-coupled tanks:
 - a. Provide closet supplies: 3/8 inches OD, chromed, soft copper tube, loose key stop, escutcheon.
 - b. Provide anti-siphon, brass ballcocks.
 - c. Flush handles: Chrome.
 3. Floor-mounted closets: Provide bolt caps with retainers.
 4. Bowls: Elongated.
 5. Color: White.
 6. Fixture material: Vitreous china.
 7. Spud material: Brass.
 8. Spud size: DN40 1-1/2 inches.
 9. Nominal flush volume: 6 Liters per flush 1.6 GPF.
- D. Water-closet Seats, General:
1. Solid plastic.
 2. Color: White.
 3. Resistant to scratching, stains, chemicals, and cleaning agents.
 4. Elongated-bowl style.
 5. Stainless steel hinge pins, bolts, and hardware.
 6. Check hinges.
- E. WC-42, Public wall hung, concealed flush valve, 120 volt sensor operated:
1. Fixture:
 - a. Wall hung, siphon jet, back spud.
 - 1) American Standard Plumbing AFWall 2258.125
 2. Flushometer valve:
 - a. Concealed, brass with chrome plated brass exposed components, 15 inches tall, 120 volt, sensor-operated diaphragm type with manual override feature, integral vacuum breaker, flush connection and spud coupling for 1-1/2 inches top spud, 1 inch wheel handle back-check angle. Match flush volume to fixture requirements.
 - 1) Sloan Royal 152-1.6 ES-SM.
 3. Seat:
 - a. Open-front seat without cover.

- F. WC-43, Public wall hung, accessible, concealed flush valve, 120 volt sensor operated:
 - 1. Fixture:
 - a. Wall hung, siphon jet, back spud.
 - 1) American Standard Plumbing AFWall 2258.125.
 - 2. Flushometer valve:
 - a. Concealed, brass with chrome plated brass exposed components, 15 inches tall, 120 volt, sensor-operated diaphragm type with manual override feature, integral vacuum breaker, flush connection and spud coupling for 1-1/2 inches top spud, 1 inch wheel handle back-check angle. Match flush volume to fixture requirements.
 - 1) Sloan Royal 152-1.6 ES-SM.
 - 3. Seat:
 - a. Open-front seat without cover.
- G. WC-45, Public wall hung, accessible, concealed flush valve, 120 volt sensor operated, with stainless steel wall box:
 - 1. Fixture:
 - a. Wall hung, siphon jet, back spud.
 - 1) American Standard Plumbing AFWall 2258.125.
 - 2. Flushometer valve:
 - a. Brass, 15 inches tall, 120 volt, sensor-operated diaphragm type with manual override feature, integral vacuum breaker, flush connection and spud coupling for 1-1/2 inches top spud, 1 inch wheel handle back-check angle. Match flush volume to fixture requirements. Provide with stainless steel wall box with stainless steel cover and vandal resistant screws.
 - 1) Sloan Royal 152-1.6 WB ES-SM.
 - 3. Seat:
 - a. Open-front seat without cover.

2.16 UNDERSINK PROTECTIVE COVERS

- A. Undersink protective covers, vinyl:
 - 1. Material: Molded closed cell vinyl.
 - 2. Minimum thermal conductivity at mean temperature:
 - a. $k \leq 1.17$, 75 deg F.
 - 3. Attachment method: Reusable snap clips or seamless pre-wrapped.
 - 4. Service: Covers to cleanouts and valves to be removable without damage to clips.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install fixtures in first class manner with proper connections to water, drainage and vent systems.
- B. Install fixtures at manufacturer's suggested height unless noted otherwise.
- C. Install fixtures in accordance with manufacturers' instructions.
- D. See that proper grounds are set to form a secure base and an absolutely rigid setting for each fixture.
- E. Provide guards and boxing as may be required to protect fixtures against damage from operations of other trades.

- F. Where pipes penetrate walls, floors, or ceilings, conceal penetrations with chrome escutcheons or stainless steel plates.
- G. Connect exposed traps and supply pipes for fixtures and equipment to rough piping systems at wall, unless otherwise specified.
- H. Where plumbing fixtures abut to walls, floors, and countertops, seal with silicone sealant: See Section 07 92 16.
- I. On flushometer valves with pipe supports, mount pipe support to wall two-thirds of flush-valve height above fixture spud.
- J. Provide undersink protective covers on water supply and waste lines exposed beneath accessible fixtures.

3.2 FIXTURE CARRIER LEVELING

- A. Level fixture carriers by shimming floor anchors with steel washers of varying thicknesses.

3.3 ACCESSIBLE FIXTURES

- A. Install accessible fixture assemblies to meet requirements of accessibility installing standards

3.4 INTERCEPTORS

- A. Install interceptors with manufacturer's recommended clearances for cleaning access.

3.5 WATER CLOSET FIXTURE CARRIERS

- A. Install each carrier to accept accessible and standard-height water-closet installations so that future change from one height to the other can be accomplished by adjusting only the position of the face plate.

3.6 HYDRANTS

- A. Dual temperature wall hydrants: Install with access to inlets and body of mixing valve.
- B. Yard hydrants: Provide crushed rock around drain hole to allow drainage.

3.7 ADJUST AND CLEAN

- A. Valves with adjustable temperature-limit stop: Adjust stop to deliver maximum 110 deg F.
- B. Remove dirt from fixtures, fittings and traps.
- C. Secure escutcheons against wall.

END OF SECTION

SECTION 23 05 00
SPECIAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Special Mechanical Requirements, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Drawings Use and Interpretation:
 - 1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except when specifically dimensioned or detailed.
 - 2. For exact locations of building elements, refer to dimensioned architectural/structural drawings.
 - 3. Field measurements take precedence over dimensioned drawings.
 - 4. Piping and ductwork plans are intended to indicate size, capacity, approximate location, direction, and general relationship of one work phase to another, but not exact detail or arrangement.
- D. Installation of Systems and Equipment:
 - 1. Installation is subject to clarification as indicated in reviewed Shop Drawings and Field Coordination Drawings.
 - a. Generally, lay out piping requiring gravity drainage first; then lay out large pipe mains, ductwork, and electrical conduit.
 - b. This procedure is intended to promote orderly installation, but not to establish trade precedence.
 - c. Dimensions indicated are limiting dimensions.
 - d. Do not use equipment exceeding dimensions indicated on detail drawings or arrangements that reduce required clearances or exceed specified maximum dimensions.
 - e. In mechanical equipment room aisles, maintain clear head room between floor and underside of ducts, pipes, and equipment to allow for future replacing of equipment and major components (e.g., coils, fans, heat exchangers, pumps).
- E. Description of Systems:
 - 1. Provide materials resulting, upon completion, in functioning systems in compliance with performance requirements specified, and modifications resulting from reviewed Shop and Field Coordination Drawings.

1.2 QUALITY ASSURANCE

- A. Perform work in accordance with following codes:
 - 1. State and local building, plumbing and mechanical codes.
 - 2. American Gas Association.
 - 3. National Electrical Code.
 - 4. National Fire Protection Association.
 - 5. Authorities Having Jurisdiction (AHJ).
- B. Use only prime quality, new materials, apparatus, and equipment.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Structural steel support drawings and calculations signed and sealed by Specialty Structural Engineer.

1.4 PROTECTION

- A. Provide covering and shielding for equipment provided to protect from damage.
- B. Repair, restore and replace damaged items.
- C. Protect nameplates on motors, pumps, and similar equipment.
- D. Protect plumbing fixtures and brass or chromium plated trim, valves, and piping from damage.
- E. Keep dirt and debris out of pipes and ducts by capping or plugging open ends.
 - 1. Keep plug or cap in place until final connections are made.

1.5 JOB CONDITIONS

- A. Avoid interference and interruption of existing utilities and services.
 - 1. Schedule work which will cause interference or interruption in advance with Owner, Construction Manager, Engineer, authorities having jurisdiction, and affected contractors.
- B. Keep roads clear of materials and debris.
- C. Examine Contract Documents to determine how other work will affect execution of mechanical work.
- D. Examine site and become familiar with existing local conditions affecting work.
- E. Determine and verify locations of existing utilities on or near site.
- F. Make arrangements for and pay for necessary permits, licenses, and inspections.
- G. Air Quality Permits: Contractor shall be responsible for obtaining EPA air quality permits. Coordinate permitting process with Owner.
- H. Record drawings:
 - 1. Keep a complete set of mechanical drawings in job site office for indicating actual installation of mechanical systems and equipment.
 - 2. Use this set of drawings for no other purpose.
 - 3. Where material, equipment, or system components are installed differently from that indicated, indicate such differences clearly and neatly.
 - 4. At project completion, submit record set of drawings in accordance with Division 01.
- I. Operation and Maintenance Data:
 - 1. See Division 01.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Motors:
 - 1. Base:
 - a. Reliance Electric.
 - 2. Optional:
 - a. Baldor.
 - b. Century Electronics; E-Plus.
 - c. General Electric; Energy Saver.
 - d. Westinghouse Motor.
- B. Shaft grounding ring for motors:
 - 1. Base:
 - a. Aegis.

C. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 ACCESS DOORS, PANELS, AND FRAMES

A. Access Doors, Panels and Frames:

1. Where not indicated on Drawings, provide access panels and/or doors at walls, and inaccessible ceilings permit access to equipment, devices and piping requiring service, adjustment, or inspection.
2. Size:
 - a. As required to allow access, inspection, service, and removal of items served.
 - b. Minimum 18 inches x 18 inches.

2.3 COVERS FOR EXPOSED VERTICAL PIPING

A. Covers for Exposed Vertical Piping:

1. 18 GA stainless steel (type 302) with No.4 finish.
2. Extend from 2 inches above ceiling to equipment or island partition.
3. Size covers to contain number of pipes served.
4. Minimize number of covers by enclosing maximum number of pipes in each drop.
5. Anchor to equipment or partition.
6. Fasten seams and joints with stainless steel pop rivets.

2.4 EQUIPMENT GUARDS

A. Equipment guards:

1. Use suitable structural frames with minimum 12 GA, 3/4 inches galvanized mesh, or expanded metal mesh.
2. Attach to equipment by removable clips and bolts with wing nuts, or other approved connectors.
3. At belts, provide opening for measuring RPMs.
4. Provide at belts, couplings, moving machinery and equipment in accordance with OSHA.
5. Design for easy access to belts and other items requiring replacement.

2.5 MOTORS AND CONTROLS

A. Motors:

1. Provide motors indicated in Mechanical Specification Divisions.
2. Ball or roller bearing type, premium efficiency type.
3. Starting and running characteristics consistent with torque and speed requirements of driven machine.
4. Motor efficiency:
 - a. NEMA Standard MG-1, part 31.
 - b. Indicate full load efficiency on each nameplate.
5. Rated in accordance with NEMA performance standards to carry full nameplate load continuously at maximum temperature rise of 40 degrees C above ambient with service factor of 1.15.
6. Motor powers as scheduled.
7. Do not allow power requirements of driven machine to exceed nominal nameplate rating of motor furnished.
8. Do not include service factor when selecting motor power.

9. Motors 1/2 hp and over: 460/3/60.
 10. Motors less than 1/2 hp: 115/1/60.
 11. Provide for items which require electric drive.
- B. Motors for use with variable frequency drives (VFDs):
1. Provide with following to prevent bearing current damage:
 - a. Shaft grounding ring:
 - 1) Discharges shaft currents to ground through use of frictionless conductive microfibers surrounding motor shaft.
 - 2) Maintenance required: none.
 - 3) Design to last for service life of motor.
 - 4) RPM limitation: none.
 - 5) Manufacturer: Aegis SGR.
 2. Motors used with variable frequency drives and controls, shall be Inverter Duty with cast iron housing and 1.15 service factor at varying speeds with adjustable frequency. Provide transient spike resistant winding insulation varnish. These motors shall be selected by variable frequency drive manufacturer and supplied by manufacturer of the controlled equipment.
- C. Motor controls and wiring for controls:
1. Provide complete installation of controls and wiring for controls for Mechanical Specification Divisions packaged/pre-wired equipment.
 - a. Include line voltage controls, low voltage controls, control switches, starters, disconnects, conduit, and wiring.
 - b. Locate disconnects on outside of equipment enclosures or guards.
 2. Starters, disconnects, conduit, and wiring furnished under Mechanical Specification Divisions shall comply with applicable Electrical Specification Divisions.
 3. Where equipment is specified with packaged/pre-wired controls but is furnished instead with loosely shipped components that require field wiring, coordinate complete installation and assume costs.

2.6 PENETRATIONS

- A. Maintain fire and smoke ratings where mechanical items penetrate fire and fire/smoke rated building elements.

2.7 STRUCTURAL STEEL FOR SUPPORTS

- A. Assume engineering responsibility for design of steel supports.
- B. Engineer Qualifications: Comply with Section 01 71 21, Specialty Engineering Requirements
- C. Design units and connections to satisfy requirements of applicable Building Codes.
- D. Design units and connections capable of withstanding the following design loads as shown on structural drawings within limits and under conditions indicated:
1. Include effect from adjacent attached construction.
 2. Wind pressure, and/or earthquake lateral forces.
 3. Live Loads.
 4. Dead load of unit plus superimposed loads.

- E. Structural Steel for Supports:
 - 1. Comply with ASTM A36.
 - 2. Galvanize members installed in fan plenums or areas of high humidity or condensation, and outside.
 - 3. Furnish other members with shop coat of rust inhibiting primer.
 - 4. Shop fabricate for field assembly using bolts.
 - 5. Minimize field welding.
 - 6. Retouch primer after field welding.

2.8 PRODUCT SUSTAINABILITY CRITERIA

- A. Where applicable, provide and document the following:
 - 1. Energy Efficient Equipment.
 - a. Provide documentation that the following products meet energy efficiency requirements:
 - 1) Fans.
 - 2) Air Handling Units.
 - 3) Fancoil Units.
 - 4) Energy Recovery devices.
 - 5) Pumps.
 - 2. Reduce Volatile Organic Compounds (VOC) for sealants, coatings, or adhesives.
 - a. Low or no VOCs and no added urea formaldehyde for duct sealants, coatings, or adhesives.
 - 3. Ozone Depleting Substances for Refrigerants
 - a. Do not use any ozone depleting substances as refrigerants.

PART 3 - EXECUTION

3.1 GENERAL

- A. When changes in location of work are required, obtain approval of Engineer before making change.
 - 1. Make changes at no extra cost.
- B. Provide necessary offsets and crossovers in piping and ductwork, whether indicated or not.
- C. Install piping and ductwork parallel to walls and vertically plumb.
- D. Do not change indicated sizes without approval of Engineer.
- E. Electrical equipment:
 - 1. Maintain space above electrical equipment rooms and closets clear of ductwork and piping.
 - 2. Maintain space above panelboards, switchboards, motor control centers, or motor control panels clear of ductwork and piping.
- F. In elevator machine rooms, install no piping except floor drains and fire protection piping that specifically serves the room.
- G. Roof penetrations:
 - 1. Make penetrations through roofs prior to installation of roofing.

2. For penetrations required after installation of roofing:
 - a. In built up roofing (BUR), provide curbs, cants, and counter flashings.
 - b. In elastic sheet roofing (ESR), arrange and pay for flashing work by authorized roofer; provide counter flashings.
3. Repair and replace roof construction which is damaged by this work in manner which will not nullify roof warranty.

3.2 LOCATING SERVICEABLE DEVICES

- A. Install devices, which may require adjustment or service maintenance, in accessible locations or provide flush-mounted access doors.
 1. Such devices include but are not limited to equipment, valves, filters, motors, drives, compressors, unions, traps, strainers, thermometers, gauges, switches, measurement devices, coils, detectors, dampers, sensors, monitors, backflow prevention devices, drains, floor sinks, cleanouts, test stations, signal devices, sprinkler heads, air vents, expansion joints, and system drains.
 2. Arrange piping, conduit, ducts, and related work to facilitate maintenance.
 3. Relocate items which interfere with access.

3.3 CUTTING AND PATCHING

- A. Requesting openings in advance.
 1. Coordinate locations with work of other sections.
- B. Avoid cutting, where possible, by setting sleeves or frames.
- C. Before cutting of structural elements, obtain written approval of Structural Engineer.
 1. Use only approved methods.
 2. Neatly cut holes as approved by structural engineer to admit work.
 3. Do not weaken walls or floors; locate holes in concrete to avoid structural members.
- D. Perform cutting, fitting, repairing, patching, and finishing of work to permit installation of mechanical work.
- E. Locate openings and sleeves to permit neat installation of piping, ductwork, and equipment.
- F. Do not remove or damage fireproofing materials.
 1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
 2. Repair or replace fireproofing removed or damaged.
- G. Remove and replace existing ceilings for mechanical work in existing areas.

3.4 EXCAVATING AND BACKFILLING

3.5 INSTALLATION OF EQUIPMENT

- A. Install equipment in accordance with manufacturer's recommendations and as specified.
- B. Provide necessary anchoring devices and supports.
 1. Use structural supports suitable for equipment, or as indicated.
 2. Check loadings and dimensions of equipment with shop drawings.
 3. Do not cut building structural members.
 4. Provide equipment supports even though not detailed on architectural and structural drawings.
- C. Equipment Bracing:
 1. See Section 23 05 48.

- D. Coordinate fit of equipment support with layouts indicated.
 - 1. Where substitute equipment is used, revise indicated supports to fit.
 - E. Arrange for necessary openings to allow entry of equipment.
 - 1. Where equipment cannot be installed as structure is being erected, provide and arrange for building in of boxes, sleeves, or other devices to allow later installation.
 - F. Install rain hoods and metal counter flashings as indicated, and to make penetrations of mechanical work through walls and roofs water and weathertight.
 - 1. Furnish clamps, waterproofing material, and labor.
 - 2. Where metal flashings are applied over concrete, paint concrete with 1/8 inches of mastic cement first.
 - 3. Set flashing in mastic cement, watertight.
 - G. Provide concrete foundations (isolation pads) or housekeeping pads for mechanical equipment as follows unless indicated otherwise:
 - 1. Install 4 inches high concrete housekeeping pads. Outside dimension of pad shall be at least 4 inches larger in all directions than base of equipment or 9 inches from center of anchor, whichever is greater.
 - 2. Use 3,000 psi concrete.
 - 3. Reinforce with No.4 bars, 12 inches on-center each way, with short No.4 dowels into floor at 24 inches on-center each way.
 - 4. Chamfer top edges 3/4 inches.
 - 5. Make faces smooth.
 - 6. Set anchor bolts for equipment.
- 3.6 INSTALLATION OF EQUIPMENT FURNISHED BY OWNER OR OTHER DIVISIONS
- A. Receive, uncrate, and set in place mechanical equipment furnished by Owner or other Divisions.
 - B. Remove, relocate, and reinstall existing mechanical equipment to be reused.
 - C. Provide rough-in and final connections to equipment requiring mechanical services.
 - 1. See schedules.
 - 2. Obtain rough-in data from inspection of same for existing equipment.
 - 3. Obtain rough-in data from final shop drawings for equipment furnished by Owner or other divisions.
 - D. Install loosely shipped fittings, valves, and other items furnished as integral part of equipment.
- 3.7 PAINTING
- A. See Section 09 91 13 and Section 09 91 23.
- 3.8 FIELD QUALITY CONTROL
- A. Perform indicated tests to demonstrate workmanship, operation, and performance.
 - 1. Conduct tests in presence of Engineer and, if required, inspectors of agencies having jurisdiction.
 - 2. Arrange date of tests in advance with Engineer, manufacturer, and installer.
 - 3. Give inspectors minimum of 24 hours' notice.
 - 4. Furnish or arrange for use of electrical energy, steam, water, or gas required for tests.
 - 5. Furnish materials required for test.

- B. Repair or replace equipment and systems found inoperative or defective and retest.
 - 1. If equipment or system fails retest, replace it with products conforming to Contract Documents.
 - 2. Continue remedial measures and retests until satisfactory results are obtained.
- C. Test equipment and systems for each item, unless otherwise recommended by manufacturer.
 - 1. Tests specified in Section 23 05 93, Testing, Adjusting, and Balancing for HVAC need not be duplicated under other sections.

3.9 ADJUST AND CLEAN

- A. Inspect equipment and put in satisfactory working order.
- B. Clean exposed and concealed items:
 - 1. Clean air surfaces of coils, fans (including fan wheels and motors), air handler plenums and air filter frames.
 - 2. Clean floor drains, cleanouts, and plumbing fixtures.
 - 3. Clean specialties such as traps and strainers and equipment surfaces such as pumps, motors, boilers, chillers, etc.
 - 4. Clean finned elements of fin tube radiation with compressed air.
 - 5. Clean piping of tags, debris, and other construction materials before insulating or painting.
 - 6. Clean debris including dirt and sand out of ductwork.

3.10 PUTTING SYSTEMS IN OPERATION - START-UP

- A. Prior to substantial completion and building occupancy, at time agreed to by Owner and Engineer, put systems into satisfactory operation.
 - 1. At first heating or cooling season following substantial completion, put systems not yet operated under their seasonal loads into satisfactory operation.
- B. Operate systems in satisfactory working order for period of 10 working days.
 - 1. After the 10 days, clean debris including dirt and sand out of ductwork.

END OF SECTION

SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Gate valves.
 2. Globe valves.
 3. Ball valves.
 4. Plug valves.
 5. Butterfly valves.
 6. Check valves.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
1. ASTM International (ASTM):
 - a. A216/A216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
 - b. D1785, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - c. D4101, Standard Specification for Propylene Injection and Extrusion Materials.
 2. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):
 - a. SP 67, Butterfly Valves.
 - b. SP 70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - c. SP 71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - d. SP 78, Cast Iron Plug Valves, Flanged and Threaded Ends.
 - e. SP 80, Bronze Gate, Globe, Angle and Check Valves.
 - f. SP 85, Cast Iron Globe & Angle Valves, Flanged and Threaded.
 - g. SP 110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
 3. Underwriters Laboratories Inc. (UL):
 - a. 842, Valves for Flammable Fluids.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.
 2. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.
- B. Contract Closeout Information:
1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Apollo Valves by Conbraco Industries, Inc.
 2. Crane ChemPharma Energy.
 3. DeZURICK/APCO/Hilton.
 4. Milwaukee Valve Company.
 5. NIBCO, Inc.
 6. Stockham by Crane ChemPharma Energy.

2.2 GATE VALVES

- A. 2 inches and Smaller: MSS SP 80, Class 150, bronze body, bronze trim, union bonnet, non-rising stem, hand-wheel, inside screw with back-seating stemwedge disc, alloy seat rings, ends.
- B. 2-1/2 inches and Larger: MSS SP 70, Class 125, cast iron body, bronze trim, bolted bonnet, [rising] [non-rising] stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.3 BALL VALVES

- A. 2 inches and Smaller: MSS SP 110, 400 psi WOG, one piece bronze body, chrome plated brass ball, full port, teflon seats, blow-out proof stem, solder or threaded ends with union, lever handle.
- B. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two piece body, chrome plated bronze ball, full port, teflon seats, blow-out proof stem, solder or threaded ends with union, lever handle.

2.4 PLUG VALVES

- A. 2 inches and Smaller: ANSI C-517, Class 125, carbon steel, round port, full pipe area, non-lubricated, EPDM packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.
- B. 2 inches and Smaller: MSS SP 78, CSA/CGA approved, Class 150, semi-steel construction, round port, full pipe area, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.
- C. 2-1/2 inches and Larger: MSS SP 78, Class 150, semi-steel construction, round port, full pipe area, pressure lubricated, teflon packing, flanged ends. Furnish worm gear-operated.

2.5 BUTTERFLY VALVES

- A. 2-1/2 inches and Larger: MSS SP 67,.
1. Body: Cast or ductile iron, wafer, lug, or grooved ends, stainless steel stem, extended neck.
 2. Disc: Aluminum bronze or stainless steel.
 3. Seat: Resilient replaceable Buna N.
 4. Handle and Operator: Hand-wheel and gear drive.
- B. 2 inches through 10 inches: 150 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F, one piece body, ASTM D1785 PVC, lug type flange facing, disc encapsulated with EPDM, stainless steel shaft, locking lever handle.
- C. 2 inches through 10 inches: 150 psi at 73 degrees F water temperature, maximum service temperature 210 degrees F, one piece body, ASTM D1785 CPVC, lug type flange facing, disc encapsulated with EPDM, stainless steel shaft, locking lever handle.

- D. 2 inches and Smaller: MSS SP 67, 175 psi, bronze body, Viton seals, stainless steel trim, lever handle UL 842 listed for gas service, threaded ends, full port.

2.6 CHECK VALVES

A. Horizontal Swing Check Valves:

- 1. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.
- 2. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.

B. Spring Loaded Check Valves:

- 1. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, [solder] [or] [threaded] ends.
- 2. 2-1/2 inches and Larger: MSS SP 71, Class 125, globe style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify piping system is ready for valve installation.

3.2 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install 3/4 inches ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- D. Install valves with clearance for installation of insulation and allowing access.

3.3 VALVE APPLICATIONS

- A. Install ball butterfly or gate valves for drain service at locations indicated on Drawings in accordance with this Section.
- B. Install ball butterfly or gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install ball butterfly or globe valves for throttling, bypass, or manual flow control services.
- D. Install spring loaded check valves on discharge of water pumps.
- E. Install lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- F. Install butterfly valves in heating water systems for shut-off service.
- G. Install butterfly valves in heating water systems interchangeably with gate and globe valves.

3.4 SCHEDULES

- A. Valve Service:

SYSTEM DESCRIPTION	SHUTOFF	THROTTLING	CHECK
Heating Hot Water			
Chilled Water			

END OF SECTION

SECTION 23 05 29 PENETRATIONS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Penetrations and Supports, as indicated, in accordance with provisions of Contract Documents.
- B. Systems Included:
 - 1. Penetrations.
 - 2. Pipe hangers and supports.
 - 3. Pipe and equipment anchors.
- C. Definitions:
 - 1. UCSS: Universal Channel Strut System.
- D. Completely coordinate with work of other trades.
- E. Concrete Anchoring:
 - 1. Cracked concrete is the baseline condition for the design of cast-in-place and post-installed anchors in alignment with both ACI 318 and International Building Code.

1.2 QUALITY ASSURANCE

- A. Pipe hanger standards:
 - 1. Manufacturers Standardization Society (MSS) SP-58 Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.
 - 2. ASME/ANSI B31.1 Code for Pressure Piping
 - 3. ACI 318: Building Code Requirements for Reinforced Concrete

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Layout for all required structural penetrations shown on structural framing plan or structural wall elevation. When working with existing construction include size and location of all existing penetrations on the drawing.
 - 2. Pipe Anchors:
 - a. Detailed drawings, signed and sealed by a Specialty Structural Engineer.
- B. Product Data:
 - 1. Pipe hangers:
 - a. Identify each hanger according to systems, pipe sizes, and orientations on which it will be used.
 - 2. Concrete Anchors:
 - a. Document Manufacturer approval or listing for cracked concrete application
 - 1) Drop-In Anchors are NOT cracked concrete rated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Pipe hangers:
 - 1. Base:
 - a. PHD Manufacturing.

- 2. Optional:
 - a. Anvil International.
 - b. Cooper B-Line.
 - c. Tolco Inc.
 - d. Erico International.
- B. Concrete inserts, pre-pour:
 - 1. Base:
 - a. Hilti.
 - 2. Optional:
 - a. Simpson.
 - b. Powers Fasteners.
 - c. Tolco.
 - d. B-line.
- C. Concrete inserts, post-pour:
 - 1. Base:
 - a. Hilti.
 - 2. Optional:
 - a. Simpson.
 - b. Powers Fasteners.
- D. Factory-fabricated supports for insulated pipe:
 - 1. Base:
 - a. Pipe Shields.
 - 2. Optional:
 - a. B-Line Systems.
 - b. Power Piping.
- E. Pipe and equipment anchors:
 - 1. Base:
 - a. Shop fabricated.
 - 2. Optional:
 - a. Field fabricated.
- F. Factory-fabricated pipe supports at plumbing fixtures:
 - 1. Base:
 - a. Sioux Chief Manufacturing.
 - 2. Optional:
 - a. B-Line Systems.
 - b. Holdrite.
 - c. Sumner.
- G. Universal channel strut system:
 - 1. Base:
 - a. Unistrut (Tyco Electrical and Metal Products).

- 2. Optional:
 - a. Erico International.
 - b. Cooper B-Line.
 - c. Tolco, Inc.
- H. Insulation Saddles:
 - 1. Base:
 - a. PHD Manufacturing.
 - 2. Optional:
 - a. Buckaroos, Inc.
- I. Elastomeric Pipe Insulation Saddles:
 - 1. Base:
 - a. Armacell engineered foams.
- J. Wooden saddles:
 - 1. Base:
 - a. Buckaroos, Inc.
 - 2. Optional:
- K. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 PENETRATIONS

- A. Penetrations - General:
 - 1. For concrete walls, floors, roofs, foundations, footings and grade beams, provide openings sufficiently sized to allow free movement of piping with insulation continuous through sleeve.
 - 2. Create openings by placing sleeves prior to pouring of concrete in accordance with requirements indicated on structural drawings.
 - 3. Core drilling or cutting will not be permitted without prior written approval by structural engineer.
 - 4. Opening diameters:
 - a. Minimum 3 inches.
 - b. Bare pipe: Minimum 1 inch larger than outside diameter of pipe.
 - c. Insulated pipe: Minimum 1-1/2 inches larger than outside diameter of insulation.
 - d. Diameter suitable for construction tolerances and to receive sealant.
 - 5. Openings for future work: Same as this work.
 - 6. Coordinate detailing of roof, foundation wall, and slab-on-grade penetrations with roofing, waterproofing, and vapor retarder installers. Protect continuity of roofing, waterproofing, and vapor retarder systems.
- B. Pipe entrance wall sleeve and anchoring:
 - 1. Provide steel, heavy wall welded or seamless pipe sleeve full circle continuously welded water stop plate.
 - 2. Provide sleeve full length of wall thickness and protect with a primer coat.

3. Structurally secure pipe to withstand water hammer force.
 - a. Extend exterior piping material into building a minimum of 305 mm 12 inches.
 - b. Provide a mechanical joint on interior end of pipe and mechanical tie in back to adjoining structural, exterior, wall.
4. Provide "Link-Seal" on pipe at exterior side of sleeve.

C. Water dams:

1. Construct water dams to meet either of the following criteria:
 - a. Steel pipe with flange water dam:
 - 1) Construct water dam by welding together Schedule 40 steel pipe and steel flange to be water tight.
 - 2) Cut flange from flat steel of same thickness as pipe wall. Flange ring width shall be 25 mm 1 inch minimum.
 - 3) Inside diameter of dam shall be approximately 25 mm 1 inch larger than outside diameter of piping or its insulation, which ever is larger.
 - 4) Install top of water dam to be 100 mm 4 inches above the finished floor.
 - 5) Permanently anchor dam flange to the floor, and seal the flange-to-floor joint water tight.
 - b. Steel water dam:
 - 1) Construct dam by inserting end of Schedule 40 steel pipe or sheet steel fully into a groove approximately 13 mm 1/2 inches deep.
 - 2) Seal the joint between dam and floor water tight.

D. Sealants:

1. Seal annular space around piping.
2. Maintain fire and smoke ratings at pipe penetrations of fire and fire/smoke rated building elements.
3. For non-rated floors and walls see Section 07 92 16.
4. For exterior and foundation walls: Use synthetic rubber seals, "Link-Seal" water proof material or system.
 - a. Optional sealing of pipe with oakum stop and caulk on exterior side is acceptable.
5. Seal water dams to floor in accordance with Section 07 92 13.

2.3 PIPE HANGERS

A. Pipe hangers - General:

1. MSS SP-58 for materials, design, manufacture, selection, application, and installation requirements.
2. ACI 319 for attachment requirements to concrete.
3. Hangers and channels, angles, and supporting steel: Galvanized unless indicated otherwise.
4. Pipes running parallel may be supported on trapezes.
5. Hanger rods of continuous thread type: Galvanize after threads are cut.
6. Galvanize structural steel, angles, rods, channels, and hardware located in boiler, mechanical, and fan rooms and on roofs.

7. Where grooved couplings are used, place hanger within 2 feet each side of fittings or refer to manufacturer's pipe support and anchorage guide.
8. Screw threads on hangers and fittings: Conform to Class 2A and 2B of ANSI/ASME-B1.1.

B. Structural considerations:

1. Steel or concrete roof/floor system including slabs or roof deck shall be in place and complete before installation of mechanical piping system.
2. Space hangers so maximum individual hanger load will not exceed values listed in paragraph "Pipe hanger loading".
3. Do not attach hangers to steel roof deck.
4. Do not attach hangers larger than 1/2 inches diameter to bottom of concrete filled floor or roof deck.
5. Individual hanger loads exceeding 1000 pounds attached to the same deck span shall not be spaced closer than 5 feet on center.
6. The sum of all hangers supported by a slab span in a 5 feet by 5 feet area shall not exceed 1000 pounds.
7. Attach hangers to beams whenever possible.

C. Pipe hanger spacing:

1. Locate hangers at each change of direction.
2. Space hangers at or within following maximum limits:

Pipe Diameter	Standard Steel		Copper	
	Fluid	Vapor	Fluid	Vapor
1/2 - 1 inch	7 feet	8 feet	5 feet	6 feet
1-1/4 - 2 inches	7 feet	9 feet	6 feet	9 feet
2-1/2 - 3 inches	11 feet	14 feet	9 feet	13 feet
3-1/2 - 4 inches	12 feet	16 feet	10 feet	15 feet
5 - 6 inches	12 feet	19 feet	10 feet	18 feet

3. For cast iron pressure piping, space maximum 12 feet on-center.
 - a. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.
4. For cast iron soil piping, space maximum 10 feet on-center.
 - a. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.
 - b. Provide bracing of 5" and larger horizontal cast iron pipe per manufacturer & CISPI.
 - c. Provide sway bracing of 4" and larger drainage piping per IPC 308.6 and NSPC for horizontal cast iron pipe.
5. For piping materials not covered in this spec, space hangers according to manufacturer's recommendations.

D. Pipe hanger rod loading:

1. Total hanger rod load (including piping, insulation, and fluid) not exceeding following limits:

Nominal Rod Diameter	Maximum Load
3/8 inches	560 pound
1/2 inches	890 pound
5/8 inches	1460 pound
3/4 inches	2030 pound

2. Do not exceed manufacturer's recommended maximum safe load if smaller than above.

E. Pipe hangers for uninsulated pipe:

1. Independent hangers: MSS SP-58 type 1, 3, 4, 5, 7, 9, 10, 11, 12, 24, 41, 43, 44, 45, or 46.
 - a. Types 7 and 10: Not allowed on pipe sizes greater than DN150 6 inches.
2. Hangers used with trapezes:
 - a. MSS SP-58 type 24 or 26.
 - b. Hanger designed as part of UCSS.
3. Hangers supporting bare copper pipe:
 - a. Copper plated or electro-galvanized hangers. Provide factory-applied felt or plastic padding to eliminate contact between support and copper pipe.
4. Hangers supporting bare glass pipe:
 - a. For horizontal piping, use electro-galvanized supports with factory-applied felt or plastic padding to eliminate contact between metal and glass.
 - b. For vertical piping, use electro-galvanized supports with factory-applied 7 mm 1/4 inches thick solid neoprene or Buna-N pads to eliminate contact between metal and glass.

F. Pipe hangers for insulated pipe:

1. Hangers shall support piping from outside diameter of insulation.
2. Independent hangers: MSS SP-58 type 1, 3, 7, 9, 10, 41, 43, 44, 45, or 46.
 - a. Types 7 and 10: Not allowed on pipe sizes greater than DN150 6 inches.
3. Hangers used with trapezes:
 - a. Pipe sizes DN50 2 inches and smaller: MSS SP-58 type 26.
 - b. Pipe sizes DN65 2-1/2 inches and larger:
 - 1) MSS SP-58 type 24 or 26.
 - 2) Hanger designed as part of UCSS.
4. Pipe sizes 2 inches and smaller: Use hanger with insulation protection shield: MSS SP-58 type 40.

5. Pipe sizes 2-1/2 inches and larger: Use hanger with factory-fabricated support:
 - a. 100 psi, waterproofed calcium silicate fully encased in sheet metal shield.
 - 1) Pipe supported on rod hangers: Pipe Shields Models A1000, A2000, A3000, A4000 and A9000.
 - 2) Pipe supported on flat surfaces: Pipe Shields Models A1000, A2000, A5000, A6000 and A7000.
 - 3) Pipe supported on pipe rolls: Pipe Shields Models A3000, A4000, A5000, A6000 and A8000.
 - b. Extend insulation inserts 1 inch beyond shields on refrigerant and chilled water lines.
 - c. For steam piping 8 inches and larger, provide supports with slide bases.
6. For piping systems insulated with Elastomeric pipe insulation, composite Elastomeric and high density insert may be used:
 - a. Jacket: 30 mils stainless steel.
 - b. Basis: Armacell Armafix NPH pipe hanger inserts.
 - c. Coordinate with section 23 07 00 Pipe, Duct and Equipment Insulation for applicability.
- G. Pipe hangers in other situations: See MSS-SP-58.
- H. Trapezes:
 1. Suspend trapezes from concrete inserts, approved structural clips or beam clamps.
 2. Construct trapezes of galvanized angle iron, UCSS channels, or other structural shapes with flat surfaces for point of support.
 3. See pipe hanger paragraphs for hanger types allowed with trapezes.
- I. Vertical pipe supports and guides for mechanical piping:
 1. Support vertical pipe runs in pipe chases from the top and every other floor down.
 2. Provide pipe guides for lateral movement on alternating floors of pipe supports.
- J. Vertical pipe supports and guides for plumbing piping:
 1. Provide vertical plumbing piping support at vertical distances as follows:
 - a. Cast Iron pipe: 15 ft.
 - b. Copper pipe: 10 ft.
 - c. PVC pipe: 10 ft. (for piping 2" and smaller, provide a guide at mid span).
 - d. CPVC pipe: 10 ft (for 2" and smaller, provide a guide at mid span).
 - e. Polypropylene pipe: 10 ft (for 2" and smaller, provide a guide at mid span).
- K. Concrete inserts:
 1. Pre-pour concrete inserts:
 - a. Continuous-slot or individual concrete inserts for use with hangers for piping and equipment exposed in labs and classrooms, and as required.
 - b. Provide inserts in time for installation in concrete.
 - c. Continuous-slot inserts:
 - 1) B-Line Figure B22I, B32I, B42I or B52I.

- d. Individual inserts:
 - 1) Grinnell Figure 282, or 281.
 - 2) Do not exceed manufacturer's recommended load on insert.
- 2. Post-pour concrete inserts:
 - a. Approved for cracked concrete applications. Drop-In Anchors SHALL NOT be used.
 - b. At concrete slabs on steel deck, install anchor in top of deck flute.
 - c. Minimum embedment depth and base material thickness per anchor size shall be according to the following schedule:

Anchor Size IN	Minimum Base Material Thickness IN	Minimum Embedment Depth IN
1/4	3	1
3/8	3-1/8	1-9/16
1/2	4	2
5/8	5-1/8	2-9/16
3/4	6-3/8	3-3/16

- L. Beam clamps:
 - 1. Pipe size 3 inches and smaller:
 - a. MSS SP-58 types 19 or 23.
 - 2. Pipe sizes larger than 3 inches but smaller than 8 inches:
 - a. Malleable-iron beam clamp: MSS SP-58 type 30.
 - b. Iron beam clamp: B-Line B3055 or equal.
 - 3. Pipe sizes 8 inches and larger:
 - a. Forged steel beam clamps: MSS SP-58 type 28 or type 29.
 - b. Steel Beam clamps: B-Line B3291 through B3298 or equal.
- M. Attachments to wood structure:
 - 1. Provide angle clips and lag screws or side beam connectors: PHD figure 920 or 905.
 - 2. Strap type hangers not acceptable.

2.4 PIPE RACKS

- A. Assume engineering responsibility for design of steel rack.
- B. Engineer Qualifications: Comply with section 01 71 21 Specialty Engineering Requirements
- C. Design racks and connections to satisfy requirements of applicable Building Codes.
 - 1. Installation shall reflect the design intent of the drawings with respect to:
 - a. General pipe arrangement.
 - b. Pipe spacing.
 - c. Pipe clearances for access.
 - d. Rack structural arrangement.
 - e. Expansion anchor forces, when indicated.
- D. Hangers attached to pipe racks: Same as for systems hung from building structural systems.

2.5 PIPE AND EQUIPMENT ANCHORS

A. Pipe Anchors:

1. Approved for cracked concrete applications.
2. Provide as indicated and required to permit complete installation of system.
3. Do not anchor piping to plaster or gypsum wallboard partition walls.
4. Provide anchoring devices at locations indicated.
5. General arrangement subject to review and approval of the Structural Engineer of Record.
6. Assume engineering responsibility for design of pipe anchors and connection of anchor to structure.
7. Engineer Qualifications: Comply with section 01 71 21 Specialty Engineering Requirements
8. Design anchors to satisfy requirements of applicable Building Codes.
9. Design for stresses determined by expansion joint manufacturer. Adjust stresses at structure connection point for distance between anchor and structure connection point.

B. Anchors:

1. Angle iron and rods with turnbuckles, unless detailed otherwise.

C. Anchors for ductwork, equipment and piping hanger rods:

1. Post-pour concrete inserts:
 - a. Approved for cracked concrete applications. Drop-In anchors SHALL NOT be used.
 - b. Hard-metal, self-drilling tapped for threaded rods and designed not to depend on lead or wood for holding power.

2.6 PIPE SUPPORTS AT PLUMBING FIXTURES

A. Pipe supports at plumbing fixtures:

1. Fire-treated dimensional lumber.
2. Factory-fabricated metal brackets.
 - a. Plastic grommets/inserts factory fabricated for specific pipe diameters and materials.
3. Factory-fabricated PVC or Polypropylene plastic pipe supports and pipe fasteners.
 - a. Fastening method: Stainless-steel bands and screws or compression fit.
 - b. PVC or Polypropylene plastic: Fire retardant per UL-94.

PART 3 - EXECUTION

3.1 GENERAL

- #### A.
- Install components as indicated and in accordance with manufacturer's instructions and recommendations.

3.2 PENETRATIONS

- #### A.
- Coordinate locations of openings in structural systems with Engineer.
- #### B.
- Maintain fire and smoke ratings at pipe penetrations of fire and fire/smoke rated building elements.
- #### C.
- Set sleeves plumb or level, in proper position, tightly fitted into work.
- #### D.
- Provide water dams around pipes penetrating the floor in wet areas such as the following:
1. Mechanical room.

2. Kitchens and Food Service areas.
3. Laundry Rooms.

3.3 PIPE HANGERS

A. Glass piping:

1. Horizontal glass piping:
 - a. Install supports on horizontal lines to allow sideways movement of piping.
 - b. Provide supports at each change of direction.
 - c. Maximum support spacing: 2.400 M 8 feet.
 - 1) Provide minimum of one support per pipe section within 610 mm 24 inches of joint.
 - 2) Provide support at branch connections.
 - d. Place support no closer than 1.830 M 6 feet from connection to vertical stack.
2. Vertical glass piping:
 - a. DN50 2 inches and smaller: Support at every other floor.
 - b. DN80 3 inches and larger: Support at every floor.
 - c. On stacks, install clamp below bottom coupling of stack, and below coupling on every third floor.
 - 1) Install clamps to restrict lateral as well as downward movement.

3.4 PIPE SUPPORTS AT PLUMBING FIXTURES

A. Pipe supports at plumbing fixtures:

1. General: Fasten piping to supports within 200 mm 8 inches of final fixture connection point (valve).
2. Fire-treated wood:
 - a. Fasten wood to studs with screws.
 - b. Fasten piping to wood support:
 - 1) Pass piping through drilled holes no more than 3 mm 1/8 inches larger than outside diameter of pipe.
 - 2) Or fasten with pipe straps: Use screws to fasten straps to wood.
3. Factory-fabricated brackets:
 - a. Fasten brackets to studs with screws.
 - b. Galvanized brackets:
 - 1) Fasten piping to brackets with plastic grommets/inserts.
 - c. Copper-clad brackets:
 - 1) Use only with copper piping.
 - 2) Isolate copper-clad brackets from metal studs with insulating tape, felt, or rubber pads.
 - 3) Fasten piping to brackets by soldering or by using plastic grommets/inserts.
4. Factory-fabricated plastic supports:
 - a. Fasten brackets to waste piping, fixture carriers, or studs.

END OF SECTION

SECTION 23 05 53
MECHANICAL IDENTIFICATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Mechanical Identification Systems, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Piping system identification:
 - 1. ASME/ANSI-A13.1 Scheme for the Identification of Piping Systems.
- B. Medical gas piping color identification:
 - 1. Compressed Gas Association Pamphlet C-9 Standard Color Marking of 8 Compressed Gas Cylinders Intended for Medical Use.
 - 2. NFPA-99 Standard for Health Care Facilities.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Pipe markers.
 - 2. Valve tags.
 - 3. HVAC duct markers.
 - 4. Equipment name plates.
 - 5. Access panel markers.
 - 6. Underground marking tape.
- B. Contract Closeout Information:
 - 1. Valve Chart.
 - a. Submit completed Spare Parts and Maintenance Material Transmittal form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Mechanical Identification Systems:
 - 1. Pipe, valve and equipment markers:
 - a. Base:
 - 1) Seton Name Plate.
 - b. Optional:
 - 1) Brady, WH.
 - 2) EMED.
 - 3) Kolbi Industries.
 - 4) 3M.
 - 5) Craftmark Identification Systems.
 - 6) Marking Services, Inc.
 - 7) Carlton Industries.
 - 8) Brimar.

2. Underground marking tape:
 - a. Base:
 - 1) Reef Industries.
 - b. Optional:
 - 1) Seton Name Plate.
 - 2) EMED.

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 PIPE MARKERS

- A. Conform to ASME/ANSI-A13.1.
- B. Pressure sensitive vinyl self-adhesive material.
- C. Mechanically fastened type: Snap on or strap on.
 1. For dirty greasy, oily pipe where pressure sensitive markers may not perform satisfactorily.
- D. Provide with arrows indicating direction of flow.
- E. Letter sizes: In accordance with table in Part 3.

2.3 VALVE TAGS

- A. Brass or anodized aluminum type.
- B. Brass:
 1. Minimum 19 gauge, polished, 1-1/2 inches 40 mm diameter with following lettering:
 - a. Service: 1/4 inches 6 mm stamped black filled letters.
 - b. Valve numbers: 12 mm 1/2 inches stamped black filled letters.
- C. Aluminum:
 1. 2 inches diameter 50 mm, 0.032 inches 0.81 mm thick, with following lettering:
 - a. Service: 1/4 inches 6 mm engraved letters.
 - b. Valve numbers: 1/2 inches 13 mm engraved letters.
- D. Valve tag fasteners:
 1. 4 ply 0.018 inches 0.457 mm copper or monel wire meter seals, brass "S" hooks or No.16 brass jack chain.

2.4 HVAC DUCT MARKERS

- A. HVAC Duct Markers:
 1. 4 inches 102 mm black painted stenciled letters denoting system number (e.g., AHU-1, RF-3, EF-5), type (supply, return, exhaust) and flow direction.

2.5 EQUIPMENT NAME PLATES

- A. Equipment name plates:
 1. 1/16 inches 1.6 mm rigid plastic, Setonply, Emedolite or bakelite with four edges beveled; or engraved aluminum with black enamel background and natural aluminum border and letters.
 - a. Two 3/8 inches 10 mm mounting holes.
 - b. Lettering size: Minimum 1/2 inches 12 mm high.
 2. In addition to nameplates, label equipment with 4 inches 102 mm black painted stencil. Single stencil location to be in clear view.

2.6 ACCESS PANEL MARKERS

- A. Metal Tack Style:
 - 1. Use on acoustical tile ceilings.
 - 2. Seton style BCM or ECM.
- B. Engraved Plastic Style.
 - 1. 3/4 inches 20 mm square with center hole for small screw.
 - 2. Seton style CM75.

2.7 UNDERGROUND MARKING TAPE

- A. Underground Marking Tape:
 - 1. 0.10 mm 4 mil inert plastic film for underground use.
 - 2. Resistant to alkalis, acids and other destructive agents found in soil.
 - 3. Minimum tensile strength: 20 pounds per 3 inches 12 kg per 100 mm width.
 - 4. Minimum elongation: 500%.
 - 5. Provide continuous printed message repeated every 16 to 36 inches 400 to 1000 mm warning of pipe buried below (e.g.: "CAUTION GAS LINE BURIED BELOW").
 - 6. Color code:
 - a. Yellow: Natural gas and fuel oil systems.
 - b. Blue: Water systems, domestic and fire.
 - c. Green: Sanitary sewer system.
 - 7. Reef Industries, Standard Terra Tape.
- B. Underground Detectable Marking Tape:
 - 1. Lamination bond of 1 layer of aluminum foil between 2 layers of inert plastic film.
 - a. Aluminum foil: Minimum 0.35 mils 0.009 mm thick.
 - b. Inert plastic film: Minimum 4.3 mils 0.11 mm thick.
 - 2. Resistant to alkalis, acids and other destructive agents found in soil.
 - 3. Minimum tensile strength: 63 pounds per 3 inches 38 kg per 100 mm width.
 - 4. Minimum elongation: 500%.
 - 5. Provide continuous printed message repeated every 400 to 1000 mm 16 to 36 inches warning of pipe buried below (e.g.: "CAUTION GAS LINE BURIED BELOW").
 - 6. Tape to be inductively locatable and conductively traceable using a standard pipe and cable device for minimum of 8 years after burial.
 - 7. Color code:
 - a. Yellow: Natural gas and fuel oil systems.
 - b. Blue: Water systems, domestic and fire.
 - c. Green: Sanitary sewer system.
 - 8. Reef Industries, Detectable Terra Tape.

2.8 CHART AND DIAGRAM FRAMES

- A. Extruded aluminum with plexiglass or glass windows.

PART 3 - EXECUTION

3.1 VALVE IDENTIFICATION

- A. Identify valves, with service designation and valve number designation on valve tags.
 - 1. Tagging of valves at unit heaters, fan coil units, air terminal unit reheat coils and plumbing fixture stops are not required.
 - 2. Install tags on valves using valve tag fasteners in manner for easy reading.
- B. Label medical gas valves in accordance with NFPA-99.
- C. Furnish 4 charts including valve identification number, location (room number, department) and purpose.
 - 1. Mount 1 chart in frame and secure on wall in location directed by Owner.
 - 2. Include remaining 3 sets in Operation and Maintenance Manuals.

3.2 PIPE IDENTIFICATION

- A. Fire-protection and Sprinkler Piping.
 - 1. Painting not required in non-finished areas.
- B. Identify piping systems with indicated lettering:

Drawing Symbol	Pipe Identification Lettering
A	Medical Air (380 kPa55 psi)
BB	Boiler Blowdown
BFW	Boiler Feed Water
C	Medical Carbon Dioxide (380 kPa55 psi)
CA	Compressed Air
CD	Condensate Drain
CLPR	Clean Low Pressure Return (under 210 kPa 30 psi)
CLPS	Clean Low Pressure Steam (under 210 kPa 30 psi)
CPD	Condensate Pump Discharge
CR	Condenser Water Return
CS	Condenser Water Supply
CW	Domestic Cold Water
CWR	Chilled Water Return
CWS	Chilled Water Supply
DA	Dental Compressed Air (380 kPa55 psi)
DI	Deionized Water
DV	Dental Vacuum
DW	Distilled Water
EV	Medical Anesthesia Evacuation
F	Fire Protection
FOR	Fuel Oil Return
FOS	Fuel Oil Supply
G	Natural Gas

GWR	Glycol Water Return
GWS	Glycol Water Supply
HPR	High Pressure Return (over 480 kPa 70 psi)
HPS	High Pressure Steam (over 480 kPa 70 psi)
HW	Domestic Hot Water Supply (temperature)
HWC(	Domestic Hot Water Circulating (temperature)
HWR	Heating Hot Water Return
HWS	Heating Hot Water Supply
IA	Medical Instrument Air (1100 kPa160 psi)
LA	Laboratory Air (380 kPa55 psi)
LO	Laboratory Oxygen (380 kPa55 psi)
LPR	Low Pressure Steam Return (under 210 kPa 30 psi)
LPS	Low Pressure Steam (under 210 kPa 30 psi)
LV	Laboratory Vacuum
MPR	Medium Pressure Return (210 to 480 kPa 30-70 psi)
MPS	Medium Pressure Steam (210 to 480 kPa 30-70 psi)
N	Medical Nitrogen (1100 kPa160 psi)
NO	Medical Nitrous Oxide (380 kPa55 psi)
NPW	Nonpotable Water
O	Medical Oxygen (380 kPa55 psi)
P	Discharge Plumbing-Sump Pump/Sewage Ejector
PCWR	Process Cooling Water Return
PCWS	Process Cooling Water Supply
PR	Condensate Pump Return
S	Sprinklers
SCW	Soft Cold Water
V	Medical-Surgical Vacuum
WAGD	Medical Waste Anesthetic Gas Disposal

C. Locate identification lettering as follows:

1. Next to each valve and fitting, except on plumbing fixtures and equipment.
2. At each branch or riser take off.
3. At each passage through walls, floors and ceilings, both sides.
4. At each pipe passage to underground.
5. On horizontal pipe runs every 20 feet 6100 mm, at least once in each room and each story traversed by piping system.
6. Identify piping contents, flow direction, supply and return.
7. So it is readable from access panels and not obscured by other work.
8. At least once in or above every room.

D. Size lettering, marker color fields, and arrows as follows:

Outside Diameter of Pipe or Pipe Covering	Length of Color Field (Markers)	Size of Letters and Arrows
mm	mm	mm
20 to 32	200	12
40 to 50	200	20
65 to 150	300	32
200 to 250	600	65
Over 250	800	90

Outside Diameter of Pipe or Pipe Covering	Length of Color Field (Markers)	Size of Letters and Arrows
IN	IN	IN
3/4 to 1-1/4	8	1/2
1-1/2 to 2	8	3/4
2-1/2 to 6	12	1-1/4
8 to 10	24	2-1/2
Over 10	32	3-1/2

E. Pipe Markers:

1. Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 degrees.

F. Where supplementary color identification of medical gas piping is used, paint or label in accordance with gases and colors indicated in CGA Pamphlet C-9.

3.3 DUCTWORK IDENTIFICATION

A. Locate duct markers as follows:

1. At each branch or riser take-off.
2. Next to equipment.

B. Stencil ductwork or exterior surface of insulation.

3.4 EQUIPMENT IDENTIFICATION

A. Attach equipment nameplates in conspicuous location, directly on item of equipment or apparatus such as starters, pumps, fans, HVAC units and control panels.

1. Secure nameplates with self-tapping screws, or nuts and bolts.

B. For unsuitable surfaces, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.

C. Identify devices located above ceilings and below raised floors with additional identification.

1. Use access panel markers (metal tack style) for acoustical tile ceilings, or engraved plastic style, 3/4 inches 20 mm square, for mounting on panel door; or equipment nameplates.
2. Coordinate with Owner on identification method and color codes.
3. Provide markers on all removable ceilings and ceiling access panels to indicate locations of valves, dampers, smoke detectors, etc., and other mechanical items that may need servicing or adjustment. Glue marking tacks in place to prevent their falling out.
4. Where fire protection devices are located inside ductwork, provide an additional tag on the duct access door identifying device inside.
 - a. Identification letter size: 1-1/2 inches 40 mm high minimum.

5. Color code access panel markers as follows:
- a. Red: Fire dampers, smoke detectors, sprinkler shutoff valves and duct type smoke detectors.
 - 1) Notation:
 - D - Damper
 - V - Valve
 - S - Smoke Detector
 - H - Heat Detector
 - b. Yellow: Steam, radiation, reheat and chilled water valves:
 - 1) Notation:
 - V - Valve
 - c. Gold: Automatic and balancing dampers:
 - 1) Notation:
 - V - Valve
 - D - Damper
 - d. Blue: Gases (valves):
 - 1) Notation
 - O - Oxygen
 - V - Vacuum
 - A - Medical Air
 - N - Nitrogen
 - NO - Nitrous oxide
 - EV - Anesthesia Evacuation
 - T - Temperature Control Air

3.5 CONTROL DIAGRAMS AND INSTRUCTIONS

- A. Provide HVAC control and systems instructions and diagrams in wall mounted frames.
 - 1. Mount framed diagrams in conspicuous, easily accessible places in equipment rooms housing appropriate HVAC system.
- B. Diagrams and instructions may be reduced in size provided they are easily readable and lettering is not smaller than "elite" type of standard typewriter.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Testing and Balancing, as indicated, in accordance with provisions of Contract Documents.
- B. Test, balance and adjust following mechanical systems:
 - 1. Air distribution systems.
 - 2. Air handling units and air moving equipment.
 - 3. Heating hot water systems including pumps.
 - 4. Heating and cooling coils.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Agency qualifications: Independent test and balance agency, member of Associated Air Balance Council (AABC), or National Environmental Balancing Bureau (NEBB).
 - 1. Work supervised by a certified Testing and Balancing Engineer.
 - 2. Indicate at least 5 successfully completed projects of similar size and scope.
- B. Testing and balancing standards: AABC or NEBB standards and procedures.

1.3 RESPONSIBILITIES OF TESTING AND BALANCING (TAB) AGENCY

- A. Directly responsible to Owner or Engineer.
 - 1. Will not have a contractual relationship with Installing Mechanical installer.
- B. Review contract document ductwork drawings before bid and advise 23 31 13 contractor as to the number and size of additional branch main volume dampers required to facilitate balancing.
- C. In accordance with 23 31 13, review contractor ductwork installation drawings before fabrication and advise where additional volume dampers are required to facilitate balancing.
- D. Schedule work with trades involved.
- E. Check, adjust, and balance system components to obtain optimum conditions for function and operation of system.
- F. Evaluate operation of systems and advise installer of necessary adjustments and corrective measures.
- G. Prepare and submit test reports.
 - 1. Submit to Owner and to Contractor for Submittal to Engineer.

1.4 RESPONSIBILITIES OF MECHANICAL INSTALLER

- A. Coordinate and schedule with testing agency.
- B. Start-up system and keep in correct operation during balancing operations.
- C. Provide necessary adjustments and corrections to systems as directed by Testing and Balancing Agency.
- D. Maintain accessibility to test locations and devices requiring adjustment.
- E. Provide additional sets of pulleys and belts as required by Testing and Balancing Agency.
- F. Provide a complete set of approved mechanical-equipment shop drawings to Testing and Balancing Agency.
- G. Provide a complete set of "As-built" drawings to Testing and Balancing Agency.

1.5 JOB CONDITIONS

- A. Balance at time directed by Engineer.
 - 1. If balancing is not done during peak cooling season demonstrate satisfactory balancing during next peak cooling season.
- B. Keep dust, dirt and debris to an absolute minimum and reinstall removed ceiling tiles to original positions at end of each work day.

1.6 CORRECTIVE WORK

- A. Provide extended warranty of ninety (90) days, after completion of test and balance work, during which time Engineer may, at Engineer's discretion, request recheck or resetting of equipment or system which is not performing satisfactorily. Provide technicians to assist as required in making such tests.

1.7 SUBMITTALS

- A. Project Information:
 - 1. Within sixty (60) days of award of contract submit a complete Submission Report including:
 - a. A company resume listing its personnel and project experience in air and hydronic balancing.
 - b. An inventory and calibration data of instruments and devices in possession of balancing agency whether or not they will be used on this project.
 - c. A working agenda that includes procedures for testing and balancing each air and water flow system.
 - d. Test and Balance Report Forms and Field Data Sheets that will appear in final report, with design data already filled in.
 - e. A written, system-by-system description of measurements, test locations and procedures that will be employed during test and balance.
- B. Contract Closeout Information:
 - 1. Final test and balance report:
 - a. Use forms similar to AABC or NEBB latest editions.
 - b. Report(s) signed by TAB Engineer.

PART 2 - PRODUCTS

2.1 JOB SITE INSPECTIONS

- A. During construction inspect installation of piping, sheet metal work, temperature controls, flow meters, pressure taps, strainers and other components of HVAC system as specified in contract documents.
- B. Note any deficiencies and submit them, in writing, to Engineer.
 - 1. Include these inspection reports in final TAB report.

2.2 FINAL TEST AND BALANCE REPORT

- A. Using field data, test forms and procedures outlined in Submission Report, perform and record measurements, and complete final TAB report including:
 - 1. Preface:
 - a. General discussion of system including any abnormalities and problems encountered.
 - 2. Instrumentation list:
 - a. List of instruments including type, model, manufacturer, serial number and calibration date.

3. System identification:
 - a. On each Test and Balance Report Form, number and/ or letter air terminal units, zones, supply, return and exhaust openings and traverse points to correspond to numbers and letters on Field Data Sheets.
4. Air handling equipment:
 - a. Manufacturer, model number, and serial number.
 - b. Design and manufacturer related data.
 - c. Total actual air flow rate by traverse if practical; if not practical, sum of outlets may be used, or a combination of each of these procedures.
 - 1) For specific systems, such as ones with diversity, see AABC National Standards.
 - d. Suction and discharge static pressure of each fan, as applicable.
 - e. Outside air and return air total air flow rate.
 - f. Actual operating current, voltage, and brake power of each fan motor.
 - g. Final RPM of each fan.
 - h. Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
 - i. Belt size and quantity.
 - j. Static pressure controls final operation set points.
5. Pumps:
 - a. Manufacturer, size, and serial number.
 - b. Design and manufacturer's related data.
 - c. Pump operating suction and discharge pressures, and final total dynamic head.
 - d. No-flow (pump discharge valve closed) suction and discharge pressures, and corresponding total dynamic head. (This procedure is to determine actual impeller size.)
 - e. Rated and actual operating current, voltage and brake power of each pump motor.
 - f. Submit pump curve indicating design, operating, and no-flow points of operation.
6. Heat exchangers:
 - a. Manufacturer and model number.
 - b. Design and manufacturer's related data.
 - c. Service and location.
 - d. Actual pressure drop and related water flow rate or steam pressure, primary side.
 - e. Actual pressure drop and related water flow rate or steam pressure, secondary side.
 - f. Primary side entering and leaving temperatures. (Not applicable for steam-to-water heat exchangers.)
 - g. Secondary side entering and leaving temperatures.
 - h. Temperature control setting.

7. Heating and cooling coils:
 - a. Manufacturer.
 - b. Design and manufacturer's related data.
 - c. Rated and actual water pressure drops through each coil and related water flow rate.
 - d. Rated and actual static air pressure drops across each coil.
 - e. Entering and leaving water temperatures.
 - f. Wet bulb and dry bulb temperatures entering and leaving each cooling coil.
 - g. Dry bulb temperatures entering and leaving each heating coil.
 - h. Water flow rate from flow stations or steam pressure.
8. Air terminal units, diffusers, registers and grilles:
 - a. Adjust air terminal units to deliver design maximum and minimum air-flow conditions.
 - b. Flow rate at each air outlet (diffuser).
 - c. Flow rate at each return and exhaust air inlet (register or grille).
9. Room Pressure relationships.
 - a. Maintain pressure relationships in rooms that are either positive (supply greater than return/ exhaust) or negative (supply less than return/exhaust).
 - b. In the final test and balance report, indicate that these pressure relationships were maintained.
- B. Units of measure:
 1. Flow rates:
 - a. Air: CFM.
 - b. Water: GPM.
 2. Temperatures: degF.
 3. Pressures:
 - a. Air: inches WC.
 - b. Water: PSIG.
 4. Pump heads: feet.
 5. Power: HP.

PART 3 - EXECUTION

3.1 GENERAL

- A. Final reports are required to be completed and submitted far enough in advance of local agencies final inspections for occupancy to provide adequate time for Engineer to review, Contractor to correct any deficiencies and reports to be revised for agencies final inspections.
- B. Coordinate and schedule testing and balancing with Contractor and Mechanical Contractor.
 1. Report deficiencies in systems to Mechanical Contractor for resolution.
- C. Accurately calibrate and maintain test instruments in good working order.
 1. If requested, conduct tests of instruments in presence of Engineer.
- D. If requested, conduct balancing tests in presence of Engineer.

- E. Do not begin balancing until system(s) have been substantially completed and are in good working order to permit preliminary measurements of total air or water volumes and system pressures.
- F. Proceed with final balancing and adjustments when systems are 95 to 100% complete.
- G. Record inspections, tests and adjustments.

3.2 AIR BALANCING METHODS

- A. Balance each air system that is served by air filters, using artificial static loading of system, to demonstrate, test and obtain system design pressure drop data.
 - 1. Provide dirty filter pressure drop conditions on system.
 - 2. Do not use high efficiency filters (75% and above) in testing and balancing.
 - 3. Static pressure losses may be simulated by using wood or sheet steel blanking plates in high efficiency filter racks and housings.
 - 4. Do not install blanking plates within 600 mm 2 feet of low efficiency filter unit or rack.

3.3 AIR BALANCE TESTING PROCEDURE

- A. Perform tests and balance system in accordance with approved Submission Report.
- B. Take readings of airflow stations if installed or make pitot tube traverse of main supply, return and exhaust air ducts.
 - 1. Obtain flow rates at fans at both maximum and minimum outside air operation.
- C. Test and adjust each diffuser, grille, and register served by an air terminal unit to within 10% of design requirements.
- D. In cooperation with HVAC Controls installer, set automatically operated dampers to operate as indicated.
 - 1. Check controls for proper calibration and list controls requiring adjustment.

3.4 WATER BALANCE TESTING PROCEDURE

- A. Complete air balancing before commencing water balancing.
- B. Perform test and balance systems in accordance with approved Submission Report.

3.5 OPERATING TEST

- A. After systems are balanced, conduct operating test of not less than 8 hours duration to demonstrate to satisfaction of Engineer that system(s) comply with requirements of plans and specifications, and that equipment and controls are functioning properly.

END OF SECTION

SECTION 23 07 00
PIPE, DUCT AND EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Pipe, Duct and Equipment Insulation, as indicated, in accordance with provisions of Contract Documents.
- B. Insulation Applications:
 - 1. Pipe insulation.
 - 2. Duct insulation.
 - 3. Equipment insulation.
 - 4. Insulation jacketing and prefabricated fitting covers.
 - 5. Insulation fasteners: Adhesives, mastics, and caulking.
 - 6. Grease and Air Ventilation Duct Wrap Fire Protection Systems.
 - 7. Special Considerations at hangers and bracing: See Section 23 05 29 Penetrations and Supports.
- C. Definitions:
 - 1. Concealed: Outside surfaces are isolated from room ambient air conditions by physical barrier.
 - a. Concealed items are typically accessed through suspended ceilings, through access doors, or by cutting and patching.
 - b. Listed below are examples of spaces that typically contain concealed items:
 - 1) Walls.
 - 2) Partitions.
 - 3) Chases.
 - 4) Shafts.
 - 5) Ceiling spaces.
 - 2. Exposed: Outside surfaces are not isolated from room ambient air conditions by physical barrier.
 - a. Exposed items are typically accessed directly from within a room or space.
 - b. Listed below are examples of rooms/spaces that typically contain exposed items:
 - 1) Mechanical rooms.
 - 2) Tunnels.
 - 3) Rooms without ceilings.
 - 3. Exposed to weather: Outside surfaces are not isolated by physical barrier(s) from weather or outside ambient air conditions.
 - 4. Runouts: Piping not more than 12 feet in length.
 - 5. Thermal conductivity (k): Btu/(h-ft-deg F).
 - 6. Serviceable: strainers, steam traps, cleanouts.
 - 7. Non-Serviceable: fittings, valves.
- D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Comply with the following fire and smoke hazard ratings:
 - 1. Test products by procedure ASTM E84, NFPA-255 and ANSI/UL-723.
 - 2. Rating requirements:
 - a. Maximum Flame Spread: 25.
 - b. Maximum Smoke Developed: 50.
 - 3. Properly identify products for flame and smoke ratings.
 - a. Shipping cartons may be labeled instead of product.
- B. Comply with requirements of the following:
 - 1. ASTM C547 Standard Specification for Mineral Fiber Preformed Pipe Insulation.
 - 2. ASTM C533 Standard Specification for Calcium Silicate Pipe and Block Insulation.
 - 3. ASTM C534 Standard Specification for Preformed Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - a. Products are allowed to deviate from this standard with regard to insulation density.
 - 4. ASTM C552-00 Standard Specification for Cellular Glass Thermal Insulation.
 - 5. ASTM C553 Standard Specification for Mineral Fiber Blanket and Felt Insulation.
 - 6. ASTM C585 Recommended Practice for Inner and Outer Diameters of Rigid Pipe 'Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
 - 7. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - 8. ASTM C1136 Standard Specification for Flexible Low Permeance Vapor Retarders for Thermal Insulation.
 - 9. ASTM C795 Thermal Insulation for Use Over Austenitic Stainless Steel.
 - 10. Federal Specification HH-I-558B Mineral Fiber Boards, Blankets, Pipe Covering.
 - 11. ASTM E 84, Surface Burning Characteristics: Underwriters Laboratories Applied Fireproofing Listing Nos. 11660-2, 11660-4.
 - 12. ASTM E 2336: Standard Test Methods Fire Resistive Grease Duct Enclosure Systems.
 - 13. ASTM E 814, Through-Penetration, 2-Hour Firestop Test.
 - 14. ASTM E 119 Standard Method of Fire Tests of Building Construction, 2 Hour Wall Panel Test, 2 Hour External Total Engulfment Test, hose stream evaluation.
 - 15. ASTM C 518 Aging Test, Steady State Heat Flux Measurements and Thermal Transmission Properties.
 - 16. ASTM E 162, Surface Flammability of Materials.
 - 17. ASTM E 136, Combustion Characteristics of Building Materials in a Vertical Tube Furnace.
 - 18. ISO 6944-1985, Method of Determining Fire Resistance of Ventilation Ducts.
 - 19. National Commercial and Industrial Insulation Standards (2013 seventh edition).
 - a. Published by Midwest Insulation Contractors Association (MICA).
 - b. Endorsed by National Insulation Association (NIA).
 - c. MICA plate numbers listed in this specification reference this document.

1.3 SUBMITTALS

A. Product Data:

1. Pipe insulation.
2. Precut insulation inserts.
3. Ductwork insulation.
4. Insulation for hot equipment.
5. Insulation for high-temperature equipment.
6. Insulation for cold equipment.
7. Jacketing and prefabricated fitting covers.
8. Insulation fasteners.
9. Schedule of services and insulation thicknesses.
10. Grooved coupling system insulation procedures and methods.
11. Grease and Air Ventilation Duct Wrap Fire Protection Systems:
 - a. Submit reports substantiating code compliance along with manufacturer's installation instructions.

PART 2 - GENERAL

2.1 MANUFACTURERS

A. Pipe, Duct and Equipment Insulation:

1. Insulation materials:
 - a. Base: As indicated.
 - b. Optional:
 - 1) Owens-Corning Fiberglass.
 - 2) Armacell.
 - 3) Nomaco K-Flex.
 - 4) CertainTeed Insulations.
 - 5) Knauf Insulation.
 - 6) Johns Manville.
 - 7) Pittsburgh Corning.
2. Grease and Air Ventilation Duct Wrap Fire Protection Systems:
 - a. Base:
 - 1) Thermal Ceramics.
 - b. Optional:
 - 1) Unifrax Corporation.
 - 2) 3M.
3. Jacketing:
 - a. Base: As indicated.
 - b. Optional:
 - 1) Ceel-Co.
 - 2) Childers Products.
 - 3) Johns Manville.
 - 4) Proto PVC Corporation.

- 5) RPR Metals.
 - 6) Pabco Metals Corporation.
 - 4. Prefabricated fitting covers:
 - a. Base: As indicated.
 - b. Optional:
 - 1) Ceel-Co.
 - 2) CertainTeed Insulations.
 - 3) Childers Products.
 - 4) Proto PVC Corporation.
 - 5) Johns Manville.
 - 6) RPR Metals.
 - 7) Pabco Metals Corporation.
 - 5. Adhesives, mastics, and sealants:
 - a. Base: As indicated.
 - b. Optional:
 - 1) Foster Products, Division of HB Fuller.
 - 2) Armacell.
 - 3) Childers Products.
 - 4) Dow.
 - 5) Johns Manville.
 - 6) Knauf Insulation.
 - B. Other manufacturers desiring approval comply with Section 01 61 00.
- 2.2 MATERIALS
- A. General:
 - 1. Do not use material that exceeds specified flame and smoke ratings.
 - 2. Use permanent treatments to jacketings and facings to impart specified fire ratings.
 - 3. Use of water soluble treatments is prohibited.
- 2.3 PIPE INSULATION - NON-FLEXIBLE FIBERGLASS
- A. Preformed commercial-grade fiberglass.
 - B. Temperature range: 0 deg F to 850 deg F.
 - C. Thermal conductivity at mean temperature:
 - 1. $k \leq 0.23$, 75 deg F.
 - 2. $k \leq 0.29$, 200 deg F.
 - 3. $k \leq 0.54$, 500 deg F.
 - D. Facing: All service jacket.
 - E. Integral vapor retarder: Provide where indicated in Part 3.
 - F. Seams, longitudinal: 2 inches self-sealing facing tabs.
 - 1. Provide adhesive on both contacting surfaces.
 - 2. Designed to perform without stapling.
 - G. Pipe insulation, non-flexible; cellular glass:

2.4 PIPE INSULATION - FLEXIBLE

- A. Commercial-grade closed-cell elastomeric or unicellular polyolefin thermal insulation.
- B. Temperature range: 40 to 200 deg F.
- C. Thermal conductivity at mean temperature:
 - 1. $k \leq 0.27$, 75 deg F.
 - 2. $k \leq 0.276$, 90 deg F.
- D. Seams, longitudinal: Factory-cut and self-sealing.
 - 1. Base product: AP Armaflex SS.

2.5 DUCTWORK INSULATION, NON-FLEXIBLE

- A. Commercial-grade fiberglass thermal insulation formed with a thermosetting resin into semi-rigid or rigid boards.
- B. Temperature range: 0 to 450 deg F.
- C. Minimum density:
 - 1. Semi-rigid: 3.0 pcf.
 - 2. Rigid: 6.0 pcf.
- D. Thermal conductivity at mean temperature:
 - 1. Semi-rigid:
 - a. $k \leq 0.22$, 75 deg F.
 - b. $k \leq 0.27$, 150 deg F.
 - c. $k \leq 0.38$, 300 deg F.
 - 2. Rigid:
 - a. $k \leq 0.23$, 75 deg F.
 - b. $k \leq 0.27$, 150 deg F.
 - c. $k \leq 0.37$, 300 deg F.
- E. Facing: All-Service-Jacket (ASJ).
- F. Temperature range: -20 to 150 deg F.
- G. Base Products:
 - 1. Semi-Rigid: Owens-Corning Fiberglas Type 703.
 - 2. Rigid: Owens-Corning Fiberglas Type 705.

2.6 DUCTWORK INSULATION - FLEXIBLE

- A. Interior Use:
 - 1. Commercial-grade fiberglass thermal insulation, formaldehyde free.
 - 2. Temperature range: 40 to 250 deg F.
 - 3. Thermal conductivity at mean temperature: $k \leq 0.30$, 75 deg F.
 - 4. Installed R-value: 6.0 hour-ft²-degF/BTU based on 2.2 inches nominal thickness.
 - 5. Density: 0.75 pcf
 - 6. Facing: Foil-Reinforced-Kraft (FRK) vapor-retarding.
 - 7. Seams: 2 inches facing tab.
 - 8. Base product: Owens-Corning Fiberglass commercial-grade all-service duct wrap.

- B. Exterior Use:
 - 1. Commercial-grade closed-cell elastomeric or unicellular polyolefin thermal insulation.
 - 2. Temperature range: -40 to 180 deg F.
 - 3. Thermal conductivity at mean temperature: $k \leq 0.27$, 90 deg F.
 - 4. Water vapor permeability: 0.8 perm-in.
 - 5. Base Product: AP Armaflex Sheet and Roll.

2.7 INSULATION FOR HOT EQUIPMENT

- A. Same as Pipe Insulation - Nonflexible.

2.8 INSULATION FOR HIGH-TEMPERATURE EQUIPMENT

- A. Calcium Silicate:
 - 1. Designed for application on systems operating at temperatures up to 1200 deg F.
 - 2. Minimum density: 14.5 pcf.
 - 3. Thermal conductivity at mean temperature:
 - a. $k \leq 0.40$, 200 deg F.
 - b. $k \leq 0.45$, 400 deg F.
 - c. $k \leq 0.55$, 600 deg F.
- B. Mineral Wool Batts:
 - 1. Designed for application on systems operating at temperature range: up to 1200 deg F.
 - 2. Minimum density: 38 pcf.
 - 3. Thermal conductivity at mean temperature:
 - a. $k \leq 0.30$, 200 deg F.
 - b. $k \leq 0.38$, 300 deg F.
 - c. $k \leq 0.48$, 400 deg F.

2.9 INSULATION FOR COLD EQUIPMENT

- A. Material: Commercial-grade elastomeric thermal insulation.
- B. Designed for application with complete adhesive coverage on systems operating at temperatures between -40 and 180 deg F.
- C. Thermal conductivity at mean temperature:
 - 1. $k \leq 0.27$, 75 deg F.
 - 2. $k \leq 0.276$, 90 deg F.
- D. Base product: AP Armaflex sheet insulation.

2.10 INSULATION FASTENERS

- A. Insulation Adhesive:
 - 1. Flexible pipe insulation: Manufacturers standard adhesive as approved for application.
 - 2. Foster 30-36.
 - 3. Foster Spark-Fas 85-70.
- B. Insulation Mastic:
 - 1. Childers CP-30.
 - 2. Foster 35-00-GPM.

C. Insulation Caulking:

1. As recommended by insulation manufacturer.

2.11 DUCTWORK INSULATION EXPOSED TO AMBIENT CONDITIONS

A. Weather Seal duct insulation system for externally insulated supply and/or exhaust/return ductwork exposed to weather or outside conditions. Install as follows, and in strict accordance with the manufacturer's printed instructions.

1. Ductwork:

- a. Inner layer of 1 inch thick DuPont Styrofoam (closed cell, Type D, rigid extruded polystyrene foam product) installed between duct stiffeners and flanges.
- b. Second layer of foil-faced urethane, 1 inch thick, installed over inner layer with all joints staggered. Foil faced jacket shall be installed in a manner to shed water, with top layer bending over sides of ductwork with no longitudinal horizontal joints.
- c. Final layer of Venture Clad 1577 CW Weather Barrier shall be installed over foil-faced urethane insulation.
- d. Seams on bends, elbows, T's and similar junctures shall be sealed with Venture Clad Smooth foil, 3-ply laminate, 3 inches wide adhesive VentureClad 1578 CW tape.

2. Round ductwork insulation shall be mitered or formed.

PART 3 - EXECUTION

3.1 APPLICATION

A. General:

1. Apply products per manufacturer's recommendations and as specified.
 - a. Include allowance for thermal expansion and contraction.
2. MICA plate numbers are listed under some insulation applications to clarify scope and acceptable methods of insulation application for particular listing.
3. Do not insulate piping until satisfactory completion of required pressure tests.
4. Do not insulate piping until heat tracing cable has been installed.
5. Do not insulate piping below grade.
 - a. Specific exceptions may exist under Pipe Insulation - Flexible.
6. Apply insulation to clean, dry surfaces and within manufacturers recommended temperature range.
7. Butt edges of insulation firmly together, and seal joints with compatible jackets, facings and adhesives as specified.
8. Apply insulation with a continuous, unbroken vapor retarder including, but not limited to, insulation of following.
 - a. Vapor seals on hangers, supports, and anchors secured directly to cold surfaces.
9. Continue insulation through sleeves and wall and ceiling openings.
10. Insulate fittings, unions, valve bodies, flanges and other pipeline accessories.
11. Insulation at piping supports: Coordinate with Section 23 05 29.
12. Rectangular and flat-oval ductwork exposed to weather:
 - a. Apply insulation and jacketing so top of ductwork crowns to prevent pooling of water.
 - 1) Minimum crown slope: 1/4 inches/FT.

13. Insulation installed in multiple layers: Stagger joints between layers.

3.2 PIPE INSULATION - NON-FLEXIBLE FIBERGLASS

A. General:

1. Provide either type of lap seal at joints:
 - a. Self-sealing facing tabs.
 - b. 3 inches wide pressure-sensitive joint-sealing tape matching facing.
 - 1) Manufacturer: Same as insulation.
 - c. Insulation application standard: MICA plate number 1-100.
 - d. Insulation application for heat traced piping standard: MICA plate number 1-900.
2. Fittings:
 - a. On non-serviceable items, use either of the following methods:
 - 1) Built-up systems:
 - a) Elbows: MICA plate numbers 2-100 through 2-800 as applicable.
 - b) Valves and fittings: MICA plate number 2-530 or 2-536 as applicable.
 - c) Flanges: MICA plate number 2-535.
 - d) Tees: MICA plate number 2-120.
 - 2) Prefabricated fitting cover encapsulated:
 - a) Elbows: MICA plate number 2-500.
 - b) Valves and fittings: MICA plate number 2-130.
 - c) Flange or grooved coupling: MICA plate number 2-535.
 - b. Serviceable items: Provide prefabricated fitting covers attached with bands.
 - 1) Exception: On systems exposed to weather, attach with method described as best by manufacturer.
 - c. Exposed fittings, flanges, valves, and pipe terminations: Provide prefabricated fitting covers.
 - d. Built-up system:
 - 1) DN50 2 inches and smaller: Finish with mineral fiber cement to thickness of adjoining pipe insulation.
 - 2) DN65 2-1/2 inches and larger: Insulate with insulation insert, mitered pipe insulation segments or preformed fiberglass fittings.
 - a) Secure with vinyl faced insulation strapping tape or 20 AWG galvanized annealed wire finished with one coat of mineral fiber cement.
 - 3) Finish with Glass Fab embedded in 2 coats of Foster 30-36 adhesive.

B. Provide non-flexible insulation on following piping systems in wall thickness indicated:

1. Hydronic systems:
 - a. Heating water piping, with or without glycol to 200 deg F:
 - 1) DN32 1-1/4 inches and smaller: 1-1/2 inches.
 - 2) DN40 1-1/2 inches and greater: 2 inches.

2. Plumbing systems:
 - a. Domestic cold water piping:
 - 1) DN40 1-1/2 inches and smaller: 1 inch.
 - 2) DN50 2 inches and greater: 1-1/2 inches.
 - b. Domestic hot/recirculating water, 100 to 140 deg F:
 - 1) DN32 1-1/4 inches and smaller: 1 inch.
 - 2) DN40 1-1/2 inches and greater: 1-1/2 inches.
 - c. Domestic hot/recirculating water 141 to 180 deg F:
 - 1) DN32 1-1/4 inches and smaller: 1-1/2 inches.
 - 2) DN40 1-1/2 inches and greater: 2 inches.
3. Low pressure steam and steam condensate piping, 15 psi or less, pumped condensate return, condensate vent, blowdown, boiler feed, and exhaust steam piping:
 - a. DN75 3 inches and smaller: 2-1/2 inches.
 - b. DN100 4 inches and larger: 3 inches.
4. Steam and steam condensate piping, 16 psi to 100 psi:
 - a. DN20 3/4 inches and smaller: 3 inches.
 - b. DN25 1 inch and larger: 4-1/2 inches.
5. Steam and steam condensate piping greater than 100 psi:
 - 1) DN20 3/4 inches and smaller: 4-1/2 inches.
 - 2) DN25 1 inch and larger: 5 inches.
6. Refrigerant systems:
 - a. Refrigerant/brine piping:
 - 1) DN32 1-1/4 inches and smaller: 1 inch.
 - 2) DN40 1-1/2 inches and larger: 1-1/2 inches.
7. Medical gas systems:
 - a. Medical air and lab air intake piping:
 - 1) All sizes: 1 inch.
 - 2) Medical air and lab air intakes are cold systems.
 - b. Medical vacuum exhaust piping:
 - 1) DN40 1-1/2IN and smaller: 1-1/2 inches.
 - 2) DN25 1IN and larger: 3 inches.
- C. Piping Within Air Handling Units:
 1. Flame-resistant, aluminum-faced, vapor retarder jacket over non-flexible insulation on steam, condensate-return, heating-water, and chilled-water piping inside air handling units.
 2. Extend vapor retarder jacket outside of unit enclosure.
 3. Cover joints with 3 inches wide pressure sensitive tape matching jacket.

3.3 PIPE INSULATION - NONFLEXIBLE CELLULAR GLASS

- A. General:
 1. Provide non-flexible insulation on following piping systems in wall thickness indicated:

3.4 PIPE INSULATION - FLEXIBLE

A. General:

1. Install insulation sleeve over piping.
2. Do not make longitudinal field cuts.
3. Seal joints with manufacturer approved adhesive.
4. Do not use flexible pipe insulation on systems with heat tracing cable or temperature maintenance cable.

B. Fittings:

1. Insulate fittings and valve bodies with segments cut from pipe insulation.

C. Provide flexible insulation on following piping systems in wall thickness indicated:

1. Hydronic systems:

a. Cooling coil condensate:

- 1) All sizes: 1 inch.

b. Chilled water piping, with or without glycol, 40 to 55 deg F:

- 1) DN40 1 1/2 inches and smaller: 1 inch.
- 2) DN50 2 inches and above: 1 1/2 inches.

2. Refrigerant systems:

a. Refrigerant/brine piping:

- 1) DN32 1-1/4 inches and smaller: 1 inch.
- 2) DN40 1-1/2 inches and larger: 1-1/2 inches.

3. Plumbing systems:

a. Domestic cold water piping:

- 1) DN40 1-1/2 inches and smaller: 1/2 inches.
- 2) DN50 2 inches and larger: 1 inch.

b. Waste piping from lab sinks to main stacks:

- 1) All sizes: 1/2 inches.

c. Waste piping from water coolers and drinking fountains to first point of mixing with waste from a different type of fixture:

- 1) All sizes: 1/2 inches.

d. Domestic water piping below grade within 5 feet of outside walls:

- 1) All sizes: 1/2 inches.

e. Horizontal rain leaders, including overflow systems and 24 inches up and down from horizontal and up to underside of roof deck:

- 1) All sizes: 1 inch.
- 2) Rain leaders are cold systems.

f. Horizontal condensate drain leaders (serving condensate drain discharge from cooling coil condensate drains, walk in refrigerator and freezer cooling units) and floor drain:

- 1) All sizes: 1 inch.
- 2) Condensate drain leaders are cold systems.

3.5 DUCTWORK INSULATION - NONFLEXIBLE

A. General:

1. Secure insulation to ductwork by impaling over welded-pin or adhesive-pin mechanical fasteners.
 - a. Secure insulation on mechanical fasteners with speed clips.
 - b. Space mechanical fasteners to hold insulation securely in place.
 - 1) Maximum spacing: 12 inches centers.
 2. Where access is not possible for pin attachment, use adhesive or caulk.
- a. Cover entire surface with brush applied adhesive.
- b. Apply caulk in continuous bead on 6 inches centers.
3. Seal joints and speed clips with 3 inches wide pressure-sensitive joint-sealing tape matching facing.
 - a. Staple corners of tape with outward clinching staples.
4. Cold systems only: Coat staples with mastic.
5. Reinforce edges with metal corner angles.
6. Apply insulation to ductwork from unit housing to ends of duct runs including diffuser necks and register ducts.
7. Do not apply insulation over coil and damper access panels.
8. Use FRK facing on concealed ductwork.
9. Use ASJ facing on exposed ductwork.

B. Provide non-flexible insulation on following ductwork in thickness indicated:

1. Outside-air rectangular ductwork:
 - a. All sizes: 2 inches.
2. Supply-air ductwork exposed in occupied spaces, except equipment rooms:
3. Factory packaged air handling units, mixed-air plenum and ductwork, component housings to fan unit inlet including transition sections and prefilter:
 - a. All sizes: 2 inches.
4. Fan discharge transition to and including final filter housing:
 - a. All sizes: 2 inches.
5. Relief-air/exhaust-air plenums behind louvers or below gravity and powered roof ventilators:
 - a. All sizes: 2 inches.

3.6 DUCTWORK INSULATION - FLEXIBLE

A. General:

1. On ductwork 24 inches wide and less, secure insulation to bottom of ductwork with 4 inches wide bands of brush-applied adhesive on 12 inches centers.
2. On ductwork over 24 inches wide, secure insulation to bottom of ductwork by impaling over welded-pin or adhesive-pin mechanical fasteners.
 - a. Secure insulation on mechanical fasteners with speed clips.
 - b. Space mechanical fasteners to hold insulation securely in place.
 - 1) Maximum spacing: 12 inches centers.

- c. Seal speed clips with 3 inches wide pressure-sensitive joint-sealing tape matching jacket.
 - 1) Staple corners of tape with outward clinching staples.
 - 2) Cold systems only: Seal staples with mastic.
 - 3. Provide either type of lap seal at joints:
 - a. Seal facing tab over adjoining facing with lap adhesive.
 - 1) Secure lap with outward clinching staples on 6 inches centers.
 - b. Use 3 inches wide pressure-sensitive joint-sealing tape that matches facing.
 - 1) Secure both sides of tape with outward clinching staples on 6 inches centers.
 - c. Cold systems only: Seal staples with mastic.
 - 4. Apply insulation to ductwork from unit housing to ends of duct runs, including diffuser necks and register ducts.
 - 5. Do not apply insulation over coil and damper access panels.
- B. Provide flexible insulation on following ductwork in thickness indicated:
 - 1. Outside-air round ductwork:
 - a. All sizes: 3 inches; minimum installed R-value of 8.0.
 - 2. Supply-air ductwork, including downstream of terminal units, sound attenuators, reheat coil casings and tube ends or specified to be covered by nonflexible insulation:
 - a. All sizes: 2-1/8 inches; minimum installed R-value of 6.0.
 - 3. Return-air ductwork in non-air conditioned areas (including utility shafts):
 - a. All sizes: 2-1/8 inches; minimum installed R-value of 6.0.
 - b. Ceiling spaces directly above conditioned spaces are considered conditioned.
- C. Flexible Elastomeric:
 - 1. For exterior ductwork exposed to weather.
 - 2. Install in accordance with MICA National Commercial and Industrial Standards Plate No.: 20A.
 - 3. Adhesive: Applied as required to assist installation.
 - 4. Mechanical fasteners: As required to assist installation.
 - 5. Provide one of following as a weather barrier:
 - a. Jacket: metal.
 - b. Aluminum composite facing with UV/weather resistant coating.
 - 1) Example: K-Flex LS sheet.
 - 2) Product must be provided with a twenty-five (25) year limited warranty against breakdown of the membrane due to ultraviolet radiation.
 - c. Factory applied multi-ply laminate UV/weather resistant facing.
 - 1) Example: Armaflex ArmaTuff Plus II.
 - 2) Thickness: 16 mil laminated covering membrane.
 - a) UV protective, blended polymeric top surface.
 - b) Puncture-resistant blended polymeric base around a scrim reinforced core.

- 3) Product must be provided with a ten (10) year limited warranty against breakdown of membrane due to ultraviolet radiation.
6. Insulation of standing seams: insulation manufactures field-cut pipe insulation with weather barrier.
7. Apply insulation and jacketing so that top of ductwork has crown that effectively prevents pooling of water.
 - a. Minimum crown slope: 1/4 inches/FT.
8. Provide flexible elastomeric insulation on the following exterior ductwork in thickness indicated:

3.7 INSULATION - HOT EQUIPMENT

A. General:

1. Secure insulation to bottom of flat surfaces wider than 24 inches by impaling over adhesive-pin mechanical fasteners.
 - a. Secure insulation on mechanical fasteners with speed clips.
 - b. Space mechanical fasteners to hold insulation securely in place.
 - 1) Maximum spacing: 12 inches centers.
2. Seal joints and speed clips with 3 inches wide pressure-sensitive joint-sealing tape that matches facing.
 - a. Secure both sides of tape with outward clinching staples on 3 inches centers, 5 mm 1/4 inches from edge.
3. Insulate flanges and fittings as indicated under Pipe Insulation, Nonflexible.
4. Reinforce ends and irregular surfaces with Glass Fab embedded in 2 coats of Foster 30-36 adhesive.

B. Provide hot-equipment insulation on following equipment in thickness indicated:

1. Air separators: 2 inches.
 - a. Insulation assembly standard: MICA plate number 4-100 or 4-120.
2. Condensate receivers above grade: 2 inches.
3. Deaerators: 2 inches.
 - a. Insulation assembly standard: MICA plate number 4-100.
4. Domestic hot water instantaneous heaters (unless factory insulated): 2 inches.
 - a. Insulation assembly standard: MICA plate number 4-100.
5. Domestic water heater storage tanks (unless factory insulated): 2 inches.
 - a. Use unfaced insulation.
 - b. Insulation assembly standard: MICA plate number 4-100.
6. Flash tanks: 2 inches.
 - a. Insulation assembly standard: MICA plate number 4-120.

3.8 INSULATION - HIGH-TEMPERATURE EQUIPMENT

A. Calcium silicate:

1. Apply blocks in layers over high ribbed lath.
2. Butt block surfaces tightly together.
3. Secure with 16 AWG galvanized annealed wire or 0.015 x 1/2 inches wide galvanized bands on 12 inches maximum centers.
4. Anchor wire and bands to welded pins, clips or angles.

5. Apply 1 inch hex galvanized wire over insulation.
6. Fill voids with 1/4 inches insulating cement.
- B. Thermal insulating wool batts:
 1. Secure insulation to metal surfaces by impaling over weld-pin mechanical fasteners.
 - a. Secure insulation on mechanical fasteners with speed clips.
 - b. Space mechanical fasteners to hold insulation securely in place.
 - 1) Maximum spacing: 16 inches centers.
- C. Provide high-temperature equipment insulation on following equipment in number of layers and total thickness indicated:
 1. Boiler breeching and flue systems inside building: 2 layers, 3-1/2 inches.
 - a. Insulation assembly standard: MICA plate number 1-100.
 2. Emergency generator muffler: 2 layers, 3-1/2 inches.
 - a. Insulation assembly standard: MICA plate number 4-800.
 3. Emergency generator exhaust piping inside building: 2 layers, 3-1/2 inches.
 - a. Insulation assembly standard: MICA plate number 1-100.
 4. Dehumidifier regenerator sump, discharge plenum, exhaust duct: 1 layer, 1 inch.
 - a. Insulation assembly standard: MICA plate number 3-130.

3.9 INSULATION - COLD EQUIPMENT

- A. Apply insulation with adhesive and coatings approved by manufacturer.
 1. Completely cover joining surfaces (equipment surfaces, and back and butting edges of insulation).
 2. Apply with 1/8 inches overlay pressure on butt joints.
 3. Apply 2 coats of white latex enamel to outside layer.
- B. Provide cold-equipment insulation on following equipment in number of layers and total thickness indicated:
 1. Water chiller boxes: 2 layers, 1-1/2 inches.
 - a. Insulation assembly standard: MICA plate number 50.
 2. Evaporator heat exchangers of double shell chillers: 1 layer, 3/4 inches.
 - a. Insulation assembly standard: MICA plate number 50.
 3. Chilled water pump casing: 1 layer, 3/4 inches.
 - a. Insulation assembly standard: MICA plate number 50.
 4. Domestic water meter: 1 layer, 3/4 inches.
 - a. Insulation assembly standard: MICA plate number 8-400.
 5. Roof drain bodies: 1 layer, 20 mm 3/4 inches.
 6. Chilled water expansion tanks: 1 layer, 3/4 inches.
 - a. Insulation assembly standard: MICA plate number 4-200.
 7. Refrigerant sumps: 1 layer, 3/4 inches.
 - a. Insulation assembly standard: MICA plate number 4-200.
 8. Chilled water air separators: 1 layer, 3/4 inches.
 - a. Insulation assembly standard: MICA plate number 4-200.

9. Water softeners: 1 layer, 3/4 inches.
 - a. Insulation assembly standard: MICA plate number 4-200.
10. Dehumidifier conditioner coils and sumps: 1 layer, 3/4 inches.
 - a. Insulation assembly standard: MICA plate number 4-200.

3.10 JACKETING AND PREFABRICATED FITTING COVERS

- A. General:
 1. Stagger jacketing and insulation joints.
- B. Systems exposed to weather:
 1. Material:
 - a. 0.016 inches smooth aluminum.
 2. Attach as recommended by manufacturer.
 3. Joints:
 - a. Orient joint laps to prevent entry of water.
 - b. Seal joints weather tight.
- C. Exposed cryogenic systems:
 1. Material: PVC.
 2. Attach as recommended by manufacturer.
- D. Hot Equipment:
 1. Material:
 - a. 0.016 inches smooth aluminum.
 2. Attach as recommended by manufacturer.
- E. High-temperature equipment:
 1. Material:
 - a. 0.010 inches smooth stainless steel.
 2. Attach with stainless-steel screws or 0.020 inches x 3/4 inches stainless steel bands on 8 inches centers.

END OF SECTION

SECTION 23 09 00
INSTRUMENTATION AND CONTROL FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Instrumentation and control for HVAC systems.
 - 2. Temperature control.
 - 3. Ventilation control.
 - 4. Heating control.
 - 5. Cooling control.
 - 6. Pneumatic piping.
 - 7. Control wiring.
 - 8. Panels and accessories.
 - 9. Miscellaneous.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 23 31 00 - HVAC - Ductwork.
 - 2. Section 23 80 00 - HVAC - Equipment.
 - 3. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
 - 4. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

- A. See Specification Section 01 61 03.
- B. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. D1693, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
 - 2. The International Society of Automation (ISA):
 - a. S5.1, Instrumentation Symbols and Identification.
 - b. S5.4, Standard Instrument Loop Diagrams.
 - 3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 5. Underwriters Laboratories, Inc. (UL).
- C. Miscellaneous:
 - 1. Controls to be in compliance with NEMA and NFPA 70 enclosure class requirements unless noted or specified otherwise.
 - 2. Unless specifically noted otherwise, components of systems shall be industrial duty suitable for moist, corrosive environments.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Wiring diagrams showing point to point termination with auxiliary interlocks for each item in each control loop.
 - 2. Pneumatic piping diagrams.

3. Information on equipment proposed for use including corrosion protection.
 4. Instrument loop diagrams and word description of loop function for each individual unit controlled including auxiliary interlocks in full compliance with ISA S5.4.
 - a. Show components in system and ensure diagrams are in full compliance with ISA S5.1 (Instrumentation Symbols and Identification) and other related ISA standards.
- B. Quality Control Submittals:
1. Secure from equipment manufacturers, detailed and complete control and power wiring diagrams, word descriptions of controls provided as part of the HVAC equipment or equipment interfaced or interlocked thereto, and submit with equipment manufacturer's submittals.
 - a. Provide the above information to control manufacturer.
- C. Contract Closeout Information:
1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Manufacturer's catalog numbers hereinafter are for reference to type, style, dimension, related items and to establish a standard of quality.
 - a. Reference to a manufacturer's number hereinafter does not imply full compliance to these Specifications.
 2. Instrumentation and control systems:
 - a. Honeywell.
 - b. Johnson Control Co.

2.2 EQUIPMENT

- A. Dampers:
1. Refer to Specification Section 23 31 00.
- B. Damper Operators:
1. Provide operators of proper size and number to secure true throttling or two-position action as required.
 2. Furnish damper operators for installation inside ductwork and attached to frame of damper, or installed outside ductwork and connected to extended shaft as required.
 3. Provide operators for outside air, spring-loaded with sufficient power to assure tight closing of dampers on fan shutdown or in the fail safe position indicated by "Sequence of Controls."
 4. Provide pneumatic operators with aluminum bodies and stainless steel shafts, low friction non-corrosive shaft bearings, piston-type operators with rolling type neoprene diaphragm, and universal mounting bracket.
 5. Electric operators:
 - a. Provide operators:
 - 1) Fully immersed in oil gear train.
 - 2) Enclosed in closed cast aluminum housing.

- b. As an alternate to 5.a.: Provide operators in NEMA 4X enclosure, Belimo ZS-300.
 - c. Provide damper operators with integral spring return motor springs to make controls fail safe in position specified under "Sequence of Controls."
 - d. Provide fully modulating operators from proportional electric controllers.
 - e. Provide end switches or proportioning controllers permitting simultaneous operation or interlocking with other equipment.
 - f. Provide separate electrical circuits for damper operators with no more than four operators on a circuit.
- 6. Coordinate with dampers provided:
 - a. Provide damper operators that are rated for the required torque.
 - b. If single damper operator can not meet torque requirement, provide sectional dampers to match operator torque.
- 7. Provide pneumatic operators wherever a pneumatic source can be provided.
 - a. Provide for conversion of electric signals for control of pneumatic operators.
- 8. Use of electric operators shall be limited to small dampers in those applications where it is impractical to provide pneumatic operators and are to be approved by the Engineer.
- 9. Ensure coordination to provide for the installation of tight closing dampers low leakage type (6 cfm per square foot at 4 inches WC pressure across damper) with compatible dampers, damper operators and related controls.
- C. Filters/Regulators: Provide at pneumatic devices as required.
- D. Motor-Operated Valves:
 - 1. Valves shall have modulating plugs and contoured disc type inner valve construction to ensure modulation of flow and shut-off features as the application demands.
 - 2. Furnish valves 2 inches and smaller with high grade bronze bodies with screwed ends.
 - a. Reducers and fittings necessary to install smaller than pipe size valves shall be furnished and installed under applicable piping sections.
 - 3. Furnish valves 2-1/2 inches and larger with iron bodies with flanged ends.
 - a. Rate valves at a maximum fluid pressure of 125 psi, and a maximum fluid temperature of 350 degrees F.
 - b. Valves to be sized in accordance with flow capacity and pressure drop indicated.

FLUID	INLET PRESSURE	DIFFERENTIAL PRESSURE
Chilled water	25 psiG	8 to 12 feet

- 4. Furnish valves for chilled water with equal percentage modulating plugs and renewable composition discs.
 - a. Coil valves shall be molded rubber diaphragm type.
 - b. Valves 2 inches and smaller shall be screwed.
 - c. Valves 2-1/2 inches and larger shall be flanged.

- d. Valve bodies suitable for 125 psiG WP.
 - e. Provide three-way mixing or diverting valves as indicated or as the application demands.
- E. Valve Operators:
 - 1. Provide operators of proper size and number to secure true throttling or two-position action as required.
 - 2. Provide pneumatic operators with aluminum bodies and stainless steel shafts, low friction non-corrosive shaft bearings, piston-type operators with rolling type neoprene diaphragm, mounting bracket and linkage.
 - 3. Provide electric operators with fully immersed in oil gear train, in tightly closed cast aluminum housing.
 - a. Provide valve linkage.
 - 4. Provide pneumatic operators wherever a pneumatic source can be provided.
 - a. Provide for conversion.
- F. Electric Control Instruments:
 - 1. Provide stainless steel sensing elements type thermostats with liquid filled, compensated thermal systems so that equally spaced dial graduations are possible over entire range.
 - a. Make thermal systems field detachable with averaging or plain bulbs as installation conditions dictate.
 - b. Provide sensing elements minimum of 60 inches in length and suitable for operation from -30 to 300 degrees F.
 - c. Provide reverse acting on-off type thermostats for controlling ventilating fans.
 - d. Provide multiple stage thermostats where designated in Paragraph "Sequence of Operation".
 - 2. Provide transformers for supplying current to control equipment operating at less than 120 V and where required by manufacturer's automatic control system design capable of supplying 125% of energy requirements of equipment connected for not less than 1 hour.
 - a. Enclose transformers in UL listed cabinets with conduit connections.
 - b. Provide fused disconnect switches on both primary and secondary sides.
 - 3. Provide low limit electric thermostats of two-position type with 20 feet bulb and manual reset.
 - a. Shall be capable of opening thermostat circuit if any 1 foot section of bulb is subjected to a temperature below thermostat setting.
 - b. Each thermostat shall have two circuits, one to shut down fan, another for alarm.
 - c. Install all freeze-stats to override starter circuits regardless of position.
 - d. For corrosive environments provide thermostats with stainless steel sensing elements.
 - 1) Ensure element is installed to sense coldest point should stratification occur.
 - 4. Provide each thermostat with an accurate red-reading thermometer sensing temperature outside of enclosure.

G. Static Pressure Gages:

1. Install gages on control panel for each system.
 - a. One gage shall serve each filter while others shall serve as a check on system.
 - b. Gages shall be Magnahelic by Dwyer 2000 ASF, flush mounted with signal flag for filter gage.
 - c. Install static pressure tips as scheduled under control panel indication points.
 - d. Static pressure ranges:
 - 1) Filter (cartridge): 0 to 2.0 inches WC.
 - 2) Air-handling systems: 0 to 10.0 inches WC (one per air-handling unit).

H. Local Temperature Control Panel:

1. Panel shall be floor or wall-mounted and be sized to accommodate electrical switches, protective devices (except electrical switches and devices furnished as an integral part of air handling unit).
2. Mount indicating controllers or receiver-controllers, three-way air valves, relay, EP and PE switches, switching relays, ammeters and other accessory items on local sub-panels set in vicinity of equipment to be served.
 - a. Where two similar items of equipment, such as pumps, are installed adjacent to each other a single panel may be used to contain all instruments.
3. Fully compensated capillaries connected to instruments shall be of sufficient length to allow them to be run between equipment and placed in such a position so that they will not obstruct service of equipment or become damaged.
4. Air pressure gages for pneumatic controls of at least 2 inches diameter shall be provided for indication of transmitter signals and output signal of all controllers, relays, EP switches, outdoor air dampers, PE switches, control valves larger than 4 inches and other points throughout system.
 - a. Provide visual indication for operating purposes.
 - b. Temperature and pressure indicating gages where scheduled for panel door mounting shall be not less than 2-1/2 inches diameter, flush mounted with accuracy of +1 degrees F.
 - c. Where a temperature indication gage is used, a pressure gage is not required for same signal.
 - d. Transmitter signal and controller output gages shall be in-line mounted or mounted on controllers if provided with tapped connections.
 - e. One or more permanently mounted gages with flexible hose terminating in a hypodermic needle may be used for checking other parts of control signals; however, signal connections may not be used as a substitute for in-line mounted gages.
 - f. All gages and instruments shall be suitably tagged with their function.
5. Miniature milliamp meters for electronic temperature transmission may be used.
6. Manufacture panels in one of the following manners:
 - a. NEMA electrical panel boxes with windows.
 - b. Install gages flush mounted in swing out panel behind window with instruments and other control items located inside enclosures behind panel.
 - 1) Refer to Paragraph "Corrosion Protection."

7. Mount all relays, PE switches, pressure switches, etc., on rear inside of enclosure.
 - a. Tag each instrument corresponding to symbols used on control diagrams.
8. Temperatures, pressures, equipment operation, and related items shall be continuously indicated on panels.
9. Points to be monitored are scheduled under another paragraph of this Specification Section.

2.3 FABRICATION

- A. Corrosion Protection:
 1. Protect metal parts of controls, instrumentation and related items from corrosive atmosphere by either protective coatings or select materials.
 - a. Aluminum and stainless steel require no further protection.
 2. Provide NEMA 4X fiberglass control enclosures with tempered glass windows and vapor tight gaskets, illustrated in Hoffman Bulletin A-50, for protection of controls from corrosive environment.
 - a. Install control instruments inside enclosure and extend remote stainless steel sensing elements through enclosure wall.
 - b. Provide vaportight seals for penetrations of enclosure.
 3. Provide in each enclosure industrial corrosion inhibitors, Hoffman Corrosion Inhibitors, as illustrated in Hoffman's technical Bulletin HCl.
 4. Protect metal accessory items such as mounting brackets and fasteners not stainless steel, fiberglass or aluminum by epoxy or phenolic coatings.
 5. Protect electric motor operator with corrosion inhibitors inside enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with requirements of Specification Section 26 05 19 and Specification Section 26 05 33.
- B. Connect control devices to perform functions indicated and perform in required sequence.
- C. Use remote element temperature transmitters for points of temperature transmitters for points of temperature measurement occurring in air ducts or shafts, or in mechanical piping system.
- D. Use remote element pressure transmitters of panel-mounted pressure gages.
- E. Where continuous indication of space temperature is on local control panels, install a thermostat and a temperature transmitter side by side.
 1. Pipe continuous indication signal to a receiver on panel.
 2. A resistance element or thermocouple signal may be used with continuous indicating meter, calibrated in degrees Fahrenheit.
- F. In general, locate thermostats for room control immediately inside door, above light switch, unless shown otherwise.
 1. Where light switch is in an entryway to room, locate thermostat on wall within room so it is capable of sensing true space conditions.
 2. Prior to installation, coordinate thermostat location with Engineer.
- G. Mount local control panels adjacent to equipment served.
- H. Where a temperature indicating gage is used at the panel, a pressure gage indicating transmitter signal is not required.

- I. Provide appropriate type continuous reading indicator for each controller, transmitter and transducer.
 - 1. Mount in-line or tapped on controller.
 - 2. Mount at local control panel.
- J. Gages with flexible hose terminating with hypodermic needle may be used for checking control system.
 - 1. Do not substitute for in-line gages.
- K. Locate panels so visual observation and adjustment can be accomplished from floor level.

END OF SECTION

SECTION 23 11 00
MECHANICAL PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Pipe and Fittings, as indicated, in accordance with provisions of Contract Documents.
- B. Systems Included:
 - 1. Pressurized piping.
 - 2. Nonpressurized piping.
 - 3. Accessories:
 - a. Dielectric fittings.
 - b. Unions.
- C. This specification lists a variety of piping that may be applicable to the project. Not all piping and fittings listed are applicable to the project, refer to appropriate spec sections for project applicability.
- D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Pipe and fittings to be ASTM labeled for rating specified.
- B. Pipe and fittings to be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed NSF International.
- C. Welder qualifications: Certified under requirements of ANSI/ASME-B31.1 Power Piping.
- D. Comply with NSF 61 for potable domestic water piping and components that come in contact with potable water.

1.3 SUBMITTALS

- A. Project Closeout Information:
 - 1. Manufacturer of listed products.
 - 2. Pre-insulated conduit piping system test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. PVC plastic pipe:
 - 1. Base:
 - a. Plastiline.
 - 2. Optional:
 - a. Cresline.
 - b. DuPont.
 - c. Eslon Thermoplastics.
 - d. R & G Sloane Manufacturing.
 - e. Schuller International.
 - f. Nibco.
 - g. CertainTeed Pipe & Plastics.
 - h. Clow Water Systems.
 - i. Tyler Pipe.

- B. Cast Iron Pipe:
 - 1. Base:
 - a. Tyler.
 - 2. Optional:
 - a. AB&I.
 - b. Charlotte Pipe.
- C. Acid Resistant Cast Iron Pipe:
 - 1. Base:
 - a. Duriron.
- D. Polyethylene Pipe:
 - 1. Base:
 - a. Performance Pipe.
 - 2. Optional:
 - a. PolyPipe.
 - b. US Poly.
- E. Polyethylene Pipe Fittings:
 - 1. Base:
 - a. Performance Pipe.
 - 2. Optional:
 - a. Performance Pipe.
 - b. US Poly.
 - c. Central Plastics.
- F. Fittings, Mechanical Groove-end and Plain-end Pipe:
 - 1. Base:
 - a. Victaulic Company of America.
 - 2. Optional:
 - a. Anvil International, Inc.
 - b. Grinnell.
- G. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 PIPE

- A. Black Steel Pipe:
 - 1. Seamless or welded steel pipe, ASTM-A53, standard weight unless otherwise indicated.
 - 2. For fire sprinkler service:
 - a. The following Testing Standards and listed grades are acceptable:
 - 1) ASTM-A135, Grade B
 - 2) ASTM-A53, Grade B.
 - 3) ASTM- A795, Grade B.
 - b. Weight: Schedule-40 unless otherwise indicated.

- B. Galvanized Steel Pipe:
1. Seamless or welded, hot-dipped galvanized steel pipe, ASTM-A53 or ASTM-B36.
 2. Joints:
 - a. Threaded.
 - b. Welded.
 - c. Cut or rolled grooved.
- C. Stainless Steel Pipe:
1. Type 304L, ASTM 312, ASTM A778 or ANSI B 36.19.
 2. Joints:
 - a. Welded.
 - b. Roll grooved.
 - c. Stainless steel ASTM 312, ASTM A778 or ANSI B 36.19.
- D. Copper Pipe:
1. Seamless copper tubing, ASTM B88, Type-K, Type-L, or Type-M as indicated.
 2. Joints:
 - a. Soldered: Use ASTM B32, 95% tin, 5% antimony solder, or Silvabrite 100.
 - b. High temperature soldered: Use 540 degrees C 1,000 degrees F solder.
 - c. Roll grooved.
 - d. Ring seal crimped, where specified and permitted by authority having jurisdiction.
 3. 2760 kPa 400 psi fittings: Heavy wall type, Mueller "Steamline".
 4. 2760 kPa 400 psi fittings: Heavy wall type, Mueller "Steamline".
- E. Acid Resistant Cast Iron Pipe:
1. Mechanical joints: Use couplings.
 2. Bell and spigot joints: Use special acid resistant packing.
- F. Cast Iron Soil Pipe:
1. ASTM A74.
 2. Bell and spigot joints: Use oakum and lead, or neoprene gaskets when allowed by code.
 3. Gaskets: ASTM C564.
 4. Bear the collective trademark of the Cast Iron Soil Pipe Institute and be listed NSF International.
- G. No Hub Cast Iron Pipe:
1. CISPI 301 or ASTM A888.
 2. Mechanical joints:
 - a. Conform to ASTM C1540: Join hubless pipe and fittings with heavy duty stainless steel couplings with neoprene gaskets.
 - b. Approved manufacturers: Husky SD 4000, Clamp All 125 or MG Couplings.
 3. Gaskets: ASTM C564.
 4. Bear Cast Iron Soil Pipe Institute trademark and NSF International listed.

- H. Ductile Iron Pipe:
 - 1. Centrifugally cast, ANSI/AWWA-C151/A21.51, lined and coated.
 - 2. Joints:
 - a. Gasketed mechanical joints: ANSI/AWWA-C111/A21.11.
 - 1) Gaskets: ANSI/AWWA-C111/A21.11.
 - b. Cut grooved.
- I. Cast Iron pressure pipe:
 - 1. ANSI/AWWA-C105/A21.5, lined and coated.
 - 2. Thickness class: 22.
 - a. Exception: When depth of cover exceeds 2440 mm 8 feet, use thickness class 23.
 - 3. Joints: Use mechanical or push-on joints below grade.
 - 4. Mechanical or push-on joints for water: ANSI/AWWA-C111/A21.11.
 - 5. Mechanical joints for fuel gas piping: ANSI-B31.2.
 - 6. Gaskets: Suitably formed of high quality vulcanized rubber, made to exact dimensions, and in form of a solid ring, with durometer hardness of approximately 85; for joint rating of 2420 kPa 350 psi internal liquid pressure, minimum.
- J. Shop Coating and Lining for ductile and cast iron pipe:
 - 1. Cement lining: ANSI/AWWA-C104/A21.4, except lining thickness may be reduced to 0.5 ANSI specified thickness for "Enameling" coating.
 - 2. Rust preventative: Non-Ox-Id 558.
 - 3. Bituminous coating: Manufacturer's standard, minimum 0.025 mm 1 mil thick.
 - 4. Provide interior surfaces of ductile iron and cast iron pipe and fittings with cement lining.
 - 5. Shop coat flange faces with rust preventative compound.
 - 6. Shop coat other surfaces of ductile iron and cast iron pipe and fittings with bituminous coating.
- K. Vitrified Clay Pipe:
 - 1. ASTM C700.
 - 2. Standard strength clay pipe, unless otherwise indicated.
 - 3. Use extra strength pipe as indicated.
 - 4. Sanitary sewer joints:
 - a. Use compression joint material conforming fully with ASTM C425.
 - b. Make joints in accordance with manufacturer's recommendations.
- L. Polyvinyl chloride (PVC) plastic pressure pipe:
 - 1. ANSI/AWWA-C900, DR18 Class 150, integral bell and spigot joints.
 - 2. NSF approved for potable water service.
 - 3. Joints using elastomeric seals: ASTM D3139.
 - 4. Elastomeric seals: ASTM-F477.
 - 5. Fittings: Cast or ductile iron with mechanical joint ends conforming to ANSI/AWWA-C110/A21.10 and gaskets to ANSI/AWWA-C111/A21.11.

- M. Polyvinyl Chloride (PVC) Plastic Sewer Pipe:
1. ASTM D3034, SDR35.
 2. Joints: Integral bell and spigot type, ASTM D3212.
 3. Gaskets: ASTM F477, rubber.
 4. Fittings: Push-on joint compatible with pipe and conforms to ASTM D3034.
 5. Workmanship:
 - a. Pipe and fittings: Homogeneous throughout and free from cracks, holes, foreign inclusions, or other injurious defects.
- N. Acid Resistant Glass Pipe:
1. Borosilicate tempered glass, ASTM C1053 or for DWV applications.
 2. Beaded flange or plain ends.
 3. Mechanical joints: Compression type stainless steel couplings.
 4. Equipment connections: Use clamped connections for easy disassembly.
- O. Acid Resistant Polypropylene Pipe:
1. DWV, Schedule-40.
 2. Polypropylene: ASTM D635; rated SE-O in accordance with ANSI/UL-94.
 3. Provide in 3050 or 6100 mm 10 or 20 feet lengths.
 4. Mechanical joints: Positive connection, easily disassembled, with no ferrous material in contact with waste.
 - a. Victaulic "Hugger".
 - b. GSR Fuseal mechanical joint.
 - c. Enfield Industrial mechanical joint.
- P. Polyvinyl Chloride (PVC) Plastic Pressure Pipe:
1. Listed with National Sanitation Foundation for use in potable water systems.
 2. Pipe:
 - a. ASTM-D1784, PVC Class 12454-B.
 - b. ASTM-D1785, PVC 1120: Schedule-40, Schedule-80, or Schedule-120.
 3. Joints:
 - a. As recommended by pipe manufacturer for specific application.
 - b. Solvent and primer:
 - 1) ASTM-F656: Primers.
 - 2) ASTM-D2564: Cements.
 - 3) ASTM-D2855: Procedure.
 - 4) ASTM-F402: Safe handling.
 - c. Mechanical roll grooved:
 - 1) Use standard flexible couplings with coupling-half mating surfaces parallel to axis of pipe.
 - d. Do not thread Schedule-40 pipe.
- Q. Polyethylene Pressure Pipe:
1. ASTM D2513, PE2306, SDR11.5.
 2. Material: Natural polyethylene, ASTM D4101, Type II.
 3. Fittings: Fusion type.

- R. Polyethylene Pipe.
1. PE 2406 conforming to ASTM D2513-96A and ASTM D2513-87.
 2. Material: Polyethylene resin shall be Chevron TR418Q or Solvay K38-20-160, (yellow in color) conforming to ASTM D248 and ASTM D3350.
 3. Pipe and tubing shall have a hydrostatic design basis of at least 800 psi at 60 degrees C 140 degrees F.
 4. Fittings: Socket type fittings conforming to ASTM D2683 or fusion type fittings conforming ASTM D3261, as applicable, in addition to the requirements of ASTM D2513-96A.

2.3 FITTINGS AND COUPLINGS

- A. Steel Pipe Fittings:
1. Socket welding fittings: ANSI/ASME-B16.11 and ASTM A234.
 2. Butt welding fittings: ANSI/ASME-B16.9, ANSI/ ASME-B16.25 and ASTM A105.
 3. Grooved fittings: Square cut, ASTM-A53 steel, or roll grooved, ASTM A135.
 4. Flanged fittings: ANSI/ASME-B16.5 and ASTM A105.
 5. Flange bolts: ASTM A193 Grade B7.
 6. Gaskets: Spiral wound metallic.
- B. Malleable Iron Pipe Fittings:
1. Threaded fittings: ANSI/ASME-B1.20.1 and ANSI/ASME-B16.3, Class 150.
 2. Threaded couplings: Same as threaded fittings except Class 300.
 3. Grooved couplings: ASTM A47, coupling segments with EPDM Grade-E gasket.
 4. Galvanized malleable iron couplings: Victaulic; or ITT Grinnell.
- C. Cast Iron Pipe Fittings:
1. Drainage fittings: Coated or galvanized, ASTM A74.
 2. Threaded fittings: ANSI/ASME-B1.20.1 and ANSI/ASME-B16.4, Class 125.
 3. Threaded drainage fittings: ANSI/ASME-B1.20.1, ANSI/ASME-B16.12 and ASTM A126.
 4. Flanged: ANSI/ASME-B16.1, Class 125.
- D. Copper Pipe Fittings:
1. Wrought copper fittings: ANSI/ASME-B16.22.
 2. Cast brass fittings: ANSI-B16.18.
 3. Mechanical groove-end fittings: Factory roll grooved.
 4. Flared tubing fittings: Use only on annealed pipe.
 5. Cast flanged fittings: ANSI/ASME-B16.24, Class 150.
 6. 2760 kPa 400 psi fittings: Heavy wall type, Mueller "Steamline".
- E. Stainless Steel Pipe Fittings:
1. ASTM A182.
 2. Roll grooved: Stainless steel, Victaulic type.
 3. Butt welding fittings: ANSI/ASME-B16.9.
 4. Socket welding fittings: ANSI/ASME-B16.11.
- F. Ductile Iron Pipe Fittings:
1. ANSI/AWWA-C110/A21.10.
 2. Gasketed mechanical joints: ANSI/AWWA-C111/A21.11.

3. Laying Length, AWWA fittings: Short body dimensions.
 4. Flanged fittings: ANSI/ASME B16.5.
 5. Thickness of iron: Not less than for ductile iron pipe with additional thickness as required for proper reinforcement of branches for tees and crosses.
- G. Cast Iron Pressure Pipe Fittings:
1. ANSI/ASME B16.1 and ANSI/AWWA C111/A21.11 mechanical joint type, suitable for minimum working pressure of 1040 kPa 150 psi plus 690 kPa 100 psi surge pressures.
 2. Laying length:
 - a. AWWA fittings: Short body dimensions.
 - b. ANSI mechanical joint fittings: ANSI/AWWA-C110/A21.10.
 - c. Others: ANSI/ASME-B16.1.
 3. Thickness, DN150 to DN300 6 through 12 inches: Not less than for cast iron pipe with additional thickness as required for proper reinforcement of branches for tees and crosses.
- H. Acid Resistant Glass Pipe Fittings:
1. Borosilicate tempered glass, ASTM C1053, for DWV applications.
 2. Beaded flange or plain ends.
 3. Mechanical joints: Inner gasket, outer compression gasket, and clamping band; stainless steel coupling.
 4. Equipment connections: Use clamped connections for easy disassembly.
- I. Acid Resistant Polypropylene Pipe Fittings:
1. DWV, Schedule-40.
 2. Material: Flame retardant polypropylene, same material as pipe.
 3. Fusion joints: Used in concealed locations.
 4. Mechanical joints: Optional in accessible locations.
 - a. Positive connection, easily disassembled, with no ferrous material in contact with waste.
 - b. Victaulic "Hugger"; GSR Fuseal mechanical joint or Enfield Industrial mechanical joint.
- J. Polyvinyl Chloride (PVC) Plastic Pipe Fittings:
1. Socket type: ASTM D2466 or ASTM D2467, Schedule-40 and Schedule-80, long radius patterns.
 2. Threaded type: ASTM D2464, Schedule-80, long radius patterns.
 3. Same pressure and temperature rating as pipe.
- K. Polypropylene Pressure Pipe Fittings:
1. Material:
 - a. Natural polypropylene.
 - b. Same material as pipe.
 2. Fusion type joints: Socket diameters compatible with pipe for fusion joining.
 3. Pipe system components product of same manufacturer.

- L. Polyethylene Pressure Pipe Fittings:
1. Material:
 - a. Natural polyethylene.
 - b. Same material as pipe.
 2. Fusion type joints: ASTM D326 inches addition to the requirements of ASTM D2513-96A. Socket diameters compatible with pipe for fusion joining.
 3. Socket type fittings: ASTM D2683 inches addition to the requirements of ASTM D2513-96A.
 4. Pipe system components product of same manufacturer.
- M. Dielectric Fittings:
1. General:
 - a. Standard product for prevention of galvanic corrosion.
 2. Dielectric union:
 - a. Ground-joint union with end connections of different material.
 - 1) End connection materials: Compatible with respective piping materials.
 - 2) Gasket and inert, non-corrosive thermoplastic sleeve shall electrically isolate end connections from each other.
 3. Dielectric waterway fitting:
 - a. ASTM A53 Schedule-40, hot dip galvanized, steel pipe casing with inert, non-corrosive thermoplastic lining (NSF/FDA listed).
 - b. Threaded or threaded X rolled grooved connections.
 - c. Victaulic, "Clearflow".
- N. Mechanical Groove-end Couplings and Fittings:
1. Couplings:
 - a. Malleable iron, ASTM A47 or ductile iron, ASTM A536.
 - b. Gaskets: EPDM Grade-E conforming to ASTM D2000 for water services up to 110 degrees C 230 degrees F.
 - c. Gaskets on plastic piping: ASTM F477.
 - d. Bolts and nuts: ASTM A183.
 - 1) Heat treated plated carbon steel, track-head.
 - 2) Minimum tensile strength: 760 MPa 110,000 psi.
 2. Fittings:
 - a. Malleable iron, ASTM-A47 or ductile iron, ASTM-A536.
 - b. Copper:
 - 1) DN50 to DN100 2 inches to 4 inches: ASTM-B75, C12200.
 - 2) DN125 to DN150 5 inches to 6 inches: ASTM-B584, CDA 844 (81-3-7-9).
- O. Unions.
1. Same type, pressure rating and material as piping.
 2. Flanges: Raised face type of same type, pressure rating and material as piping.

3. Unions in copper pipe:
 - a. DN50 2 inches and smaller: Use wrought copper solder joint copper to copper unions.
 - b. DN65 2-1/2 inches and larger: Use brass flange unions.
4. Dielectric unions: See Dielectric fittings.
- P. Ring Sealed Crimped Copper:
 1. Copper: ASME B16.22, ASME B16.51, or ASME B16.18.
 2. Mechanical pressed copper fittings: IAPMO PS-117 or ASME B16.51
 3. Operating Pressure: 200 psi CWP Max
 4. Temperature Range: -20 degF to 250 degF.
 5. EPDM sealing element, factory installed.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with ANSI/ASME B31.9 for pressure piping installations.
 1. Install piping without "bull-head" fittings.
- B. Flush out water piping systems with clean water prior to adding treatment.
- C. Flush out fuel oil piping with compressed air.
- D. In general, make connections to components in piping systems with 3-elbow swing joints to allow for movement.
 1. Movement includes but not limited to expansion, contraction, seismic, and equipment vibration isolation.

3.2 PIPING

- A. Install piping parallel to building walls at such heights as not to obstruct portion of window, doorway, stairway, or passageway.
 1. Where interference develops in field, offset or reroute piping as required to clear such interferences.
 2. Consult Drawings for exact location of pipe spaces, ceiling heights, door and window openings or other architectural details and report discrepancies to Engineer, before installing piping.
- B. Pitch Piping to Drain:
 1. Minimum pitch of 1 mm/m 1 inch in 100 feet(except drainage piping).
 2. Make piping and equipment drainable.
 3. Accomplish pipe drainage using drain valves located on equipment and fixtures or separate drains.
- C. Factory cut and thread nipples from seamless stock.
 1. Use nipples of same material as pipe with which they are used.
 2. Do not use close nipples except where such use is unavoidable.
 3. Use Schedule-80 seamless pipe for close nipples and nipples of pipes DN10 3/8 inches or smaller.
- D. Provide backing and sleeves required in walls or floors for setting of fixtures or equipment.
- E. Where transition occurs from sweated fittings (as at connection to fixture supplies, etc.), provide rigid anchorage so that no strain will be placed upon tubing.

3.3 JOINTS

A. Threaded Joints:

1. Cut piping carefully, ream, thread and work into place without springing.
2. Use a small amount of prepared pipe thread lubricant on outside threads only.
3. Provide in accordance with ANSI/ASME-B1.20.1.

B. Flanged Joints:

1. Take care to ensure that there is no restraint on opposite end of pipe or fittings which would prevent uniform gasket compression or cause unnecessary stress in flanges.
2. Keep one flange free to move in any direction while flange bolts are being tightened.
3. Do not pack or assemble bell and spigot joints affected by flanged joints until such flanged joints have been tightened.
4. Tighten bolts gradually and at a uniform rate, so that gasket compression is uniform over entire area of gasket.

C. Mechanical Joints:

1. Assemble in accordance with instructions and recommendations of pipe manufacturer.
2. Clean joint surfaces and lubricate with soap solution or water soluble lubricant immediately before joint is assembled.
3. Groove-end and plain-end joints:
 - a. Use mechanical joint system only with pipe meeting joint manufacturer's requirements.
 - 1) When joint manufacturer's pipe requirements exceed specified requirements, provide pipe that meets joint manufacturer's requirements.
 - b. Prepare pipe and install system in accordance with joint manufacturer's instructions and recommendations.

D. Use dielectric waterway fittings for connections between dissimilar metals.

3.4 UNIONS

A. Provide a union between valves, at connection to each fixture, device or item of equipment, and elsewhere as required to facilitate installing, servicing, making up and disconnecting piping.

1. Install each union to facilitate removal of parts, equipment or fixtures for inspection or cleaning.
2. Install in a position which will permit device, fixture or part to be removed without disconnecting piping except unions.

B. Install unions in accordance with Fluid Controls Institute (FCI).

1. Grooved piping systems:
 - a. Grooved type couplings may serve as unions.
2. Make connections between couplings and flanged equipment with slip-on flanges and a grooved nipple, or groove-to-flange adapter.
3. Welded piping systems:
 - a. Where flanged end-service valves are used at equipment connections, flange unions will not be required.
 - b. Make connections to flanged valves and equipment using ANSI welding neck or slip on type welding flanges.

- c. Flanged cast iron ells may be used for connections between pumps, strainers, check valves and other flanged equipment.
- C. Install dielectric fitting at each piping joint and equipment connection between ferrous and non-ferrous materials.

3.5 PIPING EXPANSION

- A. Install piping to allow thermal expansion and contraction without injury to piping, equipment or structure.
 - 1. Use loops or expansion joints where necessary and where detailed.
 - 2. Provide pipe guides at loops as indicated.
- B. Where screwed piping is used for soil, waste or vent risers, or downspouts, use caulked joints or expansion joints at intervals to allow expansion movement.

3.6 WELDED STEEL PIPING

- A. Where welded piping is specified, make welds by oxy-acetylene or electric process in accordance with ANSI/AWS D10.12 and ANSI/AWWA C206.
 - 1. Welding rods: Grade recommended for purpose by manufacturer; each rod stamped with manufacturer's name and identification.
- B. Line Welds:
 - 1. Single V-butt type.
 - 2. Mill or machine bevel pipe at 37.5 degrees to within 1.6 mm 1/16 inches of inside wall, except that in field, limited amount of pipe may be flame beveled.
 - 3. Pipe with a wall thickness of 4.8 mm 3/16 inches or less need not be beveled but may be welded by melting down into, and building up over abutting ends.
 - 4. Separate abutting ends of joints before welding to permit complete fusion to bottom without overlapping.
 - 5. Tack in 2 or more points to maintain alignment, and fusion weld.
 - 6. Weld continuously around pipe.
- C. Make welds of sound weld metal, thoroughly fused into ends of pipe, and to bottom of vee.
 - 1. Build in excess of pipe wall to give reinforcement of 0.25 pipe wall thickness.
 - 2. Weld metal shall present a gradual increase in thickness from surface of pipe to center of weld.
 - 3. Minimum weld width: 2.5 times thickness of pipe wall.
- D. Use welding ells at turns in welded lines except where pipe bends are indicated or are required for flexibility.
- E. Mitered ells will not be permitted.
- F. Do not weld pipe couplings in place of welding fittings for branch connections.
- G. Weld-O-Lets and Thread-O-Lets:
 - 1. Scribe and cut openings in main pipes for welded branches accurately taking care to remove plug and cuttings from main pipe.
 - 2. Full weld fillet welds for full depth of fillet, with additional beads to form well rounded connection as recommended by Weld-O-Let manufacturer.
 - a. Partially filled fillets not acceptable.
- H. Cut openings into pipe for welded connections accurately to give carefully matched intersections.
- I. Make welded fittings of same material with same pressure and temperature rating as pipe with which they are used.

- J. Make flanged connections to control valves, pump suction, and specialties with ANSI standard welding neck flanges.
 - 1. Other flange connections may be made with slip-on flanges provided they are seal welded on inside.
- K. Fuse fillet welds for flanges or fittings into pipe and plate for minimum distance of 1.5 times pipe wall thickness and depth of weld of 1.25 times pipe wall thickness.

3.7 THREADED STEEL PIPING

- A. Branch connections to screwed piping may be made with Weld-O-Lets or Thread-O-Lets.
- B. Do not weld pipe couplings in place of welding fittings for branch connections.

3.8 DUCTILE IRON AND CAST IRON PRESSURE PIPING

- A. Perform cutting without damage to pipe or to cement lining.
 - 1. Make pipe cuts smooth, straight and at right angles to pipe axis.
 - 2. Use approved type mechanical pipe cutters.
 - 3. In locations where use of mechanical cutters would be difficult or impracticable, existing pipe may be cut with diamond point chisels, saws, or other tools which will not cause damaging impact or shock.
- B. Use equipment, tools and methods in handling and laying pipe and fittings which prevent damage.
 - 1. Hooks inserted in ends of pipe shall have broad, well padded contact surfaces.
- C. Replace pipe and fittings in which cement lining has been broken or loosened.
 - 1. Where damaged areas are small and readily accessible, lining may be repaired, if Engineer approved.
- D. Repair pipe coating which has been damaged before installing pipe.
- E. Make connections between below ground piping and above ground piping with a flanged spigot adapter.
 - 1. Hold spigot piece in place with bolts on 2 sides of flanges between mechanical joint and flange connector.
- F. Comply with AWWA C600 for installation.

3.9 CAST IRON DRAINAGE PIPING

- A. Lay underground pipe on undisturbed earth excavated to provide firm bearing on at least 0.333 of pipe circumference for full length, with bell holes cut out.
 - 1. Where excavation has been carried too deep, place a layer of sand well tamped to bring pipe to proper grade.
 - 2. Where fill or unsound earth is encountered, place a layer of 17.3 MPa 2500 psi concrete to properly bed pipe.
- B. Bell and Spigot Joints:
 - 1. Install neoprene gaskets in accordance with manufacturer's recommendations.
 - 2. Caulk tarred oakum well into joint and pour in molten lead continuously around joint, using at least 1.4 kg of lead per 100 mm of pipe diameter 12 oz of lead per IN of pipe diameter.
 - 3. Furnish sufficient lubricant to provide a thin coat on each spigot end.
 - 4. Use lubricant that is non-toxic, imparts no taste or odor to conveyed liquid, and has no deleterious effect on rubber gasket, with consistency so that it can be easily applied to pipe in hot or cold weather and will adhere to either wet or dry pipe.

- C. Threaded Joints:
 - 1. Clean cut, American National taper pipe threads.
 - 2. Ream pipe ends to full pipe size and remove burrs, chips, cuttings before making up.
 - 3. Pipe joint cement permitted on male threads only.

3.10 COPPER PIPING

- A. Brazed High Temperature Soldered Joints:
 - 1. Take care to avoid annealing of pipe material.
 - 2. For pipe sizes DN50 2 inches and larger: Use a circular torch such as Circa Torch by Cedarberg Industries, for soldering joints.
- B. Solder: Lead-free.
- C. T-drilling:
 - 1. Tapped pipe shall be least DN25 1 inch diameter and branch shall be at least 2 pipe sizes smaller.
 - 2. Braze high temperature solder joints.
 - 3. Branch pipe shall not protrude into main.

3.11 VITRIFIED CLAY PIPING

- A. Install in accordance with ASTM C12.
- B. Lay pipe on undisturbed earth excavated to support bottom quadrant of pipe with bell holes cut out.
- C. Bring over excavated trenches to grade with compacted granular fill.
- D. Lay pipe with bell pointing upgrade, with ends abutting and true to line and grade, and smooth uniform invert.
- E. Clean sockets before pipes are lowered into trenches.
- F. Test pipe in sections as directed by Engineer.
 - 1. Maximum allowable infiltration: 70 L/m diameter/m length/day or 12.5 L/m length/day 15 GAL/IN diameter/100 feet/day or 100 GAL/100FT/ day.
 - 2. Repair visible leakage and leakage in excess of allowable.
- G. Check each line with a light: indicate a good circle throughout length.

3.12 PVC PRESSURE AND SEWER PIPE

- A. Before starting installation, insure factory installed gasket, bell recess and beveled spigot end are free of dirt.
- B. Apply lubricant to exposed surface of gasket; then to surface of spigot up to stop mark including tapered end of spigot.
- C. Assemble spigot to bell and insert; then push spigot into bell as far as stop mark either by hand or with a bar and block.
- D. Install pipe in accordance with Uni-Bell UNI-B-5, Recommended Practice for Installation of Polyvinyl Chloride (PVC) Pipe.

3.13 GLASS PIPING

- A. Install in accordance with manufacturer's recommendations and instructions.

3.14 PVC PIPING

- A. Pipe Cuts:

1. Make cuts square and straight with pipe centerline.
2. Use fine toothed hand wood saw with 55 or more points per 100 mm 14 or more points per inch.
3. After cutting, slightly ream pipe inside and remove external burrs.

B. Pipe Threading:

1. Form standard tapered pipe thread using sharp dies with a negative rake angle of 5 degrees.
2. Perform threading over inserted tapered wooden plugs to assure uniform deep threads.
3. Dies must be sharp and clean.
4. Assemble threaded joint using either graphite base compound or compound recommended by pipe manufacturer.
5. Apply to male threads only and seat joint at slightly more than hand tightness.
6. Wrench marks will not be allowed on either fitting or pipe.

C. Chemical Welding:

1. Perform in strict accordance with manufacturer's recommendations.
2. Comply with ASTM-D2855.
3. Clean both pipe and fitting contact areas with recommended cleaner.
4. Apply cement lightly to both pipe and fitting and slide fitting on to pipe with one continuous motion and at proper time.
5. Rotate fitting lightly to distribute cement.
6. Wipe off excess cement.
7. Deliver cement for chemical welding to job site in sealed pint containers and keep covered at all times when not in use.
8. Do not dilute, thin or alter cement.
9. Use only cement recommended by pipe manufacturers.

3.15 POLYPROPYLENE PIPING

- A. Make thermal welded joints in accordance with manufacturer's recommendations and instructions.

3.16 POLYETHYLENE PIPING

- A. Make thermal welded joints in accordance with manufacturer's recommendations and instructions.
- B. Assemble socket joints in accordance with manufacturer's recommendations and instructions.

END OF SECTION

SECTION 23 21 00
HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hydronic specialties.
- B. Related Sections include but are not necessarily limited to:
 - 1. Section 23 09 00 - Instrumentation and Control for HVAC Systems.
 - 2. Section 23 05 93 - HVAC Systems - Balancing and Testing.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American National Standards Institute (ANSI).
 - 2. American Society of Mechanical Engineers (ASME).
 - 3. ASTM International (ASTM):
 - a. A159, Standard Specification for Automotive Gray Iron Coating.
 - b. B36, Standard Specification for Brass Plate, Sheet, Strip and Rolled Bar.
 - c. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - d. B85, Standard Specification for Aluminum-Alloy Die Castings.
 - e. B99, Standard Specification for Copper-Silicon Alloy Wire for General Purposes.
 - f. B371, Standard Specification for Copper-Zinc-Silicon Alloy Rod.
 - g. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.
 - 4. Expansion Joint Manufacturer's Association (EJMA).
 - 5. National Electrical Manufacturers Association (NEMA).
 - 6. Society of Automotive Engineers (SAE).

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Manufacturer's catalog cuts and technical information.
 - d. Pump curves.
 - 2. Certifications.
 - 3. Test reports.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Automatic air vents:
 - a. Armstrong Machine Works; Model No.21AR.
 - b. Amtrol; Model No.720.
 2. Combination strainer and air separator:
 - a. Bell and Gossett; Rollairtrol.
 3. Tank fittings:
 - a. Bell and Gossett; Model ATFL.
 4. Balancing valves and readout meters:
 - a. Bell and Gossett; Circuit Setter Balance valves and Model R0-2 meter.
 5. Heating water pumps:
 - a. Bell and Gossett.
 6. Expansion joints:
 - a. Flexonics Div.
 - b. Zallea Brothers, Inc.
 - c. Pathway Bellows, Inc.
 7. Flexible connections:
 - a. Flexonics Div.
 - b. Barco.
 - c. Anaconda Metal Hose.

2.2 EQUIPMENT

- A. Automatic Air Relief Vents:
1. Type: Single-lever.
 2. Material: Cast iron.
 3. Vessel design limitations (psig): 150 at 250 degrees F minimum.
 4. Relief tubing: K copper.
 5. Size: As required.
- B. Manual Air Relief Vents:
1. Type: Class 150 bronze gate with rising stem and solid wedge.
 2. Material:
 - a. Bonnet, body and wedge: Bronze ASTM B62.
 - b. Packing nut and packing gland: Bronze ASTM B62 or ASTM B584 alloy C84400.
 - c. Stem: Silicon Bronze ASTM B371 Alloy C69400 or ASTM B99 alloy C65100 H04.
 - d. Hand wheel: Aluminum ASTM B85 Alloy A03800.
 - e. Hand wheel nut: Zinc-plated steel with clear chromate.
 3. Design limitations: 150 psi steam at 406 degrees F minimum.
 4. Relief tubing: K copper.

5. Size: As required.
- C. Compression Tanks:
 1. ASME code construction with gage glass and gage cocks.
 2. Size: As recommended by manufacturer.
- D. Combination Strainer and Air Separator:
 1. ASME code constructed.
 2. Type: Tangential flow.
 3. Design pressure: 125 psiG minimum at 350 degrees F.
 4. Air collector tube.
 - a. Stainless steel.
 - b. 63% open area design (minimum).
 5. NPT vent connection.
 6. NPT blowdown connection.
 7. Tangential nozzles:
 - a. NPT up to 3 inches diameter.
 - b. Flanged, 4 inches and larger.
 8. Strainer:
 - a. Galvanized steel.
 - b. Free area not less than five times the cross sectional area of the connecting pipe.
 - c. Removable.
 9. GPM: As indicated.
- E. Tank Fittings:
 1. Body: Cast iron.
 2. Tubes: Copper and copper plated.
 3. Vent tube plug: Brass.
 4. Ball check: Stainless steel.
 5. Design pressures: 125 psi minimum.
- F. Balancing Valve:
 1. Type: Calibrated balance valve.
 2. Connections:
 - a. NPT up to 3 inches diameter.
 - b. Flanged for 4 inches or larger.
 3. Readout valve: Brass fitted with integral EPT insert and check valve.
 4. Calibrated nameplate.
 5. Integral seals.
 6. Preformed polyurethane insulation.
 7. Working pressure: 125 psiG at 250 degrees F minimum.
- G. Readout Meter for Balancing Valves.
 1. Type: Portable.
 2. Range: 0 to 100 feet of water.

3. Increments: 0.5 feet.
 4. Accuracy: +0.5%.
 5. Accessories:
 - a. Carrying case.
 - b. 10 feet hoses.
 - c. Shut-off and vent valves.
 - d. Balance valve calculator.
 6. Maximum operating temperature: 250 degrees F liquids and gases.
- H. Readout Meter for Water Flow Measuring Devices:
1. Type: Portable.
 2. Range: 0 to 100 inches of water.
 3. Accuracy: +2%.
 4. Increments: 1 inch of water.
 5. Accessories:
 - a. Carrying case.
 - b. 10 feet hoses.
 - c. Shut-off valves.
 - d. Operating manual.
 6. Maximum operating temperature: 250 degrees F water at 250 psiG.
- I. Heating Water Pump:
1. Type: Centrifugal, single-stage, in-line type , in-line suction and discharge.
 2. Material:
 - a. Volute: Cast iron ASTM A159.
 - b. Impeller:
 - 1) AA sizes: Brass, ASTM B36.
 - 2) A, F sizes: Cast bronze, ASTM B584.
 - c. Pump shaft: Steel
 - d. Seal assembly:
 - 1) Housing: Brass.
 - 2) Bellows: Buna-N.
 - 3) Ring: Carbon.
 - 4) Spring: 304 stainless steel.
 - 5) Seat: Ceramic.
 - 6) Seat gasket: Buna-N.
 - e. Volute gasket: Cellulose fiber.
 - f. Companion flanges:
 - 1) 1 to 1-1/2 inches: Formed steel.
 - 2) 2 inches: Cast iron, ASTM A159.
 - g. Shaft sleeve: Copper alloy 110 or aluminum bronze, ASTM B584.

J. Expansion Joints:

1. For piping 2-1/2 inches or smaller.
 - a. Type: Bellows.
 - b. Material:
 - 1) Bellows: Two-ply stainless steel.
 - 2) Shrouds and end fittings: Carbon steel.
 - c. Stroke: 1-3/4 inches compression, 1/4 inches extension minimum.
 - d. Maximum operating temperature: 750 degrees F.
 - e. Maximum working pressure: 175 psi.
 - f. Maximum test pressure: 250 psi.
 - g. Fittings: NPT.
2. For piping 3 inches or larger:
 - a. Type: Controlled flexing bellows.
 - b. Material:
 - 1) Bellows: Stainless steel.
 - 2) Carrier rings and fittings: Steel.
 - c. Maximum transverse travel: 7-1/2 inches.
 - d. Temperature limits: -20 to 850 degrees F.
 - e. Allowable pressure: Vacuum to 300 psi.
 - f. Fittings: Flanged.

K. Pipe Guides:

1. Type: System consisting of a spider which rigidly attaches to pipe and is housed in a sleeve which can be rigidly anchored.
2. Material: Steel.

L. Flexible Connectors:

1. Type: Flexible corrugated single braid hose.
2. Material: Stainless steel.
3. Maximum working pressure: 150 psiG.
4. Maximum test pressure: 250 psiG.
5. Normal burst pressure: 650 psiG minimum.
6. Fittings:
 - a. For sizes up to 2-1/2 inches diameter: NPT.
 - b. For sizes 3 inches or larger: Flanged.

2.3 FABRICATION

- A. Fabricate pumps complete with motor and pump as one unit.

2.4 SOURCE QUALITY CONTROL

- A. Pump Impeller Trimming:

1. Trim impellers to a diameter to provide design flow to each terminal with minimum pump power consumption for each pump.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install hydronic specialty items where indicated or required.
- B. Install at high point in closed water systems and at high point of coil headers an automatic relief vent.
 1. Install shut-off valve ahead of each vent.
 2. Extend relief tubing from vent to drip pan or drain.
- C. Install flexible connectors at pump suction and discharge and where indicated.
- D. Install pipe guides in accordance with EJMA Standards.
 1. Space at 4 and 14 pipe diameters from expansion joints.
 2. Install at expansion loops as indicated.

3.2 FIELD QUALITY CONTROL

- A. See Section 23 05 93.

3.3 CLOSEOUT ACTIVITIES

SECTION 23 21 14 GEOTHERMAL LOOP HEAT EXCHANGER

PART 1 - GENERAL

1.1 DESCRIPTION

A. Description of Work:

1. This specification designates the requirements for a complete geothermal loop heat exchanger (GLHE), made to controlled dimensions, Specifications and requirements as per ASTM D3035 for polyethylene pipe, ASTM D2683 for socket fusion fittings and ASTM D3261 for butt/saddle fusion fittings.
2. Extent of GLHE piping work is indicated on Drawings and schedules, and by requirements of this Section.
 - a. This Section includes pipe and pipe fittings for GLHE including all drilling, backfilling, flushing, pressure testing, and other incidental work as required for a complete and operational GLHE.
 - b. Work shall include all outside pipe up through the floor to the transitions off the header in the Mechanical Room.
3. Refer to other Division 23 Sections for hydronic specialties; HVAC pumps; ground coupled heat pump loop glycol systems; and testing, adjusting and balancing.
4. The successful Contractor will be required to coordinate their work with the successful building General and Mechanical Contractor to provide a fully operating and functioning GLHE system.
5. The location of the GLHE connection to the building heat pump piping system and the point of responsibility change is shown on the plans.

1.2 RELATED WORK

A. Related Work:

1. All applicable Division 1 Sections for general conditions.
2. All applicable Division 2 Sections for excavation, backfilling, and disposal of waste materials.
3. Section 23 05 23 – General Duty Valves.
4. Section 23 21 23 - Hydronic Pumps.

1.3 QUALITY ASSURANCE

A. Codes and Standards:

1. Mechanical Code Compliance: Fabricate and install GLHE water piping in accordance with applicable mechanical code.
2. Comply with all local and state laws and ordinances.

B. Qualification of GLHE Contractors:

1. The entire exterior GLHE system shall be fabricated, installed and tested by a qualified specialist in this type of work.
2. Driller's Qualifications: Drillers shall be Water Well Contractors licensed by the State of Nebraska.
3. Pipe Installer's Qualifications: Installers must have completed a certified training program offered by the International Ground Source Heat Pump Association (IGSHPA) or IGSHPA approved manufacturer's certification program and shall have at least two (2) years of successful installation experience on projects with GLHE work similar to that required for this project.

4. Pipe Fabricators Qualifications: The only acceptable method for joining buried pipe systems is by a heat fusion process.
 - a. GLHE fabricators must have completed a heat fusion school in which each participant has performed a heat fusion procedure under direct supervision of an IGSHPA Certified Heat Fusion Technician; an IGSHPA approved manufacturing certification program, or a DOT certified heat fusion technician.
 - b. Certified technicians must attend a retraining school annually.
5. Contractor shall maintain and furnish to Engineer complete drilling logs.
6. Should the Contractor hit rock formations or other material that make the use of the specified loop lengths impractical, Contractor shall contact the Engineer to discuss alternate layouts of the wellfield.
7. In the event that loops cannot be installed to the depth shown on the Drawings, the Contractor shall notify the Engineer prior to proceeding and obtain his concurrence on the Contractor's proposal as to the number, depth and spacing of loops.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery, Storage and Handling:

1. See Division 01.
2. Pipe shall be stored in a manner, which will prevent the detrimental effects of weather, temperature, and other exposure to adverse conditions.
 - a. Storage areas shall not interfere with the operations of the owner or the operation of any of the other contractors at the project site.
3. All pipes and fittings are to be sealed to prevent debris, rodents and other foreign material from entering the piping system.
4. Store pipes and pipe fittings in accordance with manufacturer's recommendations.
5. All pipes and fittings are so sealed to prevent debris, rodents and other foreign material from entering the piping systems.
6. Pipes and fittings shall not be stored in sub-freezing weather for more than 24 HRS.
 - a. Pipes and fittings exposed to prolonged freezing materials shall be removed from the job site or stored in a heated area.

1.5 SUBMITTALS

A. Product Data:

1. Submit manufacturer's technical product data and installation instructions for GLHE piping materials, valves, hangers, pressure and temperature test ports, thermometers, pressure gauges, backfill material (grout), joining methods and products.

B. Record Drawings:

1. At project closeout, submit record drawings of installed ground coupled heat pump loop water piping and piping products, in accordance with requirements of Division 01.
2. Formation logs indicating strata encountered for first bore hole drilled, the bore hole nearest the center of the loop field, and the bore hole at each corner of the loop field.
3. Detailed pressure test procedure from polyethylene pipe manufacturer with acceptance test criteria.
4. Loop field installation, flushing and pressure test logs for each zone.

5. Maintenance Data: Submit maintenance data and parts lists for ground coupled heat pump loop water piping materials and products.
 - a. Include this data, product data, and Record Drawings in maintenance manual in accordance with requirements of Division 01.

C. Documentation:

1. Well drilling procedure describing, in detail, the procedure for drilling holes, placing and pressure testing piping, backfilling/grouting, purging and charging the GLHE.
2. Evidence of completion of a certified training program offered by the International Ground Source Heat Pump Association as well as evidence that all technicians on the job site have attended a heat fusion training/retraining school within the past 12 months.
 - a. Proof of certification shall also be maintained at the job site.
3. Letter of certification from pipe and fittings manufacturer, along with a certification document from the resin supplier, verifying compliance with IGSHPA standards.

1.6 PERMITS

A. Permits:

1. All permits, fees, licenses, etc., required for this project shall be obtained and paid for by the Contractor.
2. Contractor shall obtain all permits, pre-notification forms, and other approvals from the State of Nebraska at least fourteen working days prior to the commencement of work.
 - a. No well field work shall commence without written notification from the State and City have been reviewed and approved by the Engineer.
3. Well field shall be registered with the City and State as required upon completion.

1.7 WARRANTY

A. Special Product Warranty:

1. GLHE installation Contractor shall submit a written warranty with operation and maintenance data.
 - a. Warranty shall provide for repair and/or replacement of pipe and fittings due to failure in workmanship within the specified warranty period.
 - b. Warranty period shall be five (5) years from date of Substantial Completion and shall cover both materials and labor as required for pipe, fittings, backfilling material, trenching, etc.
 - c. Note that this warranty shall be provided in addition to the 25 year pipe and fitting material warranty provided by the manufacturer.
 - d. Both the installation warranty and the 25 year pipe manufacturer warranty shall be transferable.

1.8 APPLICABLE PUBLICATIONS

A. Publications:

1. International Ground Source Heat Pump Association (IGSHPA) manuals.
2. ASHRAE Commercial/Institutional Ground Source Heat Pump Engineering Manual.
3. ASHRAE Ground Source Heat Pumps - Design of Geothermal Systems for Commercial and Institutional Buildings.
4. ASTM D3035.
5. ASTM D2683.
6. ASTM D3261.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Geothermal High Density Polyethylene Pipe and Fittings:
 - 1. Centennial Plastics LLC.
 - 2. Chevron Phillips Chemical Company, LP – Driscoplex 5300 Climate Guard.
 - 3. ISCO Industries – 5300 Series Climate guard system.
 - 4. Requirement: Pipe and fittings manufacturer shall provide a letter of certification, which includes a certification document from the resin supplier that verifies compliance with IGSHPA standards.
- B. Thermally Enhanced Bentonite Grout: Black Hills Bentonite Company.
- C. Watertight Wall Sleeves:
 - 1. Calpico Pipe Linx.
 - 2. Thunderline Link Seal.
- D. Valve Tags and Pipe Labels:
 - 1. Seton.
 - 2. Brady.
 - 3. Craftmark.

2.2 GEOTHERMAL LOOP HEAT EXCHANGER PIPING

- A. General:
 - 1. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated.
 - a. Provide sizes and types matching piping and equipment connections; provide fittings of materials, which match pipe materials used in GLHE water piping.
 - b. Where more than one type of materials or products are indicated, selection is installer's option.
- B. Geothermal Loop Heat Exchanger Piping (Below Grade):
 - 1. Material: Piping shall be extruded high density polyethylene (HDPE) conforming to the specifications and requirements of ASTM D3035.
 - a. The pipe shall be virgin resin with an allowance for on-site manufacturer re-processed resin.
 - b. No recycled resin shall be used.
 - c. The approved pipe products are Driscoplex 5300 Climate Guard Pipe or equal.
 - d. Pipe shall be inert to most chemical compounds.
 - e. Heat transfer fluids such as propylene glycol, methanol, sodium chloride and calcium chloride shall have no effect on the pressure capability or long-term performance of the pipe.
 - f. The pipe shall not rust, rot, pit, corrode or otherwise react to highly corrosive soils into which it may be placed.
 - 2. Resins exhibiting the balance of properties offered by pipe-grade resin possessing the ASTM D3350 PE3408 cell classification No. 345434C.

3. Pipe schedules and dimension ratios (DR) shall be approved for the operating pressures (both static and dynamic) and temperatures expected.
 - a. As a minimum, the following industry standard pressure ratios and schedules shall be used:

Nominal Pipe Size	Vertical Pipe	Horizontal Pipe
3/4 IN	DR-11	DR-11
1 IN	DR-11	DR-11
1-1/4 IN	DR-11	DR-13.5 or Schedule 40
1-1/2 IN	DR-11	DR-13.5 or Schedule 40
2 IN	N/A	DR-15.5 or Schedule 40
3 IN	N/A	DR-15.5 or Schedule 40

4. The GLHE system pipe fittings which are molded shall be manufactured to the dimensional specifications and requirements of ASTM D2683 (for socket fusion fittings) or ASTM D3261 (for butt/saddle fusion fittings).
 - a. The material used in the manufacturing of the fitting shall be the same approved extrusion material as the connecting pipe.
 - b. Pipe and fittings shall be approved by pipe manufacturer as meeting requirement of this specification.
 - c. For fabricated fittings, a minimum "quick-burst" strength of the fittings shall not be less than that of the pipe, nor less than four times the long-term water-rated working pressure.
 - d. The approved fittings are Chevron Phillips Driscoplex 5300 Climate Guard or equal pressure-component fittings.
5. All "U" bend fittings and piping loops for vertical bore holes shall be factory or shop fabricated and field pressure tested to 100 PSIG before inserting into the bore hole.
 - a. See Part 3 for further pressure testing requirements.
 - b. Installer shall record each bore hole piping pressure test in a log book to be submitted as part of the Project Record Documents.
 - c. Log book shall use same bore hole labeling scheme as indicated in the Construction Documents.
6. Each GLHE pipe loop shall be marked with the manufacturer's name and product name, nominal size, ASTM dimensional standard, PPI material classification, cell classification, manufacturer's date code, and incremental loop length (using the U-bend as the datum point).
 - a. Print lines shall repeat a minimum of every 5 FT.
7. Joining Method:
 - a. The approved joints are socket or butt heat fusion, flanging, transition fittings and proof-tested, approved mechanical "couplers".
 - 1) NO OTHER JOINING METHODS ARE ACCEPTABLE, INCLUDING SADDLE HEAT FUSION.
8. Thermal Efficiency:
 - a. Pipe shall provide exceptional heat transfer capabilities when compared to the average k-value of other thermoplastic materials.
 - 1) The thermal conductivities (k-values) in Btu/HR/FT/DEGF shall be approximately 0.225.

2.3 BENTONITE GROUT

A. Grout Requirements:

1. Bentonite slurry material shall consist of powdered sodium bentonite clay (API Specification: API 13A, 11th Edition, April 1984) and clean water in the proportion specified by the bentonite grout manufacturer.
 - a. The minimum acceptable proportion shall be at least 9.5 LBS of powdered bentonite to 1 GAL of water (15% solids content).
 - b. A thermal enhancement compound (high-grade silica sand) shall be added to the slurry and shall be specified and supplied by the manufacturer bentonite base material.
2. Bentonite and thermal enhancement compound shall be mixed as required by manufacturer to provide listed conductivity and shall be pre-manufactured and prepackaged prior to delivery.
3. Bentonite pellets or granular bentonite shall consist of powdered sodium bentonite clay (API Specification: API 13A, 11th Edition, April 1984).
4. All bentonite grout materials shall have a permeability less than 1×10^{-7} cm/sec.
5. All bentonite slurry grout materials shall have a thermal conductivity of 0.90 Btu/HR/FT/DEGF or greater.
6. All bentonite grout materials shall be approved for surface seals and aquifer seals per Title 178 NAC 12 and local code requirements.
7. Thermally enhanced grout shall be Black Hills Bentonite Thermal Grout Select by GeoPro, Inc.

2.4 SLEEVES

A. Sleeve Requirements:

1. Sheet Metal: 10 gage, galvanized steel, round tube closed with welded joints.
2. Steel: Galvanized, welded steel pipe.
3. Modular Sleeve Seals: Modular mechanical type, interlocking synthetic rubber links, bolted connections and pressure plates, watertight seal to 20 PSIG.

2.5 DIELECTRIC UNION COUPLINGS OR FLANGED CONNECTIONS

A. Requirements:

1. Specifically designed to isolate piping systems and equipment of dissimilar materials.
 - a. Must effectively prevent galvanic action and stop corrosion.
2. Same end connections as systems or equipment installed, full line size.
3. Provide at all locations where dissimilar materials join.

2.6 UNDERGROUND-TYPE PLASTIC LINE MARKERS

A. General:

1. Manufacturer's standard permanent, bright-colored; continuous-printed plastic tape, intended for direct-burial service; not less than 6 IN wide and 4 mils thick.
 - a. Provide tape with printing which most accurately indicates type of service of buried pipe.
2. Provide multi-ply tape consisting of solid aluminum foil core between two layers of plastic tape.

2.7 FLANGES, UNIONS AND COUPLINGS

A. General:

1. Pipe Size 2 IN and Under: 150 PSIG malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
2. Pipe Size Over 2 IN: 150 PSIG forged steel flanges for ferrous piping; bronze flanges for copper piping; preformed neoprene gaskets.

2.8 MANUAL AIR VENTS

A. General:

1. Short vertical sections of 2 IN DIA pipe to form air chamber, with 1/2 IN brass needle or coin-operated valve at top of chamber.

PART 3 - EXECUTION

3.1 INSPECTION

A. Requirements:

1. Examine areas and conditions under which ground loop exchanger water piping materials and products are to be installed.
 - a. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.
2. Carefully inspect the pipe to detect any damage that may have occurred during shipping or as a result of excessive abuse at the job site.

3.2 COORDINATION

A. Requirements:

1. Sequence, coordinate and integrate installation of geothermal loop heat exchanger materials for efficient flow of the work.
 - a. Give particular attention to large equipment or piping requiring positioning prior to closing in the building.
2. Coordinate the GLHE work with work of the building general contractor such that:
 - a. Interference between GLHE, mechanical, electrical, architectural, and structural work, including existing services, will be avoided.

3.3 IDENTIFICATION OF EXPOSED PIPE AND VALVES

A. General: Install mechanical identification in accordance with Section 23 05 53.

3.4 IDENTIFICATION OF BELOW-GRADE PIPING

A. General:

1. Each pipe shall be permanently indent marked with the manufacturer's name, nominal size, pressure rating, relevant ASTM standards, cell classification number and date of manufacture.
 - a. Each fitting shall be identified with the manufacturer's name, nominal size, pressure rating, relevant ASTM standards and date of manufacture.
2. Provide underground plastic tape pipe markers.
 - a. Install tape 6-18 IN below finished grade, immediately above all horizontal pipe runs.
3. Attach coated 14 GA copper trace wire along entire length of all underground polyethylene pipes and terminate in the buildings mechanical room.

3.5 INSTALLATION OF GEOTHERMAL LOOP HEAT EXCHANGE PIPING (BELOW GRADE)

A. General:

1. Install underground piping as indicated and in accordance with applicable local codes and in accordance with manufacturer's written instructions.
 - a. Lay underground piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert.
 - b. Make welded fittings in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.
 - c. Clean interior piping of dirt and other superfluous material as work progresses.
 - d. Maintain swab or drag in line and pull past each joint as it is completed.
 - e. Place plugs in ends of uncompleted piping at end of day or whenever work stops.
2. Construction and installation shall be in accordance Division 2 for trench construction, embedment material, bedding, haunching, initial backfill and final cover.
3. Bore depth shall be 330 FT: Use drilling technique (such as "sonic") that will enable full depth bores to be drilled and excavated.
4. Excavation, Laying Pipe and Backfilling (Also refer to Division 2):
 - a. Ground loop heat exchanger contractor shall perform all excavation and backfilling necessary to install the required mechanical work.
 - 1) Coordinate the work with other excavating and backfilling work in the same area.
 - b. Grade the bottom of the trenches accurately to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length.
 - c. All horizontal outdoor piping shall be buried a minimum of 78 IN deep.
 - 1) If the soil contains sharp rocks, dig the trench 12 IN deeper than required and install a base of 12 IN of suitable backfill before placing the pipe.
 - 2) Provide rounded corners at changes of direction and at trench "tees".
 - d. The full length of each pipe section shall rest solidly upon the pipe bed.
 - 1) Keep pipe interior clean and dry during laying operations.
 - 2) When work is not in progress, plug the ends or close them by another acceptable method.
 - 3) Do not lay pipe in water and keep water out of trench until joining is complete. Provide valves, plugs, or caps, as required, where pipe ends are left for future connections.
 - e. Deposit suitable granular sand backfill material under the pipe in 6 IN layers and thoroughly compact.
 - 1) Provide a minimum of 4 IN sand bed, or 1/8 of pipe outside diameter, whichever is greater.
 - 2) Provide tamped granular sand backfill in 6 IN layers to a minimum 12 IN above top of pipe.
 - 3) Be careful not to disturb the pipe.
 - 4) Carry backfilling simultaneously on both sides of pipe to eliminate the possibility of lateral displacement.

- f. After the piping is installed, tested, flushed, purged, inspected and approved while still under pressure, deposit suitable backfill material in layers and thoroughly compact in accordance with appropriate Division 2 Sections.
 - 1) Insure that no sharp rocks come into contact with any pipe walls.
 - 2) Coordinate the laying of the header piping with all existing new site utilities as well as landscape plans.
- g. Pre-grading and similar exposed finish work that is disturbed or damaged by excavation shall be repaired and restored to their original condition and elevation by the Geothermal Loop Heat Exchanger Contractor at his/her own expense.
- 5. Join the pipe and fittings using the butt or socket fusion process, NO OTHER PIPE JOINING METHOD IS ACCEPTABLE.
 - a. Make vertical loop takeoff tee fittings using tees on header piping 1-1/4 IN and above.
 - b. Use bell reduction fittings at all pipe reductions to eliminate trapped air.
 - c. Use reducing socket tees when fabricating socket type reducing headers.
 - d. Allow joints to cool for 3 HRS before exposure to cold joint testing or pressure testing.
- 6. Any kinks or sharp bends in the piping are not acceptable.
 - a. Also, only continuous length pipe is acceptable for change of directions (no butt or socket fusion joints).
 - b. Consult pipe manufacturer for minimum bend radius.
 - c. Install elbow fittings for bends, which require tighter radii than manufacturer recommends.
- 7. Care should be taken to make sure the total system pressure, operating plus surge, does not exceed the pressure rating of a specific DR or Schedule of Pipe.
- 8. To ensure long-term performance, pipe should be installed strictly in accordance with accepted engineering design methodology for water source heat pump applications, and in accordance with the manufacturer's installation instructions.
- 9. When installed down-hole, as in a vertical loop, ample precautions should be taken to make sure the ballast used to facilitate the insertion process does not impinge, gouge or cut into the pipe.
- 10. To facilitate drilling of vertical bore holes, portable slush pits or small trenches shall be used.
 - a. All drilling fluid and bentonite residue shall be removed from the site.
 - b. If trenches are used for slush pits, they shall be backfilled and compacted in accordance with Division 2 requirements.
- 11. Prior to installation, each vertical pipe loop shall be filled with water and hydrostatically tested in the field prior to insertion in the vertical bore hole.
 - a. The duration of the test and acceptance criteria shall be specified in the pipe manufacturer's written pressure testing instructions.
 - b. Exercise suitable safety precautions during testing, to guard against injury to personnel near lines being tested, in case of pipe system component, or joint failure under pressure.
 - c. Results of all tests shall be recorded and supplied to the Engineer upon completion of the project, or as required by the Engineer.

12. Lateral pipes shall be purchased in such lengths and installed in such manner as to minimize the number of fusion joints required.
13. Lateral piping supply and return lines or bundles shall be separated to minimize thermal interference between the two.
 - a. The number of points where supply and return lines cross one another shall be minimized.
14. Slope lateral piping to provide venting.
 - a. Slope pipe upward in direction of flow.
15. Open ends of all lateral pipe shall be sealed to prevent the entry of contaminants until final connections are made.
16. Connect polyethylene piping to steel piping in Mechanical Room using adapter fittings.
17. After each vertical loop in a zone is connected to the lateral piping, and prior to backfilling, the piping system shall be pressure tested.
 - a. Testing shall be by air or water pressure, at 1.5 times the normal operating pressure.
 - b. The duration of the test and acceptance criteria shall be the more stringent of the pipe manufacturer's written pressure testing instructions and as specified herein.
 - c. Exercise suitable safety precautions during testing, to guard against injury to personnel near lines being tested, in case of pipe system component, or joint failure under pressure.
 - d. Results of all tests shall be recorded and supplied to the /Engineer upon completion of the project, or as required by the /Engineer.
18. Connect loop field piping to the supply/return header system as shown.

3.6 PRESSURE TESTING

A. General:

1. Prior to insertion of U-Tube into bore hole: Test at 100 PSI for five (5) minutes minimum.
2. Following purging of system, system shall be tested at 60 PSI for one (1) hour minimum.
3. Discard any coils with leakage before U-Tube insertion and replace any U-tubes found to be defective after insertion.
 - a. Follow manufacturer's guidelines for verifying pressure changes during test.

3.7 GROUTING

A. General:

1. Bentonite Grout Slurry: Each bore hole shall be continuously pressure grouted from the bottom of the bore hole to the top of the bore using a grout pump per manufacturer's recommendations and in accordance with IGSHPA's standards specified in their publication "Proper Grouting Procedures for Ground-Source Heat Pump Systems", and all state and local code requirements.
2. Each bore hole shall be grouted within 3 HRS of being drilled.
3. Tremie pipes used to pressure grout the bore holes shall be inserted with the pipe loop and removed as the bore hole is filled.
 - a. No permanent tremie pipes are allowed.
4. Since settling of the grouting material will occur after the initial grouting, the contractor shall monitor each bore hole and add grout as required.

5. Conductivity Testing: Contractor shall be responsible for sending (2) samples of grout as described below to GeoPro for thermal conductivity testing at no additional cost to the owner.
 - a. Sample #1: Shall be taken during the grouting of the 1st bore hole.
 - b. Sample #2: Shall be taken during the grouting of the 14th bore hole.

3.8 INSTALLATION OF VALVES

- A. General:
 1. Install valves in accordance with manufacturer's written instructions and in accordance with applicable Division 23 Specifications.

3.9 INSTALLATION OF SEALS AND SLEEVES

- A. General:
 1. Pipe 3-1/2 IN and smaller: Seal pipe penetrations through walls below grade using steel pipe sleeves and flexible polyurethane foam.
 2. Seal around penetrations utilizing techniques, which allow optimum sealant movement.

3.10 FIELD QUALITY CONTROL

- A. Requirements:
 1. Cold Joint Testing.
 - a. All fusion joints 2 IN and smaller shall be tested for cold joints prior to pressure testing and backfilling.
 - 1) Cold joint test shall consist of compressing pipe approximately 1 IN from fusion joint.
 - 2) Separation of joint or subsequent leak during pressure test shall indicate cold joint.
 - 3) All cold joints shall be repaired and retested prior to backfilling.
 - 4) All joints, which fail the cold joint test shall be recorded and supplied to the Engineer upon completion of the project, or as required by the Engineer.
 2. Upon completion of GLHE installation, perform complete GLHE hydrostatic pressure test per polyethylene pipe manufacturer's written instructions, and as follows:
 - a. Notify Engineer 48 HRS prior to test.
 - b. Leave joints, including welds, uninsulated and exposed for examination during the test.
 - c. Provide temporary restraints where required.
 - 1) If temporary restraints are not practical, isolate expansion joints from testing.
 - d. Flush system with clear water.
 - e. Isolate equipment that is not to be subjected to the test pressure from the piping.
 - 1) If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve.
 - 2) Flanged joints at which blinds are inserted to isolate equipment need not be tested.
 - f. Set relief valve set at pressure no more than 1/3 higher than test pressure to protect against damage by expansion of liquid or other source of over-pressure during the test.

- g. Use ambient water temperature as a testing medium except where there is risk of damage due to freezing.
 - 1) Another liquid may be used if it is safe for work persons and compatible with the piping system components.
- h. Use vents to release trapped air while filling the system.
- i. Examine system to see that equipment and parts that cannot withstand test pressure are properly isolated.
- j. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the normal operating pressure.
 - 1) The test pressure shall not exceed the maximum pressure for any vessel, pump, valve or component on the system under the test.
- k. After the hydrostatic test pressure has been applied for at least ten minutes, examine the piping joints and connections for leakage.
 - 1) Eliminate leaks by tightening, repairing or replacing components as appropriate and repeat hydrostatic test until there are no leaks.
- l. Engineer shall verify acceptance of the pressure test.
- m. Clean and flush piping system.

3.11 ADJUSTING, CLEANING AND AIR PURGING

A. General:

- 1. The GLHE contractor shall be responsible for flushing, purging, cleaning and filling all of the outside piping.
 - a. Outside piping is defined as all ground coupled heat pump loop external to the building and installed as part of this Contract.
- 2. Flushing, Testing and Cleaning:
 - a. Cleanliness: During installation, trash, soil and small animals shall be kept out of the pipe.
 - 1) Ends of the pipe shall be capped until the pipe is joined to the circuit.
 - b. Flushing the Vertical Ground Heat Exchanger: Before connection of the vertical heat exchanger loops to the header lines, each loop shall be flushed thoroughly and left filled with clean water.
 - 1) If the loop is not immediately joined to the header, it shall be capped.
 - c. Pressurizing: The horizontal piping system shall be water filled and pressure tested by zone as specified in this Section prior to back fill of the trenches.
 - 1) Every joint and fitting shall be visually and physically examined.
 - 2) Notify Engineer 48 HRS before test.
 - 3) Make note of test in log book mentioned previously in this specification.
 - 4) Record test duration, pressures, etc.
- 3. Air Purging:
 - a. The hydronic system shall be purged of all air by bleeding air from all high spots and circulating water through the system for minimum of 48 HRS.

- b. Prior to backfilling, the complete loop field piping system shall be purged of air and flow tested to ensure proper water flow in all portions of the heat exchanger.
 - 1) A portable temporary purging unit shall be utilized and consist of the following: Purge Pump-high volume and high head; open reservoir, filter assembly with bypass; connecting piping, and connection hoses.
 - c. Using the purging unit described above, flush and purge each Geothermal Loop Heat Exchanger zone until free of air, dirt and debris.
 - 1) A minimum velocity of 2 FT/sec is required in all pipe sections to remove the air.
 - a) The flush and purge water velocity shall not exceed 7 FT/sec.
 - b) This flushing and purging operation should be conducted with the water source heat pump piping isolated with shut off valves.
 - c) Do not flush and purge through the heat pump units.
 - (1) Temporary hoses shall be connected during the flush-out procedure in such a way as to bypass the heat pump, auto-flow control valve, and the strainer.
 - d) Coordinate with the building mechanical contractor (Do not allow the acid solution used to purge and flush the indoor metal pipe system to the heat pump units to become mixed with the solution in the GLHE).
 - d. Utilizing the purging unit, conduct a pressure and flow test on the completed Geothermal Loop Heat Exchanger to ensure the system is free of blockage.
 - 1) If the flow test indicates blockage, locate the blockage systematically clamping off loops with a pinch-off tool or using the shut-off valves, remove the blockage, then repurge and conduct the pressure and flow test again until all portions of the system are flowing.
 - 2) The flow test must be observed and approved by the Engineer.
 - e. The Geothermal Loop Heat Exchanger inspection report is to be filled out by the Contractor and is to be witnessed by the Engineer.
 - 4. System Startup: Prior to heating and cooling system startup by the building mechanical contractor, ensure all valves are in correct position and GLHE is unblocked and leak free prior to system startup.
 - a. The GLHE Contractor shall be present at and coordinate with the building mechanical contractor during building mechanical system startup.
 - b. The General Contractor shall coordinate filling of the entire heat pump loop system (inside the facility and outside the facility) with propylene glycol, as scheduled.

END OF SECTION

SECTION 23 21 23 HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. System lubricated circulators.
 - 2. In-line circulators.
 - 3. Vertical in-line pumps.
 - 4. Close coupled pumps.
 - 5. Base mounted pumps.
 - 6. Dual drive pumping system.
 - 7. Side-stream filters.
- B. Related Sections include but are not necessarily limited to:
 - 1. Section 23 05 23 - General-Duty Valves for HVAC Piping.
 - 2. Section 23 21 00 - Hydronic Specialties.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. Underwriters Laboratories Inc. (UL):
 - a. 778, Motor Operated Water Pumps.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide pumps to operate at system fluid temperatures indicated on Drawings without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
- B. This specification is for Hydronic (HVAC) systems pump requirements only. See Division 43 Process Gas and Liquid Handling, Purification, and Storage Equipment specifications for process pump requirements.

1.4 SUBMITTALS

- A. Product Data: Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements. Submit also, manufacturer model number, dimensions, service sizes, and finishes.
- B. Manufacturer's Installation Instructions: Submit application, selection, and hookup configuration with pipe and accessory elevations. Submit hanging and support requirements and recommendations.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- D. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience , and with service facilities within 100 miles of Project.

- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.
- 1.6 PRE-INSTALLATION MEETINGS
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Protect systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- 1.8 FIELD MEASUREMENTS
 - A. Verify field measurements prior to fabrication.
- 1.9 WARRANTY
 - A. 01 78 36 - Warranties.
 - B. Furnish five year manufacturer warranty for pumps.
- 1.10 EXTRA MATERIALS
 - A. 01 78 43 - Spare Parts and Extra Materials.
 - B. Furnish one set of mechanical seals for each pump .
 - C. Furnish two sets of cartridges for each side-stream filter.
- PART 2 - PRODUCTS
- 2.1 IN-LINE CIRCULATORS
 - A. Manufacturers:
 - 1. Armstrong Fluid Technology.
 - 2. Taco Comfort Solutions.
 - B. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 175 psiG maximum working pressure.
 - C. Casing: Cast iron, with flanged pump connections.
 - D. Impeller: Stamped brass or cast bronze, keyed to shaft.
 - E. Bearings: Two, oil lubricated bronze sleeves.
 - F. Shaft: Alloy or stainless steel with copper or bronze sleeve, integral thrust collar.
 - G. Seal: Carbon rotating against stationary ceramic seat, 225 DEGF maximum continuous operating temperature.
 - H. Drive: Flexible coupling.
 - I. Electrical Characteristics and Components:
 - 1. Motors: 1750 rpm unless indicated otherwise.
 - 2. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- 2.2 VERTICAL IN-LINE PUMPS
 - A. Manufacturers:
 - 1. Armstrong Fluid Technology.
 - 2. Bell & Gossett by Xylem, Inc.
 - 3. Taco Comfort Solutions.
 - B. Type: Vertical, single stage, close coupled, radial or horizontally split casing, for in-line mounting, for 250 psiG working pressure.
 - C. Casing: Cast steel, with suction and discharge gage port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
 - D. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.

- E. Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.
- F. Shaft Sleeve: Aluminum bronze.
- G. Seal: Carbon rotating against stationary ceramic seat, 225 DEGF maximum continuous operating temperature.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
- B. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4 inches and over.
- C. Install pumps on vibration isolators.
- D. Install flexible connectors at or near pumps where piping configuration does not absorb vibration. Refer to Section 23 21 00.
- E. Provide line sized shut-off valve and strainer on pump suction, and line sized [soft seat check valve, balancing valve, and shut-off valve] [combination pump discharge valve] on pump discharge. Refer to Section Section 23 21 00.
- F. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump so no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and larger.
- G. Provide air cock and drain connection on horizontal pump casings.
- H. Provide drains for bases and seals.
- I. Check, align, and certify alignment of base mounted pumps prior to start-up.
- J. Install close coupled and base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place.
- K. Lubricate pumps before start-up.
- L. Provide side-stream filtration system for heating water and , chilled water systems. Install across pump with flow from pump discharge to pump suction from pump taps.

3.2 FIELD QUALITY CONTROL

- A. Comply with Division 01 Sections: Field inspecting, testing, adjusting, and balancing.
- B. Inspect for alignment of base mounted pumps.

3.3 SCHEDULES

- A. Include schedules on drawing sheets for all pumps.

3.4 CLOSEOUT ACTIVITIES

SECTION 23 25 13
CHEMICAL TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Chemical Treatment Systems:

1. Sensors.
 2. Controllers.
 3. Equipment.
 4. Systems:
 - a. Hot water/glycol heating system:
 - 1) 40% propylene glycol and 60% water.
 - 2) System capacity: 570 GAL.
 - b. Chilled water/glycol cooling system:
 - 1) 40% propylene glycol and 60% water.
 - 2) System capacity: 580 GAL.
- B. Provide a contract for a one year period, transferable to the Owner, to include the following:**
1. Initial water analysis and recommendations.
 2. System start-up assistance.
 3. Training of operating personnel.
 4. Periodic field service and consultation.
 5. Performance shall be by a qualified full-time local representative.
 6. Customer report charts and log sheets at no additional charge.
 7. Laboratory and technical assistance.
 8. Furnish all chemicals for the one year period.

1.2 QUALITY ASSURANCE

- A. Chemicals, service and equipment shall be supplied by a single water treatment company for undivided responsibility.**
- B. The water treatment company shall have:**
1. Regional water analysis laboratory.
 2. Development facilities and service department.
 3. Full time personnel located within the trading area of the jobsite.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data:
 - a. Manufacturer's installation instructions.
 - b. Manufacturer's catalog cuts and technical data.
2. Chemical shot feeder tank and appurtenances, materials and valving methods.
3. Testing equipment with operating instructions for Owner's testing personnel.
4. A contract agreement for a one year period as specified under the Summary Article.

B. Contract Closeout Information:

1. Operation and Maintenance Data:

- a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.4 SERVICE CONTRACT

A. A Contract Agreement satisfactory in form and substance to the Owner shall be executed between the Contractor and the water treatment company, through its authorized agents, binding upon the water treatment company to furnish supervisory service to assure the use of proper chemical treatment to and for the various systems involved for a period of one year from the date of the initial treatment thereof, as described in the following paragraphs.

- 1. The furnishing of the necessary chemicals for the treatment of the boiler during temporary heating periods and supervision of their use shall be included in the Contract Agreement.
- 2. The Contract shall be assigned to the Owner on the date that the facilities are accepted by the Owner so that water treatment will continue uninterrupted during the one year life of the Contract.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

- 1. Chemical System:
 - a. Mogal Corp.
 - b. Dow Chemical.
 - c. Nalco Chemical Co.

2.2 REQUIREMENTS

A. Hot Water Propylene Glycol and Chilled Water Propylene Glycol:

- 1. 50% propylene, 50% water.
- 2. Chemically treated:
 - a. Protect against scale and corrosion.
 - b. Levels as recommended by water treatment company.
 - c. Compatible with propylene glycol.

B. Chemical Shot Feeder:

- 1. By-pass type.
- 2. Valving.
- 3. Capacity: As shown on Drawings.
- 4. Materials:
 - a. Tank: Mild steel.
 - b. Closure: Cast iron with Buna-N O-ring.
 - c. Maximum pressure: 200 psi.

C. Water Test Equipment:

- 1. Test:
 - a. pH.
 - b. Treatment residual.

2. Reagents.
3. Carrying case.
4. All supplemental equipment.

2.3 SPARE PARTS

- A. Chemical shot feeder:
 1. One complete closure assembly:
 - a. Lid.
 - b. O-ring.
 2. Three lid O-rings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. After installation and testing of piping systems, flush system and clean system.
 1. Supervise flushing operation.
 2. Provide flushout chemicals.
 3. Provide pumps and appurtenances necessary to flushout the systems.
 4. Residual chemical levels:
 - a. Phosphate: 0.
 - b. Alkalinity: 100 PPM maximum.
 - c. Suspended solids: 0.
 - d. pH value: 8.4 or less.
 5. Provide written reports:
 - a. Stating that flushout is complete.
 - b. Residual chemical levels.
- B. Drain and flush system:
 1. All low points shall be drained and flushed.

3.2 APPLICATION

- A. Fill systems with 50% propylene glycol solution:
 1. Supervise fill operation.
 2. Provide all pumps and appurtenances necessary to fill systems.
 3. Add necessary chemicals for chemical treatment.

3.3 FIELD QUALITY CONTROL

- A. Instruct operating personnel in introduction of water treatment.

END OF SECTION

SECTION 23 31 00
HVAC - DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. HVAC ductwork and accessories.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 23 09 00 - Instrumentation and Control for HVAC Systems.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - a. 52, Method of Testing Air Conditioning Devices Used in General Ventilation for Removing Particulate Matter.
 - 2. National Fire Protection Association (NFPA).
 - 3. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
 - a. Ducted Electric Heat Guide for Air Handling Systems.
 - b. HVAC Duct Construction Standards - Metal and Flexible.
 - 4. Underwriters Laboratory, Inc. (UL):
 - a. 555, Standard for Safety Fire Damper and Ceiling Fire Damper.
 - b. 555S, Standard for Safety Leakage Rated Dampers for Use in Smoke Control Systems.
 - c. Building Materials Directory.
- B. Qualifications:
 - 1. Fabricator: Firms regularly engaged in the manufacture of the specific product, of type, size required, whose products have been in use in similar service for not less than three years.
 - 2. Installers: Firm with at least five years installation experience on products similar to that required for this Project.

1.3 DEFINITIONS

- A. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 2. Installer and applicator are synonymous.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Efficiency ratings per ASHRAE 52 for factory built and assembled filter units.
 - 2. Scaled ductwork drawings (1/4 inches equals 1 foot) showing duct and accessory layout and support.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

C. Miscellaneous Submittal:

1. Documentation of qualifications for fabricators and installers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Transverse joints (factory fabricated aluminum):
 - a. Ductmate Industries, Inc.
2. Flexible ducts:
 - a. Thermaflex.
 - b. Condu-flex.
 - c. Glass-flex.
3. Turning vanes:
 - a. Ductmate Industries, Inc.
 - b. Duro Dyne.
 - c. SEMCO Incorporated.
 - d. Ward Industries, Inc.
4. Flexible duct connections:
 - a. Vent Fabrics.
 - b. Duro Dyne.
5. Flexible connector thrust restraint:
 - a. Mason WB.
6. Access doors in ductwork:
 - a. Vent Fabrics.
 - b. American Warming.
7. Backdraft dampers:
 - a. Air Balance.
 - b. Ruskin.
 - c. American Warming.
8. Fire and combination smoke and fire dampers:
 - a. Air Balance.
 - b. Ruskin.
 - c. American Warming.
9. Ceiling diffusers:
 - a. Anemostat.
 - b. Carnes.
 - c. Titus.
10. Grilles and registers:
 - a. Anemostat.
 - b. Carnes.
 - c. Titus.

11. Air filters:
 - a. American Air Filter.
 - b. Farr.
 - c. Continental.
12. Manual (volume) dampers:
 - a. Air Balance.
 - b. Ruskin.
 - c. American Warming.
13. Duct sealers:
 - a. Durkee-Atwood.
 - b. Unitec McGill.
 - c. Benjamin Foster.
 - d. Design Polymerics.
14. Temperature control and automatic dampers:
 - a. Air Balance.
 - b. Ruskin.
 - c. American Warming.
15. Louvers:
 - a. Ruskin.
 - b. Air Balance.
 - c. American Warming.

2.2 COMPONENTS

- A. Duct and Fittings (Metallic):
 1. Materials:
 - a. 3003 H-14 aluminum alloy:
 - 1) Comply with ASTM B209.
 2. Fabrication (galvanized steel):
 - a. Minimum Sheet Metal Thickness:
 - 1) Per SMACNA for 4 inches WC pressure class.
 - a) Heavier gage sheet material may be used with associated reinforcement as an alternate to minimum thickness specified.
 - b) Lighter gage sheet material with associated reinforcement shall not be used as an alternate to minimum thickness specified.
 - b. Longitudinal Seams:
 - 1) Pittsburgh lock seam.
 - 2) Continuously Welded.
 - c. Transverse Seams:
 - 1) SMACNA T-22 or T-24 companion flange.

- 2) Factory fabricated flanged duct connection system:
 - a) Ductmate 25/35.
 - b) Angles and Cleates: Galvanized.
 - c) Snap cleats: Galvanized.
 - d) Gaskets: Close cell neoprene.
 - e) Bolts and screws: Stainless.
- d. Sealing:
 - 1) Per SMACNA for Seal Class A.
- B. Supports and Hangers:
 1. Materials (for aluminum duct):
 - a. Support angles: Aluminum or stainless steel, minimum 1-1/2 by 1-1/2 by 1/4 angle.
 - b. Hanger rods: Stainless steel.
 - c. Anchors: Stainless steel wedge type.
 2. Materials (for galvanized duct):
 - a. Support angles: Galvanized or stainless steel, minimum 1-1/2 by 1-1/2 by 1/4 angle.
 - b. Hanger rods: Galvanized or Stainless steel.
 - c. Anchors: Stainless steel wedge type.
 3. Fabrication: Trapeze type units.
 4. Strap hangers are not allowed.
- C. Turning Vanes:
 1. Materials: Same as duct.
 2. Fabrication:
 - a. Fabricate double vane units.
 - b. Pressure drop through elbows: Maximum 20% of velocity pressure.
- D. Flexible Connections:
 1. Materials: Hypalon, double coated closely woven glass fabric.
 2. Fabrication: Withstand 4.5 inches water column, positive and negative pressure.
- E. Access Doors:
 1. Materials:
 - a. Inner panel, out panel and frame: Same as duct.
 - b. Gaskets: Closed cell neoprene.
 - c. Insulation: 1 pound density fiberglass.
 - d. Hinges: Stainless steel.
 - e. Latches:
 - 1) Aluminum-zinc alloy.
 - 2) Outside lever handle.
 - 3) Adjustable spacer.
 - 4) Beveled inside flange.

- 5) Studs:
 - a) Minimum 3/8 inches diameter stud for doors up to 24 inches wide x 48 inches high.
 - b) Minimum 1/2 inches diameter stud for doors larger than 24 x 48 inches.
2. Fabrication:
 - a. Provide four-side continuous gaskets.
 - b. Utilize continuous piano hinges.
 - c. Latches required:
 - 1) 12 inches in any direction: One.
 - 2) Up to 18 x 18 inches: Two.
 - 3) Up to 24 x 48 inches: Two with inside handles.
 - 4) Up to 24 x 72 inches: Three with inside handles.
 - 5) Minimum door size: 12 x 12 inches.
- F. Flexible Duct:
 1. Material: Continuous steel supporting spiral covered with 100% continuous filament fiberglass with nonporous fiberglass/vinyl liner and reinforced Mylar/neoprene outer cover.
 2. UL listed, Class 1 with flame spread of 25 or less and smoke development rating not to exceed 50.
- G. Drain Pan:
 1. Materials: Aluminum.
 2. Fabrication: 0.080 inches.
- H. Backdraft Dampers:
 1. Material:
 - a. G90 galvanized steel.
 - b. Blade edge seals: Extruded vinyl.
 2. Fabrication:
 - a. Frame thickness: 0.125 inches minimum.
 - b. Blade thickness: 0.070 inches minimum.
 - c. Linkage: 1/2 inches tie bars.
 - d. Bearings: Synthetic.
- I. Fire Dampers:
 1. Materials:
 - a. Frame, blades, enclosure: Galvanized steel.
 2. Fabrication:
 - a. Frame: 20 GA, G60.
 - b. Blades:
 - 1) Curtain type.
 - 2) 24 GA, G60.
 - c. Enclosure: 20 GA, G60.
 - d. Fusible link: 212 degrees F, UL listed.
 - e. Fire rating: 1-1/2 hour per UL 555.

- f. Mounting: Vertical or horizontal.
- g. Design with blade package out of air stream.
- J. Combination Fire and Smoke Dampers:
 - 1. Materials:
 - a. Frame, blades, enclosure: Galvanized.
 - 2. Fabrication:
 - a. Frame: 5 inches x 16 GA.
 - b. Blades:
 - 1) 6 inches wide.
 - 2) 16 GA.
 - c. Bearings: Stainless steel sleeve pressed into frame.
 - d. Jamb seals:
 - 1) Flexible metal.
 - 2) Compression type.
 - 3) Stainless steel.
 - e. Sleeve: Factory-supplied 20 GA.
 - f. Fusible link: 212 degrees F, UL listed.
 - g. Fire rating:
 - 1) Per UL 555.
 - 2) For rating see Drawings.
 - h. Leakage rate: Class III per UL 555S.
 - 3. Mounting: Vertical or horizontal.
 - 4. Operator/Actuator: Normally closed (NC).
 - 5. Factory installed.
 - 6. 120 V, 60 HZ.
 - 7. UL listed.
- K. Diffusers:
 - 1. Materials:
 - a. Body: Extruded aluminum.
 - b. Ceiling diffuser gaskets: Sponge rubber.
 - 2. Fabrication:
 - a. Type: Square or rectangular with removable core.
 - b. Key operated opposed blade damper mounted in neck except where indicated on Drawings to be omitted.
 - 1) Dampers to be housed in round to square adapters.
 - c. Linear supply diffusers:
 - 1) Internal pattern control vanes which also function as volume control dampers, adjustable through slots.
 - 2) Mounting: Hanger inside ductwork.
 - 3) Length: As indicated on Drawings.
 - 4) Number of slots, size, location, and throw: See Drawings.

- d. Finish:
 - 1) Circular diffusers: Clear satin anodized.
 - 2) Interior of perforated supply and return diffusers: Flat black paint.
- L. Volume Dampers and Flow Equalizers for Round Neck Diffusers:
 - 1. Material: Aluminum.
 - 2. Fabrication:
 - a. Design for neck velocity: 2500 feet/MIN.
 - b. Center rod operator accessible through diffuser without removing diffuser.
 - c. Furnish with screws, duct collars, transitions and air pattern deflectors as required.
- M. Air Grille and Register Assembly:
 - 1. Materials:
 - a. Assembly: Extruded aluminum.
 - b. Gaskets: Sponge rubber.
 - 2. Fabrication:
 - a. Supply registers: Two sets individually adjustable louvers.
 - b. Exhaust and return registers: 45 degrees deflection front blades.
 - c. Dampers: Key-operated opposed blade.
 - d. Screws, duct collars, and transitions as required.
 - e. Finish:
 - 1) Manufacturer's standard factory applied finish.
 - 2) Color: White.
- N. Air Filters:
 - 1. Materials:
 - a. Holding frame: Aluminum.
 - 2. Fabrication:
 - a. Factory built and assembled unit.
 - b. Efficiency rating as per ASHRAE 52.
 - c. 2 inches thickness minimum.
 - d. Efficiency: 20%.
 - e. Air velocity: 450 fpm maximum.
 - f. Clean pressure drop: 0.2 inches WG maximum.
 - g. Size, capacity, and type: As indicated on Drawings.
- O. Duct sealer:
 - 1. NFPA rating of "Non-Combustible".
 - 2. Flame spread rating: 25 or lower, in dry condition.
 - 3. Smoke developed rating: 50 or lower, in dry condition.
 - 4. Resistant to water and water vapors.
 - 5. Comply with UL 181.
 - 6. Pressure rupture rating: 16 inches WG, minimum.

- P. Louvers:
1. Stormproof.
 2. Continuous blade appearance.
 3. ASTM B221 extruded aluminum, alloy 6063T5, minimum 0.081 inches thick.
 4. Minimum free area: As scheduled.
 5. Maximum pressure drop: 0.10 inches of water at 900 fpm at zero water penetration.
 6. Bird screen:
 - a. 1/2 inches SQ mesh.
 - b. 16 GA aluminum.
 - c. Install in standard, folded frame.
 7. Anchors, fasteners, reinforcing: Aluminum or stainless steel.
 8. Finish:
 - a. Meet requirements of AAMA 2605.
 - 1) PCDF coating with minimum 70% resin content.
 - 2) Color: To be selected by Engineer.
 - b. Architectural Class I coating per AA DAF 45.
 - 1) AA-M12C22A41, clear.
 - 2) AA-M12C22A42, black.

2.3 MAINTENANCE MATERIALS

- A. Extra Materials:
1. Furnish Owner with the following extra materials:
 - a. 2 complete filter media change(s) for each filter unit.
 - b. Filter media used during construction is in addition to this requirement.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Metal Ductwork:
1. Install with longitudinal seams sealed for zero leakage.
 - a. For welded seams, submit sample for approval by Engineer.
 2. Install gaskets at each transverse joint and fasten sections together with bolts.
 - a. Tighten for zero leakage.
 3. Install supports and hangers with anchors in accordance with SMACNA HVAC Duct Construction Standards.
 4. Install turning vanes in square elbows:
 - a. Unsupported vane length not to exceed 48 inches.
 - b. Position vanes at proper angle to meet specified pressure drop.
 5. Install flexible connections at fans:
 - a. Locate as close as possible to fan.
 - b. Allow 1 inch of slack to prevent vibration transmission.
 - c. Install thrust restraints across connectors.
 6. Install access doors where indicated on Drawings and at smoke and fire damper in accordance with NFPA requirements.

7. Volume extractors:
 - a. Install at supply registers, grilles, diffusers and supply branch connections from ducts.
 - b. Provide branch duct extensions into main duct above and below extractor when branch duct is narrower than main duct.
- B. Flexible Ductwork:
 1. Install in concealed areas between: low velocity duct work and diffusers, return air grilles or exhaust outlets and ducts.
 2. Use low loss fittings for connection to duct.
 3. Connect to metal duct collars by means of non-combustible synthetic rubber sealing compound and stainless steel drawband.
 4. Install with maximum length of 3 feet and no change in direction.
- C. Drain Pans:
 1. Install at fan coil cooling coils, control valves above finished ceilings and at other sources of moisture.
 2. Install metal tubing at drain and terminate above floor drain, equipment drain and as shown on Drawings.
- D. Acoustical Liners:
 1. Install for a minimum length of 30 feet from equipment or mechanical room walls, whichever is greater.
- E. Dampers:
 1. Install where indicated on Drawings of sizes shown.
 2. Install fire and smoke dampers in ductwork passing through 1 hour or higher fire-rated construction.
 - a. Install in wall and floor openings utilizing steel sleeves, angles and other materials following practices required to provide installation in accordance with local building codes.
- F. Diffusers:
 1. Install where shown on Drawings of size and capacities scheduled on Drawings.
 2. Install painted lay-in type in lay-in ceilings.
 3. Install prime painted diffusers in areas where duct work is concealed.
 4. Install anodized diffusers in exposed duct work.
- G. Air Grille and Register Assemblies:
 1. Install where shown on Drawings of size and capacities scheduled on Drawings.
 2. Install prime painted grilles and registers in areas where duct work is concealed.
 - a. Field paint to match adjacent surface finish.
- H. Louvers:
 1. Install in accordance with manufacturer's instructions.
 - a. Provide anchoring and bracing accessories as required.
 - b. Provide aluminum flashing at sill to match louver.
 - 1) See Specification Section 07 62 00.
- I. Roof-mounted Intake Hoods: Install where shown on Drawings.

J. Air Filters:

1. Install where shown on Drawings of size and capacity scheduled on Drawings.
2. Do not operate equipment during construction without filters.

END OF SECTION

SECTION 23 80 00
HVAC - EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Heating, ventilating, and cooling equipment.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 23 05 93 - HVAC Systems - Balancing and Testing.
 - 2. Section 23 09 00 - Instrumentation and Control for HVAC Systems.
 - 3. Section 23 31 00 - HVAC - Ductwork.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Air Movement and Control Association (AMCA).
 - 2. Air Conditioning and Refrigeration Institute (ARI).
 - 3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - a. HVAC Applications Handbook, Chapter entitled "Sound and Vibration Control."
 - b. 20, Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.
 - c. 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
 - 4. Canadian Standards Association (CSA).
 - 5. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 6. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 7. National Roofing Contractors Association (NRCA).
 - 8. Underwriters Laboratories, Inc. (UL):
 - a. 507, Standard for Electric Fans.
- B. Miscellaneous:
 - 1. Gage thickness specified herein shall be manufacturer's standard gage for steel and Brown and Sharpe gage for non-ferrous metals.
 - 2. Corrosion protection of equipment to be as specified herein.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Fabrication and/or layout drawings.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Wiring diagrams.
 - d. Control diagrams.

- e. Manufacturer's catalog cuts and technical data.
 - f. Corrosion-protection information.
 - g. Fan curves.
 - h. Sound data.
 - i. Vibration isolation.
 - j. Control description.
 - k. Performance data on all equipment.
- 3. Certifications:
 - a. Provide certification of thickness of corrosion-protection coating.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Vibration isolation assemblies:
 - a. Mason.
 - b. Vibration Mounting and Controls Co.
 - c. Vibro-Acoustics.
 - 2. Cooling coils - direct expansion:
 - a. Carrier.
 - b. Daikin Applied.
 - c. AAON.
 - 3. Heating coil - electric:
 - a. Carrier.
 - b. Daikin Applied.
 - c. AAON.
 - 4. Fan coils:
 - a. Carrier.
 - b. Daikin Applied.
 - c. AAON.
 - 5. Energy recovery units - fixed plate type:
 - a. Temp-X-Changer.
 - b. Exothermic.
 - 6. Packaged roof-top AC units:
 - a. Daikin Applied.
 - b. AAON.
 - c. Carrier.

2.2 GENERAL

A. All Manufactured Units:

1. Factory wired and assembled.
2. Use fasteners made of same material as unit.
3. Fabricate motor assemblies and unit housings with vibration isolation assemblies:
 - a. Type: As per Table 47, Chapter 48, ASHRAE HVAC Applications Handbook.

2.3 MANUFACTURED UNITS

A. Equipment Coils:

1. Cooling coils - direct expansion:
 - a. ARI certified.
 - b. Material:
 - 1) Aluminum.
 - 2) Copper with aluminum fins for use in administration units only.
 - c. Fin spacing: Minimum 80 fins per foot.
 - d. Minimum standard operating limit: 250 psi.
 - e. Size and capacity as scheduled.
2. Heating and cooling coils - water - steam:
 - a. ARI certified.
 - b. Material:
 - 1) Aluminum.
 - 2) Copper with aluminum fins for use in administration units only.
 - c. Fin spacing: Minimum 80 fins per foot.
 - d. Minimum standard operating limit: 200 psi.
 - e. Equip with vent, drain and condensate connections.
 - f. Size and capacity as scheduled on Drawings.
3. Heating coil - electric:
 - a. ARI certified.
 - b. 80% nickel, 20% chromium elements.
 - c. Maximum heating density: 35 watts/SQIN.
 - d. Built-in thermal protection.
 - e. Airflow switch.
 - f. Built-in circuit fusing.
 - g. Control voltage transformer.
 - h. Terminal block.
 - i. Magnetic contactor.
 - j. Fused disconnect switch.
 - k. Step controller as required by instrumentation.
 - l. Single point electrical connection.
 - m. Size and capacity as scheduled on Drawings.

- B. Fan Coils:
1. ARI certified.
 2. Coils: See paragraph(s) in Article 2.3, Equipment Coils.
 3. Blower:
 - a. Fan wheels: Centrifugal forward-curved, double width.
 - b. Fan housing: Galvanized steel.
 - c. Statically and dynamically balanced.
 - d. Motor:
 - 1) Integral overload protection.
 4. Cabinet:
 - a. Material: Galvanized steel, 18 GA minimum.
 - b. Exposed units equipped with hinged access panel, intake and discharge grilles.
 - c. Concealed units equipped with return plenum, filter section and discharge duct collar.
 5. Drain pans:
 - a. Material: Galvanized steel.
 - b. Equip with drain connection.
 - c. Insulated.
 6. Filters: See Specification Section 23 31 00.
 7. Size and capacity as scheduled on Drawings.
- C. Energy Recovery Units - Fixed Plate Type:
1. Operating temperature range: -60 to +200 degrees F.
 2. Materials:
 - a. Heat transfer plate: 0.012 inches aluminum alloy 1100.
 - b. Casing: 16 GA stainless steel alloy 304.
 3. Heat exchanger:
 - a. Counter flow design through corrugated plates.
 - b. Maximum 7/16 inches between plates.
 - c. Maximum pressure differential: 5 WG.
 - d. Mechanically sealed end strips.
 4. Casing:
 - a. Gasketed and bolted access cover.
 - b. Integral flanged duct connections.
 5. Accessories:
 - a. Bypass plenum with 16 GA steel dampers.
 - 1) Modulating motor.
 - 2) Controlled by roomstat/ductstat.
 - b. Factory-installed removable water wash system.
 - 1) Remote stainless steel waterwash control cabinet.
 6. Performance and capacity as scheduled on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fixed pitched drive sheave after sheave has been sized based on accepted test and balance report.

3.2 FIELD QUALITY CONTROL

- A. Comply with Specification Section 23 05 93.

3.3 ADJUSTING

- A. Install new filters on units which have been running prior to acceptance of Project.

END OF SECTION

SECTION 23 81 46
UNITARY HEAT PUMP

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Unitary Heat Pump, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Units shall be AHRI Certified™, the trusted mark of performance assurance for heating, ventilation, air conditioning and commercial refrigeration equipment, using AHRI Standard 1360.
- B. The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: quality control checks.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details and field connection details.
 - 2. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics and gauges and finishes of materials.
 - 3. Include: single-line diagrams; electrical, and capacity data; piping and electrical connection drawings.
 - 4. Fan curves:
 - a. Provide fan curves reflecting the following conditions:
 - 1) Scheduled operating point clearly plotted.
 - 5. Submit product data of filter media, filter performance data, filter assembly and filter frames.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data.

1.4 SERVICEABILITY – ACCESS

- A. The cabinet shall be designed so that all components are easily accessible for service and maintenance through the unit's side and front.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Unitary heat pump:
 - 1. Base:
 - a. Climate Control.
 - b. Freidrich Air Conditioning.
 - 2. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Heat pump: Packaged water source type, horizontal or vertical as indicated.
 - 1. Units: ARI listed and certified.
 - 2. Sizes and capacities: As scheduled.
 - 3. Provide heat pump unit including cabinet, filter, flexible hoses, and controls by one manufacturer.

- B. Cabinet: 1.2 mm 18 GA steel with 13 mm 1/2 inches fiberglass insulation discharge air duct cooler, removable front panel and control access door, and filter rack.
 - 1. Finish: Baked enamel.
 - 2. Conceal controls behind control access door.
 - 3. Removable panel: To allow compressor removable without removing entire unit.
 - 4. Sub-base: Welded, reinforced to carry entire unit weight.
- C. Refrigerant circuit: Chassis-mounted compressor, coaxial refrigerant to water heat exchanger, solenoid valve, completely factory installed.
 - 1. Easily removed from cabinet for service.
 - 2. Evaporator coil drain pan: Cleanable without removing chassis.
 - 3. Finish on sheet metal parts: Factory applied corrosion resistant enamel and epoxy coating.
 - 4. Filter: Throwaway type.
- D. Compressor: Hermetically-sealed, permanent split capacitor type.
 - 1. Thermal overload.
 - 2. Vibration isolated internally and externally.
- E. Coils, evaporator: Seamless copper tubes with aluminum fins.
- F. Evaporator fans:
 - 1. Forward-curved centrifugal type, direct connected.
 - a. Motor:
 - 1) Three speed; 1075 rpm maximum.
 - 2) Electronically commuted motor. Brushless DC.
 - 2. Electronically commuted motor.
- G. Coaxial (tube in tube) refrigerant to water heat exchanger:
 - 1. Copper inner water tube.
 - 2. Steel refrigerant outer tube.
 - 3. Rated working pressure: 450 psiG.
- H. Refrigerant reversing valve: Four way solenoid activated.
 - 1. Valve shall be designed to allow heating operation should solenoid fail.
- I. Controls:
 - 1. Control system: 24-volt, including unit mounted 24 volt terminal board and transformer.
 - 2. Room thermostat: 24-volt wall mounted.
 - a. Provide wiring between unit and thermostat.
 - 3. Heating to cooling changeover: Manual.
 - a. Provide selector switch for OFF-HEAT-COOL.
 - b. Provide FAN-AUTO selector switch (in sub-base if thermostat is wall mounted).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accord with manufacturer's instructions and recommendations.

END OF SECTION

SECTION 23 83 16

RADIANT FLOORING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Radiant Flooring System, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Manufacturer authorized representative.
 - 2. Minimum 5 years in business.
 - 3. Minimum 10 projects completed.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Complete layout for each area drawn at 1/4 inches to 1 foot scale indicating spacing on drawings.
 - 2. Manifold locations and details.
 - 3. Radiant flooring control wiring diagrams.
 - 4. Fabrication drawings for sheet metal radiant floor manifold covers.
- B. Project Information:
 - 1. Certification of installer qualifications.
 - 2. Test reports.
- C. Contract Closeout Information:

1. Warranty.

1.4 WARRANTY

- A. Warrant piping and tubing to be free from defects for a period of twenty-five (25) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Radiant Flooring System:
 - 1. Base:
 - a. Rehau.
 - 2. Optional:
 - a. Wirsbo.
 - b. Heatway.
 - c. Heatlink.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Radiant Flooring System:
 - 1. Hydronic type, control system with snow/ice detectors (for snow melt systems), piping, flow balancing manifolds and cabinets.
 - 2. Performance: As scheduled.

3. See Drawings for location and layout of system and auxiliary equipment.
4. Provide electrical control wiring.
- B. Piping/Tubing:
 1. Polyethylene cross linked (PEX) pipe with oxygen barrier (Rehau RaupeX-B).
 - a. Operating temperature: 180 degrees F continuous.
 - b. Operating pressure: 100 psi.
 - c. Low temperature rating: Minus 80 degrees F.
 - d. Conform to applicable ASTM standards.
 - e. Conform to Plastic Pipe Institute standards.
 2. Distribution manifolds, fittings, and clamps:
 - a. Material: Brass or stainless steel.
 - b. Provide balanced flow in each pipe circuit without reverse return assembly. Provide balance valve for each circuit.
 - c. Manifolds complete with manual air vent, isolation valves on supply side for each circuit, balancing valves on return side for each circuit, mounting brackets, and manifold connectors.
 - d. Balance valves, ball valves, and plastic to metal pipe adapters as recommended by manufacturer.
 3. Above grade or interior piping to manifolds: Black steel per Sections 15510.
 - a. Zone distribution piping and layout including number of manifolds in each zone shall be by snow melt and radiant flooring system supplier.
 - b. Snow melt and radiant flooring zones shall be as scheduled.
- C. Distribution Manifold Enclosures:
 1. Radiant flooring system:
 - a. Provide factory fabricated manifold recessed wall cabinet with hinged door and primed finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect entire area for system for acceptability.
- B. Correct, or have corrected, all unsatisfactory conditions.

3.2 PREPARATION

- A. Remove standing water from area prior to starting work.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
- B. Before piping is covered by concrete, installation shall be inspected by Engineer and manufacturer's representative.
- C. Provide technical direction during installation of snow melt controls by manufacturer.
- D. Install piping below finished concrete surface with spacing as required.
- E. Do not install piping across expansion, construction, or working joints in concrete. Where unavoidable, provide plastic corrugated protection sleeve tube. Such locations shall be minimized.
- F. Secure piping to structural rebar with plastic, non-metallic ties.
- G. Do not walk on piping during installation.

H. Make joints bubble tight at 80 psi prior to pour.

I. Do not exceed minimum radius bends.

3.4 TESTING

A. Test system for damage, faults, and flow balance.

B. If tests indicate failure of system replace entire section of concrete and damaged piping.

END OF SECTION

SECTION 01 10 00 SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Phased construction.
 - 4. Future work.
 - 5. Purchase contracts.
 - 6. Owner-furnished products.
 - 7. Contractor-furnished, Owner-installed products.
 - 8. Specification and Drawing conventions.
 - 9. Miscellaneous provisions.

1.2 PROJECT INFORMATION

- A. Project Identification: WisDOT Project No. 1225-1073, Safety Rest Areas 51 and 52.
 - 1. Project Location:
 - a. Rest Area 51: southbound Interstate 43, mile 168, Maribel, Wisconsin
 - b. Rest Area 52: northbound Interstate 43, mile 168, Denmark, Wisconsin
- B. Owner:

Wisconsin Department of Transportation
Bureau of Highway Maintenance
4822 Madison Yards Way
Madison, WI 53705
- C. Engineer:
 - A. Mead & Hunt
2440 Deming Way
Middleton, WI 53562
Contact: Scott Hasburgh
tel. 608-443-0436
email: scott.hasburgh@meadhunt.com

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Construction of two Safety Rest Areas along with two associated Equipment Garages replacing existing facilities along Interstate 43 in Wisconsin. Rest Area Buildings are each 6,430 GSF facilities of Type II-B construction with insulated precast concrete exterior walls, and the Equipment Garages are each about 650 sf of Type V wood light framing. The Safety Rest Area buildings are conditioned by a new ground-source geothermal system. Work includes HVAC, plumbing, and electrical work in conjunction with building construction, including utility tie-ins at the perimeter of the building. Demolition of existing facilities and all site and civil work shall be performed under separate contract.

- B. Type of Contract:
1. Project will be constructed under two coordinated, concurrent multiple contracts.
 2. All site demolition, roadwork, site utility work, earthwork, grading, landscaping, stormwater management, and other civil work shall be performed under a separate contract (WisDOT project number 1225-10-73.) Owner shall coordinate schedules of the Contracts. Contractors shall fully cooperate with each other to maintain project schedule and budget, including coordination of site access and maintenance during construction.

1.4 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products [and making building services connections].
- B. Owner-Furnished Products:
1. Refrigerator for Break Rooms.
 2. Clothes washers for staff use.
 3. Electric clothes dryers for staff use.

1.5 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and Specifications.

1.6 MISCELLANEOUS PROVISIONS

- PART 2 - PRODUCTS (NOT USED)
- PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 26 00 10 ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Electrical General Requirements, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Concrete Anchoring:
 - 1. Cracked concrete is the baseline condition for the design of cast-in-place and post-installed anchors in alignment with both ACI 318 and International Building Code.
- D. Drawing Use and Interpretation:
 - 1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except:
 - a. Specific installation details.
 - b. When specific dimensions are indicated for electrical equipment it is intended that these be limiting dimensions. When proposed equipment exceeds these limiting dimensions, notify Engineer. Features and functions of specified equipment shall not be superseded by these limiting dimensions.
 - 2. For exact locations of building elements, refer to dimensioned architectural/structural drawings.
 - 3. Field measurements take precedence over dimensioned drawings.
 - 4. Intention is to indicate size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement.
 - 5. Field verify locations and arrangement of existing systems and equipment.
- E. Installation of systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.
 - 1. No exceptions shall be made for submitted equipment that does not meet the physical dimension requirements of the originally specified equipment.

1.2 SYSTEM DESCRIPTION

- A. Provide materials to provide systems in compliance with performance requirements specified.
- B. Provide modifications required by reviewed shop drawings and field coordinated drawings.
- C. Electrical equipment associated with mechanical and plumbing equipment connections including, but not limited to, overcurrent protection, feeder sizes, and starter and disconnect sizes, shall be coordinated with approved mechanical and plumbing shop drawings. Any revisions to electrical equipment as a result of approved mechanical and plumbing shop drawings shall be the responsibility of the Contractor. HDR shall not be responsible for issuing changes to drawings or specifications associated with these revisions. Contractor shall send a confirming RFI associated with any revisions so that HDR can acknowledge the change and confirm it is acceptable. The Contractor shall be responsible for documenting all revisions on the record drawings. Refer to Section 01 61 00 for additional information.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with but not limited to:
 - 1. Federal, state and local codes, regulations and ordinances.
 - 2. All authorities having jurisdiction.
 - 3. Underwriters Laboratories, Inc. (UL) requirements.

4. Occupational Safety and Health Act (OSHA).
5. Factory Mutual System (FM) requirements.
6. International Building Code (IBC).
7. NFPA-70: National Electrical Code (NEC).
8. NFPA-70E: Standard for Electrical Safety in the Workplace.
9. NFPA-72: National Fire Alarm and Signaling Code.
10. NFPA-101: Life Safety Code.
11. ACI 318: Building Code Requirements for Reinforced Concrete.

1.4 SUBMITTALS

- A. Product Data:
 1. Concrete Anchors:
 - a. Document Manufacturer Approval or Listing for cracked concrete application.
 2. Drop-in anchors are not cracked concrete rated and will not be allowed.
- B. Contract Closeout Information:
 1. Final performance test reports.

1.5 PROTECTION

- A. Provide covering and shielding for equipment to protect from damage.
- B. Protect nameplates on motors and similar equipment, to prevent defacing.
- C. Repair, restore or replace damaged, corroded and rejected items.
- D. Comply with manufacturer's storage, shipping and receiving requirements required to maintain full warranty.

1.6 JOB CONDITIONS

- A. Examine Contract Documents to determine how other work will affect execution of electrical work. All work required for this coordination shall be included in bid.
- B. Make arrangements for and pay for permits, licenses, and inspections.
- C. Cause as little interference or interruption of existing utilities and services as possible.
 1. Schedule work which will cause interference or interruption in advance with Owner, Engineer, authorities having jurisdiction and affected trades.
- D. Determine and verify locations of existing utilities on or near site.
 1. Notify Engineer of any discrepancies prior to commencing work.
- E. Temporary construction power and communications (See Division 01)
- F. Record drawings:
 1. Keep a complete set of electrical drawings in job site office for indicating actual installation of electrical systems and equipment.
 2. Use this set of drawings for no other purpose.
 3. Where any material, equipment, or system components are installed differently from that indicated, indicate differences clearly and neatly using ink or indelible pencil.
 4. Drawings may be electronic if using an electronic redline or markup program and utilizing contract drawing files as a base.
 5. At project completion, submit record set of drawings. Refer to Section 01 78 39 for specific requirements.

1.7 ENVIRONMENTAL CONDITIONS

- A. General:
 - 1. Provide NEMA 1 enclosures for electrical equipment unless otherwise indicated.
- B. Conduit: See Section 26 05 33.
- C. Cable: See Section 26 05 19.
- D. Boxes and Fittings: See Section 26 05 34.
- E. Damp and Wet Locations:
 - 1. Exterior applications:
 - a. Provide NEMA 3R enclosures for electrical equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Concrete Anchors:
 - 1. Hilti.
 - 2. Simpson Strong-Tie.
 - 3. Powers Fasteners.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Concrete Anchors:
 - 1. Cast-in-place or post installed anchor approved for cracked concrete applications.
 - a. Note: Drop-In Anchors shall not be used.
- B. Material and Equipment:
 - 1. Current and standard design of manufacturers regularly engaged in their production.
- C. Where UL approval or listing is required in electrical specifications, suitable approval or listing from other nationally recognized testing laboratory (NRTL) is acceptable.
- D. Use UL labeled electrical materials and fabricated assemblies.
- E. Structural Steel for Supports:
 - 1. ASTM A36.
 - 2. Galvanize members installed in areas of high humidity or condensation.
 - 3. Furnish other members with shop coat of rust inhibiting primer.
 - 4. Shop fabricate for field assembly using bolts.
 - 5. Minimize field welding.
 - 6. Retouch primer and galvanizing after field welding.
 - 7. Unless support is otherwise indicated where weight of equipment exceeds 400 pounds, submit engineering design and calculations signed and sealed by a registered Engineer licensed to practice Structural Engineering in the state in which the project is located.
- F. Rain Hoods and Counter Flashings, not exposed to view:
 - 1. Stainless steel: Minimum 1 mm 20 GA.
 - 2. Sheet copper: Minimum 0.7 kg 24 oz.

- G. Access Doors, Panels and Frames:
 - 1. Provide where indicated on Drawings.
 - 2. Where not indicated on Drawings, provide access panels and/or doors at walls, and inaccessible ceilings as required to permit access to equipment, devices and piping requiring service, adjustment, or inspection.
 - 3. Size:
 - a. As required to allow access, inspection, service, and removal of items served.
 - b. Minimum 460 x 460 mm 18 x 18 inches.
- H. Concrete Anchors:
 - 1. Cast-in-place or post installed anchor approved for cracked concrete applications.
 - a. Note; Drop-In Anchors SHALL NOT be used.
- I. Firestopping:
 - 1. Maintain fire and smoke ratings where electrical items penetrate fire and fire/smoke rated building elements.
 - 2. Firestop penetrations of fire rated walls, floors and assemblies.
 - a. Penetrations shall comply with UL listing and Fire Resistance Directory requirements for construction or assembly.
 - b. Use materials and methods as specified in Section 07 84 00.

PART 3 - EXECUTION

3.1 GENERAL

- A. When changes in location of any work are required, obtain approval of Engineer before making change.
- B. Do not change indicated sizes without written approval of Engineer.
- C. Provide offsets and crossovers in conduits, raceways, cable trays and ducts.

3.2 CUTTING AND PATCHING

- A. Provide cutting, fitting, repairing, patching and finishing of installed work.
 - 1. Include installed work of other sections where it is to disturb such work to permit installation of electrical work.
 - 2. Repair or replace existing or new work disturbed.
- B. Avoid cutting, where possible, by setting sleeves or frames, and by requesting openings in advance.
- C. Before cutting, obtain approval of Structural Engineer.
 - 1. Use only approved methods.
 - 2. Cut holes approved by Engineer neatly to admit work.
 - 3. Do not weaken walls or floors; locate holes in concrete to avoid structural members.
- D. Locate openings and sleeves to permit neat installation of conduits and equipment.
- E. Do not remove or damage fireproofing materials.
 - 1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
 - 2. Repair or replace fireproofing removed or damaged, at no extra cost.

3.3 INSTALLATION

- A. Install equipment in accordance with manufacturer's recommendations.
- B. Anchoring Devices and Supports.
 - 1. Use anchoring devices and structural supports suitable for equipment and install in accordance with manufacturer's recommendations.
 - 2. Check loadings and dimensions of equipment with shop drawings.
 - 3. Do not cut, or weld to, building structural members.
 - 4. Provide equipment supports even though not detailed on architectural and structural drawings.
- C. Verify equipment will fit support layouts indicated.
- D. Provide boxes, sleeves and devices for installation.
- E. Make penetrations through roofs prior to installation of roofing.
- F. For penetrations required after installation of roofing:
 - 1. In built-up roofing (BUR), provide curbs, cants and base flashings.
 - 2. In elastic sheet roofing (ESR), arrange and pay for flashing work by authorized roofer.
- G. Install rain hoods and metal counter flashings as indicated and make penetrations of electrical work through walls and roofs water and weathertight.
 - 1. Furnish clamps, waterproofing material and labor.
 - 2. Where metal flashings are applied over concrete, paint concrete with 3 mm 1/8 inches of mastic cement first.
 - 3. Set flashing in mastic cement, watertight.
- H. Have repair and replacement of roof construction, damaged by this work, done in manner which will not nullify roof warranty.
- I. Install equipment to permit easy access for normal maintenance.
 - 1. Maintain easy access to switches, motors, drives, pull boxes, receptacles, etc.
 - 2. Relocate items which interfere with access.
- J. Provide concrete foundations (isolation pads) or housekeeping pads for floor mounted electrical equipment as follows unless otherwise indicated:
 - 1. Install nominal 100 mm 3.5 inches high concrete housekeeping pads. Outside dimension of pad shall be at least 100 mm 3.5 inches larger in all directions than base of equipment or 228 mm 9 inches from center of anchor, whichever is greater.
 - 2. Use 20.7 MPa 3,000 psi concrete.
 - 3. Reinforce with No.13 No.4 bars, 300 mm 12 inches on-center each way, with short No.13 No.4 dowels into floor at 600 mm 24 inches on-center each way.
 - 4. Top surface shall be level. The use of shims underneath equipment is strictly prohibited.
 - 5. Chamfer top edges 20 mm 3/4 inches.
 - 6. Make faces smooth.
 - 7. Set anchor bolts for equipment.

3.4 PAINTING

- A. See Section 09 91 13, and Section 09 91 23.

3.5 FIELD QUALITY CONTROL

- A. Perform indicated tests to demonstrate workmanship, operation, and performance.
 - 1. Conduct tests in presence of Engineer and, if required inspectors of agencies having jurisdiction.
 - 2. Arrange date of tests in advance with Engineer, manufacturer and installer.
 - 3. Give minimum of 24 hours notice to inspectors.
 - 4. Furnish or arrange for use of electrical energy, steam, water, diesel fuel, or gas required for tests.
 - 5. Furnish lubricating materials required for test.
- B. Repair or replace equipment and systems found inoperative or defective and retest.
 - 1. If equipment or system fails retest, replace it with products conforming with Contract Documents.
 - 2. Continue remedial measures and retests until satisfactory results are obtained.
- C. Test equipment and systems as indicated for each item, unless otherwise recommended by manufacturer.

3.6 FINAL PERFORMANCE TEST

- A. Perform panel load balance, short circuit, and freedom from ground, and ground test (including ground fault protection where provided).
 - 1. As part of putting systems in operation, provide tabulated results of load balance and voltage at each switchboard, panelboard and motor control center. Use true RMS measuring metering devices.
 - 2. Provide neutral to ground resistance tests to prove neutral is grounded in only one location.
 - 3. Provide ground test at service entrance and provide report on resistance to earth of the grounding electrode system.
 - 4. See individual specifications for additional testing and commissioning.

3.7 ADJUST AND CLEAN

- A. Inspect equipment and put in good working order.
- B. Clean exposed and concealed items.
- C. Where new work occurs in existing areas where no other work has been done, clean area and restore to original condition.

3.8 PUTTING SYSTEMS IN OPERATION - START-UP

- A. Put systems into satisfactory operation prior to final acceptance, at time agreed to by Construction Manager, Owner and Engineer.
- B. Operate systems in good working order for period of 5 working days.

3.9 DEVICE MOUNTING

- A. See symbol legend for device mounting heights unless otherwise noted.
 - 1. Mounting heights indicated on legend shall supersede Architectural and Interiors elevations.
- B. Dimensions are to center of device unless otherwise indicated.
- C. All light switches and/or lighting control wall stations shall be mounted within 12 inches measured horizontally from the door frame or wall opening used to enter the space.
- D. Coordinate device locations with equipment/furnishings abutting walls such as, but not limited to, architectural millwork, casework, lockers, mirrors, and equipment. Refer to architectural and casework/equipment elevations to facilitate coordination of device placement. Devices shall be relocated at Contractor's expense if conflict exists after installation.

- E. Coordinate device mounting height with wainscoting where provided. Where top of wainscot and device mounting height overlaps, shift device down to provide 50 mm 2 inches gap between top of device and top of wainscot.
- F. Locate exit signs and fire alarm flashing lights so that all are visible from corridor locations. Relocate and/or add signs as required to resolve conflicts.

END OF SECTION

SECTION 26 05 19
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Low Voltage Electrical Power Conductors and Cables, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Low voltage to include all systems with line voltage of 0 volts to 600 volts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Splices and taps for smaller than No.6 AWG wire:
 - 1. Base:
 - a. 3M.
 - b. Ideal Electric.
 - c. Heyco Molded Products.
 - d. Elastimold.
 - e. Buchanan Construction Products.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Wire: Single conductor, soft drawn, copper wire with 600 volt insulation, UL listed.
 - 1. For feeders and branch circuits as defined by NEC: Type THWN/THHN or XHHW-2.
 - 2. For exterior feeder and branch circuits as defined by NEC: Type XHHW-2.
 - 3. For branch circuits served by GFCI circuit breakers: Type XHHW-2.
 - 4. For line voltage of 100 volts and larger: Use no wire smaller than No.12 AWG, except as follows:
 - a. Smaller size wire may be used only where specifically indicated.
 - 5. Size conductors to match over current/overload protective device unless larger conductors are indicated.
 - 6. No.10 and smaller wire: Solid conductor.
 - 7. No. 10 AWG conductor to be used for 20 ampere, 120V circuits exceeding 30 M 100 feet.
 - 8. No. 10 AWG conductor to be used for 20 ampere, 277V circuits exceeding 60 M 200 feet.
 - 9. Power and communication connections to motors and to generators shall be with stranded conductors.
 - 10. Grounding conductors shall be insulated, unless installed exposed in plenum spaces or otherwise noted.
- B. For line voltage of 0 to 30 volts for lighting control/signal circuits: Use no wire smaller than No. 18 AWG.
 - 1. Wire gauge shall be increased up to No. 14 AWG where voltage drop is a concern.
 - 2. Wire shall be a shielded twisted pair with stranded copper conductors.
 - 3. Minimum insulation value shall be 300V for Class 2 circuits and 600V for Class 1 circuits.

- C. Splices and taps for smaller than No.6 AWG wire:
 - 1. 3M, "Scotchlok" or "Hyflex".
 - 2. Ideal "Wingnut" or "Wirenut".
 - 3. Heyco.
 - 4. Elastimold insulated conical spring-type connectors.
- D. Splices and taps for No.6 AWG wire and larger: Use compression connectors with pre-stretched insulation to equal insulation of wire being spliced.
- E. Splices and taps - General: Do not make splices and taps with crimp or indenter-type connectors.
- F. Pulling lubricant: Do not use cable pulling lubrication compound containing petroleum or other products which may deteriorate insulation.
- G. Color-coding: Color code conductors in accordance with NEC as follows:
 - 1. Color code all wiring.
 - 2. Use the color-coding schedule within Section 26 05 53.
 - 3. Color-coding of conductor ends only will be acceptable for feeder phase conductors.
 - 4. Color-coding of conductor ends only will be acceptable for neutral and grounding conductors number 4 AWG and larger.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wiring in conduit unless otherwise indicated.
- B. Install no more than 3 phase conductors in one conduit.
- C. Provide a separate neutral conductor for each phase conductor in receptacle branch circuits, appliance branch circuits, and lighting branch circuits.
- D. Run panelboard and motor feeders in individual conduits.
- E. Conductors not noted on plan shall be sized to overcurrent protective device feeding circuit. See feeder schedule on plans for requirements.
- F. Lighting control cabling:
 - 1. 0-10V control wires shall be allowed to be routed in the same conduit as line voltage wires (in a Class 1 configuration) when routed from fixture to fixture (and to area lighting controller(s) as applicable) within a room, provided that the 0-10V wire insulation meets NEC requirements.
 - 2. When 0-10V wires are routed between rooms or if the cable length exceeds 50 feet, wires shall be routed in a Class 2 configuration as follows:
 - a. When above an accessible ceiling and concealed from view, 0-10V wires may be routed on the outside of the line voltage conduit and attached to conduit via Velcro cable straps.
 - b. When routed in an exposed ceiling or above an inaccessible ceiling, 0-10V wires shall be routed in their own dedicated conduit.
- G. Underground conductors shall not be spliced.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Grounding and Bonding for Electrical Systems, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
 - 2. Institute of Electrical and Electronics Engineers (IEEE):
 - a. 837, Qualifying Permanent Connections Used in Substation Grounding.
 - 3. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 4. Underwriters Laboratories, Inc. (UL):
 - a. 467, Electrical Grounding and Bonding Equipment.
- B. Assure ground continuity is maintained throughout the entire Project.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Fabrication and/or layout drawings:
 - a. Plan drawings showing type, size and locations of all grounding system components.
- B. Product Data:
 - 1. Manufacturer's specifications and evidence of required approvals for all materials and components.
- C. Miscellaneous:
 - 1. Ground rod and/or grounding system resistance and continuity test reports signed by the Project's supervising electrical foreman.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Ground rods and bars and grounding clamps, compression connectors and lugs:
 - a. Burndy.
 - b. Harger Lightning Protection.
 - c. Heary Brothers.
 - d. Joslyn.
 - e. Robbins Lightning Protection.
 - f. Blackburn.
 - g. Thompson.

2. Exothermic weld connections:
 - a. Erico Products Inc., Cadweld.
 - b. Harger Lightning Protection.
 - c. Thermoweld.
 3. Inspection test well:
 - a. Erico.
 - b. Quazite Composolite.
 - c. Armorcast Products Company.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 COMPONENTS

- A. Wire and Cable:
1. Bare conductors: Soft drawn tinned stranded copper.
 2. Insulated conductors: Same as bare conductors with XHHW insulation, color coded green.
- B. Equipment Room Ground Bus Bars:
1. Solid copper:
 - a. 1/4 inches thick.
 - b. 4 inches wide.
 - c. Length as indicated on drawings, or 24 inches minimum.
 2. Predrilled grounding lug mounting holes in NEMA standard 2-hole patterns.
 3. Stainless steel or galvanized steel mounting brackets.
 4. Insulated standoffs.
- C. Ground Rods:
1. 3/4 inches x 10 feet.
 2. Copperclad:
 - a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
 - b. Corrosion resistant bond between the copper and steel.
 - c. Hard drawn for a scar-resistant surface.
- D. Mechanical connectors:
1. UL 467.
 2. Permitted only where specifically indicated or specified.
- E. Grounding Connectors and Lugs:
1. Compression type:
 - a. Standards: UL 467 and IEEE 837.
 - b. High copper alloy content.
 - c. Non-reversible.
 - d. Terminals for connection to bus bars shall have two bolt holes.
- F. Piping, tubing and Conduit Clamps:
1. High-copper alloy cast U-bolt fitting.
 2. 90 degree lay-in cable clamp.
 3. Burndy Type GAR.

- G. Exothermic Weld Connections:
 - 1. Copper oxide reduction by aluminum process.
 - 2. Molds properly sized for each application.
- H. Conduit: See Section 26 05 33.
- I. Grounding type insulated bushings: See Section 26 05 33.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Install products in accordance with manufacturer's instructions.
 - 2. Size grounding conductors and bonding jumpers in accordance with NFPA 70 Article 250, except where larger sizes are indicated on the Drawings.
 - 3. Remove paint, rust, or other non-conducting material from contact surfaces before making ground connections.
 - 4. Where ground conductors pass through floor slabs or building walls provide non-metallic sleeves and install per Section 26 00 10.
 - 5. Do not splice grounding conductors except at ground rods.
 - 6. Install ground rods and grounding conductors in undisturbed, firm soil.
 - a. Provide excavation required for installation of ground rods and ground conductors.
 - b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
 - c. Unless otherwise specified, make all splices, taps and connections with compression type connectors or exothermic welds.
 - d. Provide sufficient slack in grounding conductor to prevent conductor breakage during backfill or due to ground movement.
 - e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
 - 7. Do not use exothermic welding if it will damage the structure to which the grounding conductor is being welded.
- B. Grounding Electrode System:
 - 1. Provide a grounding electrode system in accordance with NFPA 70 Article 250 and as indicated on the Drawings.
 - 2. Grounding conductor terminations:
 - a. Ground bars mounted on wall, use compression type terminal and bolt it to the ground bar with two bolts.
 - b. Ground bus in electrical equipment, use compression type terminal and bolt it to the ground bar.
 - c. Piping systems, use mechanical type connections.
 - d. Building steel, below grade and encased in concrete, use compression type connector or exothermic weld.
 - e. Install grounding jumper of same size around water meter and interconnection valves using ground clamps.
 - f. At above grade terminations, label the conductors per Section 26 05 53.

- C. Main Switchboard Ground:
 - 1. Install main grounding conductor in steel conduit and connect to grounding electrode system using an exothermic weld or UL listed compression fitting.
 - a. Unless otherwise indicated, install main ground unspliced in exposed conduit.
 - b. Make connections easily accessible for inspection, not underground or concealed in floors or walls.
 - 2. Bond grounding conductor to conduit at entrance and exit, of same type and quality as other conductors in building.
 - 3. Locate neutral ground disconnecting link or links in main switchboard so that low-voltage neutral bar with interior secondary neutrals can be isolated from common equipment grounding bus.
- D. Raceway Bonding/Grounding:
 - 1. Metallic conduit shall be installed so that it is electrically continuous.
 - 2. All conduits to contain a grounding conductor with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
 - 3. NFPA 70 required grounding bushings shall be of the insulating type.
 - 4. Provide double locknuts at all pullboxes and equipment entries..
 - 5. Bond conduit, at entrance and exit of equipment, to the equipment ground bus or lug.
 - 6. Make metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.
- E. Exposed Metallic Conduit Grounding:
 - 1. Low voltage circuits: Threaded grounding bushing.
- F. Ground all neutral conductors, conduit systems, cabinets, equipment, motor frames, etc., in accordance with NEC and applicable codes.

3.2 DISTRIBUTION

- A. Make metallic raceway fittings and grounding clamps tight to ensure that equipment grounding system will operate continuously at ground potential to provide low impedance current path to insure proper operation of overcurrent devices during possible ground fault currents.
- B. Do not solder grounding circuit connections.
- C. Provide each conduit with grounding type insulated bushing where metallic conduits terminate without mechanical connection to metallic housing (switchboards, motor control centers, etc.).
 - 1. Connect each bushing to grounding bus in equipment with bare copper conductor.
- D. In nonmetallic conduits or ducts, maintain continuity of equipment grounding system by bar or conductor installed and connected by approved method to conductive noncurrent-carrying equipment at both ends.
- E. Ground all conduit, panelboards, receptacles, accessible fixtures, switchgear, transformers, motors, and motor equipment.
- F. Make ground continuity positive throughout entire project.

3.3 FIELD QUALITY CONTROL

- A. Provide a continuity test on the components of the grounding electrode system.
- B. Complete grounding system: Resistance of 5 ohms or less.

- C. Test resistance of installed ground system after backfilling and before connection to any other grounded system including underground piping, utility services or other building ground systems.
 - 1. Test ground grid resistance by fall-of-potential method.
 - 2. Perform test at the main ground bar.

END OF SECTION

SECTION 26 05 33 CONDUITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Conduits, as indicated, in accordance with provisions of Contract Documents.
- B. Conduit runs are diagrammatic. Verify and coordinate locations in field.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Electrical Components, Devices, and Accessories shall be listed and labeled in accordance with NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Certifications:
 - 1. Conduit: Stamp each length with name or trade mark of manufacturer and affix UL label.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data for each product specified.
 - 2. IBC Certificates of Compliance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. As noted for each type listed below.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Rigid Metal Conduit (RMC):
 - 1. Manufacturers:
 - a. Base:
 - 1) Allied Tube and Conduit Corp.
 - b. Optional:
 - 1) Republic Conduit
 - 2) Wheatland Tube
 - 2. Materials
 - a. Hot dipped galvanized, or sherardized, including threads.
 - b. Standard pipe thread with coupling; deliver with thread protector and end caps.
 - c. Standards:
 - 1) NEMA/ANSI C80.1 – Electrical Rigid Steel Conduit – Zinc Coated (ERSC).
 - 2) UL 6 - Electrical Rigid Metal Conduit – Steel.
- B. Intermediate Metal Conduit (IMC):
 - 1. Manufacturers:
 - a. Base:
 - 1) Allied Tube and Conduit Corp.

- b. Optional:
 - 1) Republic Conduit.
 - 2) Wheatland Tube.
 - 2. Materials
 - a. Intermediate metal conduit (IMC): Hot dipped galvanized steel of intermediate wall thickness including threads.
 - b. Standard pipe thread with coupling; deliver with thread protector and end caps.
 - c. Standards:
 - 1) NEMA/ANSI C80.6 –Electrical Intermediate Metal Conduit (EIMC).
 - 2) UL 1242 - Standard for Electrical Intermediate Metal Conduit – Steel.
- C. Electrical Metal Tubing (EMT):
 - 1. Manufacturers:
 - a. Base:
 - 1) Allied Tube and Conduit Corp.
 - b. Optional:
 - 1) Republic Conduit.
 - 2) Wheatland Tube.
 - 2. Materials
 - a. Electrical Metal Tubing (EMT): Galvanized steel of thin wall thickness.
 - b. Standards:
 - 1) NEMA/ANSI C80.3 –Steel Electrical Metal Tubing (EMT).
 - 2) UL 797 - Electrical Metallic Tubing – Steel.
- D. Flexible Metal Conduit (FMC):
 - 1. Manufacturers:
 - a. Base:
 - 1) Anamet Electrical.
 - b. Optional:
 - 1) Electri-Flex.
 - 2) AFC.
 - 3) International Metal Hose.
 - 2. Materials
 - a. Flexible Metal Conduit (FMC): Steel, hot dipped galvanized.
 - b. Standards:
 - 1) UL 1 – Standard for Flexible Metal Conduit.
- E. Liquid-Tight Flexible Metal Conduit (LFMC):
 - 1. Manufacturers based on specification compliance:
 - a. Base:
 - 1) Anamet Electrical.

- b. Optional:
 - 1) Electri-Flex.
 - 2) AFC.
 - 3) International Metal Hose.
 - 2. Materials
 - a. Liquid-tight Flexible Metal Conduit (LFMC): Steel, hot dipped galvanized with PVC jacket.
 - b. Standards:
 - 1) UL 1660 – Standard for Liquid-Tight Flexible Nonmetallic Conduit.
- F. Rigid Polyvinyl Chloride Nonmetallic Conduit (PVC):
 - 1. Manufacturers:
 - a. Base:
 - 1) Carlon.
 - b. Optional:
 - 1) Allied.
 - 2) Cantex
 - 2. Materials
 - a. Rigid Polyvinyl chloride (PVC): Schedule 40 or 80, meeting minimum requirements of NEC.
 - b. Standards:
 - 1) UL 651 - Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
 - 2) NEMA TC-2 and TC-3 – Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
- G. Conduit Fittings:
 - 1. Manufacturers:
 - a. Base:
 - 1) Appleton Electric.
 - b. Optional:
 - 1) Cooper Crouse-Hinds.
 - 2) Killark.
 - 3) Thomas & Betts.
 - 4) O-Z/Gedney.
 - 2. Materials
 - a. Standards:
 - 1) ANSI/NEMA FB-1 – Fittings, Cast metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
 - 2) UL 514B - Conduit, Tubing, and Cable Fittings.

- b. RMC Fittings
 - 1) Threaded cast ferrous alloy with corrosion resistant finish. Cast body with gasketed corrosion resistant screw cover and threaded hubs.
 - 2) Not Approved: Zinc alloy and similar soft metal die castings.
- c. IMC Fittings:
 - 1) Threaded cast ferrous alloy with corrosion resistant finish. Cast body with gasketed screw cover and threaded hubs.
 - 2) Not Approved: Zinc alloy and similar soft metal die castings.
- d. EMT Fittings:
 - 1) Steel compression-ring type.
 - 2) Set screw type fitting with pressure-cast bodies for 19mm 3/4 inches conduit and smaller and steel body and cup type screws for 25mm 1 inch conduit and larger.
- e. FMC Fittings:
 - 1) Dry locations: Squeeze type, malleable iron, zinc-nickel plated, straight and angle connectors for all sizes except twist-in connectors for 19mm 3/4 inches and below flexible metal conduit.
 - 2) Damp or wet locations: liquid-tight connectors.
- f. PVC Conduit Fittings:
 - 1) PVC plastic solvent weld type, with threaded adapters as required.
- g. Bushings:
 - 1) Threaded, galvanized, malleable iron.
 - 2) Bushings for conductors No.4 and larger: Separate insulated bushings.
 - 3) Do not use insulated throat connectors.
 - 4) Grounding bushings: With screw termination for green grounding wire.

H. Expansion Fittings:

- 1. Manufacturers:
 - a. Base:
 - 1) Cooper Crouse – Hinds.
 - b. Optional:
 - 1) O-Z/Gedney.
 - 2) Appleton Electric.
- 2. Materials
 - a. Description:
 - 1) Watertight deflection type cast slip joint fitting for conduit, with flexible bonding conductor for continuity of ground through metallic conduit.
 - b. Design Standards:
 - 1) O-Z/Gedney: Type DX.
 - 2) Cooper Crouse – Hinds: Type XJG.

- I. Inserts and Attachments:
 - 1. Select inserts and attachments to suit loading conditions.
 - a. See Section 01 31 11 for load limitations where more than one trade may be applying loads to device.
 - 2. Inserts For Placement in Concrete Formwork:
 - a. Malleable iron, wedge with nut, galvanized finish.
 - b. Size inserts to suit threaded hanger rods.
 - 3. Attachments to Existing Construction:
 - a. Malleable iron, wedge, galvanized finish.
 - 4. Use plastic toggles where securing directly to drywall.
 - 5. Attachments to existing construction are not permitted. See support details.
- J. Supports, Sleeves and Seals:
 - 1. Conduit supports:
 - a. Standards:
 - 1) UL 2239 - Hardware for the Support of Conduit, Tubing, and Cable.
 - 2) Listed and in compliance with other applicable standards.
 - b. Designed specifically for electrical installations.
 - c. Hangers:
 - 1) Steel zinc-nickel plated threaded rods with straps or clamp conduit holder.
 - d. Straps:
 - 1) One-hole and two-hole malleable iron, hot-dipped galvanized or steel, zinc-nickel or zinc plated.
 - e. Beam Clamps:
 - 1) Malleable iron, hot-dipped galvanized or zinc-nickel plated.
 - f. Channels and Fittings:
 - 1) Channels: Hot-dipped galvanized.
 - 2) Fittings: Galvanized.
 - g. Trapeze assemblies:
 - 1) Constructed from channels and supported by at least two threaded rods attached to building structure.
 - 2. Sleeves:
 - a. Black iron pipe, RMC or IMC sized to accommodate work passing through.
 - 3. Sealer for sleeves and openings around conduit:
 - a. UL listed for assembly.
 - b. See Section 07 84 00.
 - 4. Sealer for use inside conduits:
 - a. Manufacturers:
 - 1) Base:
 - a) Arnco.

- 2) Optional:
 - a) Polywater .
- b. Materials
 - 1) Description:
 - a) Watertight / Air tight foam sealant for electrical conduit.
 - b) Listed for application with electrical wiring and conduit.
 - 2) Design Standards:
 - a) Arnco: Hydra-Seal.
 - b) Polywater: FST Duct Sealant.

PART 3 - EXECUTION

3.1 SCHEDULE OF CONDUIT UTILIZATION

- A. Use no conduit smaller than 19 mm 3/4 inches.
- B. Size conduit in accordance with NEC unless indicated larger.
- C. Rigid Steel Conduit (RMC) or Intermediate Metal Conduit (IMC) shall be used in following locations unless otherwise noted:
 - 1. Outdoors exposed.
 - 2. In exterior masonry walls.
 - 3. In wet locations.
 - 4. For exposed interior runs below 3050 mm 10 feet above finished floor unless otherwise indicated.
- D. Electrical Metallic Tubing (EMT) shall be used for other 600 volt and below dry applications as follows:
 - 1. Concealed in walls or above finished ceilings.
 - 2. Exposed EMT may be used below 3050mm 10 feet level in following locations:
 - a. From floor to ceiling in electrical equipment rooms.
 - b. Directly above motor control centers in locations other than electrical equipment rooms.
 - c. Directly above junction boxes or control panels associated with elevators or mechanical equipment with conduit termination point of 1830 mm 6 feet or more above floor.
- E. Flexible metal conduit (FMC) shall be used for applications limited to:
 - 1. For connection to luminaires above suspended ceilings.
 - 2. In architectural millwork and casework.
- F. Liquid-tight flexible metal conduit (LFMC) shall be used for applications including, but not limited to:
 - 1. All damp and wet locations.
 - 2. For connection to equipment subject to vibration.
 - 3. Mechanical equipment connections, not exceeding 915 mm 36 inches length.
- G. Rigid polyvinyl chloride nonmetallic conduit (PVC) may be used subject to following:
 - 1. Do not use exposed PVC conduit unless otherwise noted.
 - 2. Provide a 600 volt, insulated, green grounding conductor in each PVC conduit.
 - a. Power circuits: Proper ampacity per NEC.
 - b. Communications circuits: No.12 AWG minimum.

3. 45 degrees and greater bends in PVC conduit runs larger than 1-1/2 inches shall be made with rigid steel conduit.
4. Schedule 80 PVC conduit may be used as follows:
 - a. Routing of grounding electrode system conductors and telecommunications ground backbone runs below and above grade and stubs through concrete slabs on grade.
5. Direct-burial Schedule 40 PVC or concrete-encased Type EB may be used as follows:
 - a. Exterior Lighting: See Section 26 56 00.
 - b. Voice and data systems where underground and in or under concrete slabs on grade.
 - c. For 600 volts and below:
 - 1) Underground and concrete encased conduits 600 volts and below for feeders and branch circuits.

3.2 INSTALLATION - GENERAL

- A. Provide separate conduit systems for all lighting, power, and communications systems, unless otherwise indicated.
 1. Provide dedicated junction boxes and pull boxes to separate wiring systems.
- B. Where practical, group home runs to same panelboard.
 1. Do not enclose more than three single phase circuits or one three phase circuit in one raceway unless noted otherwise.
- C. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.
- D. Protect inside of conduit from dirt and debris during construction by capping openings with tapered plugs or plastic caps.
 1. If moisture or debris gets into conduit remove before wire is drawn into place.
- E. Make conduit field cuts square and ream to full size.
 1. Shoulder conduit in couplings.
- F. Do not install conduit under pads for fans, pumps, boilers, or other machinery.
- G. Seal and waterproof penetrations of floor slab at mechanical rooms above grade.
 1. Where required, provide firestop systems in accordance with Section 07 84 00.
- H. Provide sealing fittings on rigid galvanized conduit in hazardous areas and install in accordance with NEC.
- I. Sum of angles in any power conduit run shall not exceed 360 degrees.
- J. Sum of angles in any telecommunications conduit run shall not exceed 180 degrees.
 1. Install pull boxes every 100 feet in long conduit runs.
 2. Conduit bends:
 - a. Make field bends with tools designed for conduit bending.
 - 1) Heating of metallic conduit to facilitate bending is not permitted.
 - b. Hand conduit bender may be used on 19 mm 3/4 inches RMC, IMC or EMT conduit and 25 mm 1 inch EMT conduit.
 - 1) Use conduit bending machine for larger sizes.
 - c. Make no bends with radius less than 12 times diameter of associated cable.

- d. Make no bends with radius less than 6 times the diameter of telecommunications conduits up to 2 inches, or less than 10 times the diameter of telecommunications conduits greater than 2 inches.
 - e. No conduit bends shall exceed 90 degrees.
 - K. Provide conduit bodies, junction boxes, or pull boxes when the maximum number of bends have been exceeded.
 - 1. Covers shall be accessible.
 - 2. Conduit bodies for power circuits may be used as follows:
 - a. On exposed runs at junctions, bends, or offsets where splices are not required.
 - b. Around outside corners of walls and equipment or around beams.
 - c. Conduit bodies are not allowed for use with conduits containing telecommunication cables.
 - L. Empty conduits:
 - 1. Install 5mm 3/16 inches minimum diameter polypropylene or nylon pull-line from end to end with tag at each end designating opposite terminus.
 - M. Make joints in threaded conduit watertight with white nonlead compound applied to male threads only.
 - 1. Cut square, ream smooth, and properly thread field joints to receive couplings.
 - 2. Do not use running threads.
- 3.3 INSTALLATION OF CONDUIT ABOVE GRADE
- A. Unless otherwise noted, install conduits concealed within walls and above finished ceilings.
 - B. Do not run horizontally in CMU.
 - C. Run conduit in straight lines at right angles to or parallel with walls, beams, or columns.
 - D. Keep conduit away from uninsulated hot water and steam pipes.
 - 1. Where crossings are unavoidable, leave minimum 150 mm 6 inches clearance.
 - E. Avoid running conduits underneath water lines except for crossings.
 - F. Do not cross conduit in front of access door in HVAC duct.
 - G. Provide conduit support designed for building structural conditions to carry load imposed.
 - H. Provide inserts or fasteners to attach hangers to structure.
 - 1. Attachment to metal roof deck may be by means of pre-punched tabs, pre-punched holes, or with screws in sides of ribs or toggle bolts in bottom of ribs.
 - 2. Space hangers in joints between precast units minimum 100 mm 4 inches from walls.
 - I. Use trapeze assemblies to support multiple conduits.
 - 1. Coordinate layout to provide adequate access to cable tray assemblies if applicable.
 - J. Installation of conduit or rack of conduits shall not interfere with placement of specified luminaire.
 - K. Hangers in roof deck:
 - 1. Do not extend above tops of ribs, or otherwise interfere with vapor retarder, insulation, or roofing.

- L. Independently support conduit systems from building structure or walls with approved hangers.
 - 1. Do not use following to support conduit:
 - a. Wire including ceiling support wires.
 - b. Perforated strap hangers.
 - c. Plastic or nylon tie wraps.
 - 2. Do not support from piping, ducts or support systems for piping or ducts.
 - 3. Do not support from ceiling or ceiling support systems.
 - 4. Do not install to prevent ready removal of equipment, piping, ducts, or ceiling tiles.
 - 5. Do not support from drywall.
- M. Support suspended conduits within 300mm 12 inches of any change of direction of 45 degrees or greater.
- N. Neatly seal openings around conduits, etc., where they pass through fire rated construction or exterior walls or roof. Provide proper rated seal for fire-rated penetrations.
- O. No exterior horizontal roof supported conduit runs are permitted in lengths exceeding 6 feet unless indicated otherwise.
- P. Conduit stub-outs:
 - 1. Terminate conduit with insulating bushing.
- Q. Install rigid conduits squarely into boxes.
 - 1. Rigidly clamp to box with locknut on outside and inside and provide bushing on inside.
- R. Fit all conduit ends at switch and outlet boxes with approved lock nuts and bushing forming approved tight bond with box when screwed tightly in place.
- S. Above lay-in tile ceilings, make connections to lay-in type luminaires with flexible steel conduit no longer than 1830 mm 6 feet.
 - 1. Conduit shall be supported to structure or support wires above ceiling. Do not install on ceiling or ceiling tiles.
 - a. Zip ties shall not be used as a means of attachment.
 - 2. Arrange conduit and box systems for easy removal of lay-in ceiling.
- T. Provide connections to door security devices in hollow metal jamb posts using 13 mm 1/2 inches flexible steel conduit.
- U. Provide expansion joint fittings as follows:
 - 1. On conduit at all building expansion or control joints where conduit is rigidly attached to structure.
 - 2. Where necessary to compensate for thermal expansion and contraction.
 - 3. Flexible metal conduit may be used for expansion fittings on runs smaller than 1 inch where exposed or concealed above suspended ceilings.
 - a. Leave slack in conduit for movement.
 - b. Fasten on each side of joint.
- V. Provide junction box with duct-seal on raceways subject to different temperatures including but not limited to:
 - 1. Conduits passing from interior to exterior of structure.
 - 2. Conduits serving cold storage rooms, freezers, and refrigeration equipment.

- W. When roof exhaust fans are equipped with housing conduit entries and integral disconnects, install conduit to roof exhaust fans through fan housing with no conduit exposed.

3.4 INSTALLATION OF CONDUIT WITHIN OR THROUGH STRUCTURAL ELEMENTS

- A. Conduit shall not be installed within structural elements, i.e. concrete columns, beams, decks, or slabs unless otherwise noted.
1. Conduit in concrete columns:
 - a. Install no conduit larger than 19 mm 3/4 inches in concrete columns.
 - b. Do not install multiple conduits in a single concrete column without the Structural Engineers approval.
 2. Conduit in slab on grade:
 - a. The outside diameter of a single conduit or vertical dimension of two or more stacked conduits (including crossovers) shall not exceed 1/3 the thickness of the slab.
 - b. The outside horizontal dimension of two or more adjacent conduits shall not exceed twice the depth of the slab and the separation between groups of conduits shall not be less than the thickness of the slab.
 3. Conduit in elevated slabs on metal deck:
 - a. Do not install conduit in concrete slabs on metal deck without the Structural Engineer's approval except as follows:
 - 1) The outside diameter of a single conduit or vertical dimension of two or more stacked conduits (including crossovers) shall not exceed 1/6 the total thickness of the slab.
 - 2) The outside horizontal dimension of two or more adjacent conduits shall not exceed the total thickness of the slab and the separation between groups of conduits shall not be less than the total thickness of the slab.
 - 3) The conduit shall have a minimum concrete cover of 19 mm 3/4 inches top and bottom.
 4. Conduit in elevated slabs:
 - a. Do not install conduit in elevated concrete slabs without the Structural Engineer's approval except as follows:
 - 1) The outside diameter of a single conduit or vertical dimension of two or more stacked conduits (including crossovers) shall not exceed 1/6 the thickness of the slab.
 - 2) The outside horizontal dimension of two or more adjacent conduits shall not exceed the thickness of the slab and the separation between groups of conduits shall not be less than the thickness of the slab.
 - 3) The conduit shall have a minimum concrete cover of 3/4 inches top and bottom.
- B. Conduit passing through concrete wall or slab penetrations:
1. All core drilling, sleeves, block-outs, and other penetrations must be approved by Structural Engineer prior to installation.
 2. Space sleeves and core drills to ensure minimum of three (3) times nominal trade diameter of largest adjacent conduit between sleeves or core drills.
 3. Use block-outs for concentrations of conduits in confined area.

3.5 INSTALLATION OF CONDUITS IN BELOW GRADE, NON-CONCRETE ENCASED DUCTBANKS

- A. Minimum size of underground conduit shall be 20 mm 3/4 inches.
- B. Maintain depth of conduit at least 762mm 30 inches below finished grade.
 - 1. Remove materials from trench that could damage conduit.
 - 2. Use sand or selected material for bedding and first layer of backfill.
- C. Provide minimum separation of 300 mm 12 inches of concrete or compacted dirt between communications systems conduits and power systems conduits operating at 100 volts or greater when conduits follow parallel path.
- D. For steel conduits in contact with earth or a vapor retarder, coat with 2 coats asphalt emulsion before installation, or use PVC coated steel conduit.
- E. Use long radius bends and deflection couplings for changes in direction.
 - 1. Maintain a minimum radius of 914mm 36 inches.
- F. Tighten taper-fit joints with light blows of a sledge hammer.
 - 1. Dope threaded joints and tighten with tool.
 - 2. Seal plastic joints around entire perimeter with chemical bonding agent.
- G. Cap empty conduit.
 - 1. Seal ends with approved waterproofing compound after conductors have been installed.
- H. Provide rigid steel conduit elbows where non-metallic conduit emerges from underground, with threaded adapters for change of material.
 - 1. Provide 914mm 36IN minimum radius or larger elbows as required by local utility company.
- I. Do not place backfill until work is inspected and approved.
- J. Provide identification for underground conduits.
 - 1. Use warning tape for direct-buried conduits.
 - 2. For warning tape, backfill trench to within 305mm 12 inches of finished grade.
 - 3. Install tape continuously along entire length of trench, and complete backfill operation.
- K. All conduit stub-outs on site shall be identified in one of following ways and noted on as-built drawings provided to Owner:
 - 1. Cap conduits indicated to be stubbed out underground with glued-on PVC caps.
 - 2. Permanently marked.
 - 3. Dimension from landmark on site or building.
 - 4. Using a Global Positioning System (GPS) device accurate to within 6 inches.

END OF SECTION

SECTION 26 05 34 BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Boxes, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. UL 514A – Metallic Outlet Boxes.
 - 2. ANSI/NEMA FB-1 – Fittings, Cast metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
 - 3. ANSI/SCTE 77 Specification for Underground Enclosure Integrity.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Describe configurations, finishes, colors, and dimensions for the following:
 - a. Ingrade splice boxes.
 - b. Special mounting boxes and covers.
 - c. Floor boxes.
 - d. Poke-thru assemblies.
 - e. Provide IBC Certificates of Compliance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Galvanized Outlet Boxes and Fittings:
 - 1. Base:
 - a. Hubbell Electrical Products – RACO.
 - 2. Optional:
 - a. Emerson Industrial – Appleton Electric.
 - b. Thomas & Betts –Steel City.
- B. Wet Location Boxes/Covers:
 - 1. Base:
 - a. Hubbell.
 - 2. Optional:
 - a. Thomas & Betts.
 - b. Robroy.
- C. Box Supporting Brackets:
 - 1. Base:
 - a. Hubbell/RACO.
 - b. Erico/Caddy.
- D. Ingrade Splice and Pull Boxes:
 - 1. Base:
 - a. Hubbell Quazite.

E. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 WALL OUTLET BOXES

A. General:

1. Minimum Size.
 - a. 100 mm 4 inches square or octagon.
 - b. Depth as required.
2. Lighting outlet boxes.
 - a. Galvanized.
 - b. Use extension and plaster rings as required.
 - c. Verify proper depth with partition thickness.
 - d. Provide with proper fittings to support and attach luminaires.
 - e. Support outlet boxes for luminaires and other ceiling mounting devices in lay-in acoustical tile ceilings by bar hangers anchored to ceiling construction members which do not interfere with tile removal.
3. Switch and receptacle boxes for concealed wiring.
 - a. Galvanized.
4. Pull and junction boxes.
 - a. Galvanized steel, code gauge.
 - b. Cover:
 - 1) Same material as box, screw-on type.
5. Masonry boxes for CMU installation.
 - a. 3-1/2 inches deep, non-gangable with integral brackets to hold box to concrete block from front and back. Includes break-off front tabs.
 - b. Hubbell RACO Block-Loc series.
6. Extension Rings.
 - a. To suit conditions.
7. Hardware.
 - a. Grounding screw and connectors as required by wiring method.
8. Supports.
 - a. Box supporting brackets.
 - 1) Caddy MEB1 and SGB Series.
 - b. Far side box support.
 - 1) Hubbell/RACO Model No. 978.
 - 2) Erico Model No. 766.
 - 3) Caddy Model No. J1A35.

B. Narrow switch boxes (for hollow metal jambs):

1. Base Product: Hubbell-Raco 426.

C. Weatherproof box and cover (mounted to building):

1. Box:
 - a. Corrosion resistant cast malleable iron type, with threaded hubs and neoprene gasket.
 - b. Design basis: Crouse-Hinds Type FS.

2. Cover for damp locations:
 - a. Suitable for damp location when receptacle is in use.
 - b. Gasketed and self-closing, zinc die cast, gray, lift cover.
 - 1) Single outlets: Hubbell RW51550.
 - 2) Duplex outlets: Hubbell RW51470.
 - 3) Duplex GFCI and USB receptacles: Hubbell RW51040.
3. Cover for wet locations:
 - a. Suitable for wet location when receptacle is in use.
 - b. Die-cast aluminum construction, meets extra-duty rating in UL 514D.
 - c. Padlockable, gasketed NEMA 3R cover.
 - 1) Single outlets: Hubbell WP700E.
 - 2) Duplex outlets: Hubbell WP26E with duplex adapter.
 - 3) Duplex GFCI receptacles: Hubbell WP26E.

2.3 INGRADE SPLICE AND PULL BOXES

- A. Polymer concrete, PC Style gasketed boxes, green color; with open base.
- B. Size.
 1. 6 inches width x 8 inches length x 6-3/4 inches depth.
 2. 8 inches width x 18 inches length x 8 inches depth.
 3. 11 inches width x 18 inches length x 12 inches depth.
 4. 12 inches width x 12 inches length x 12 inches depth.
- C. ANSI/SCTE 77 Tier Load Rating.
 1. Tier 15.
- D. Cover Text.
 1. Power.
 2. Comm.
 3. Fiber Optics.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mounting Outlet Boxes for Concealed Wiring:
 1. Boxes mounted adjacent to studs shall be attached directly to stud with a minimum of 4 metal screws.
 - a. Provide far-side box support on all boxes.
 - b. Box side support shall be secured to box with drywall screws.
 2. Boxes that are not attached directly to studs shall be attached to box support bracket spanning studs.
 - a. Bracket shall be attached to studs with 2 screws at each end.
 - b. Attach box to bracket with 2 screws minimum.
 3. For outlets mounted above or below counters, benches, or furniture, coordinate location and mounting heights with casework, millwork and furniture.
 - a. Adjust outlet mounting height to agree with required location for equipment served.
 4. Position outlet boxes to locate luminaires as shown on reflected ceiling plans.

- B. When a metallic junction box for electrical receptacles or switches is contained within a 1 or 2-HR rated fire or smoke wall of gypsum wall board construction and an opening is provided for box in surface of wall, area of opening shall not exceed 16 square inches, unless junction box is protected by approved UL listed firestop.
 - 1. Aggregate area of such junction boxes in a rated wall not protected by an approved firestop shall not exceed 100 square inches in 100 SQ FT of wall area as measured from floor to structural deck or rated membrane.
 - 2. Junction boxes with openings on opposite faces of rated walls shall have a horizontal separation of 24 inches as a minimum, regardless of box size, unless protected by an approved method.
 - 3. Locations of studs do not have any bearing on the above requirements, nor does the use of mineral wool fire-safing alter these requirements.
- C. Back to back boxes shall not be installed within the same stud cavity.
 - 1. Where installation within the same stud cavity is required based on device layout, unfaced glass or mineral fiber sound batting or putty pads with sound reduction characteristics shall be installed to prevent sound transfer between rooms. Where putty pads are used, they shall cover all openings on box.
- D. Fill unused punched-out openings in boxes with closures.
- E. Use outlet boxes sized to accommodate quantity of conductors enclosed.
- F. Provide pull boxes or junction boxes in conduit runs where indicated or as required to facilitate pulling of wires or making of connections.
 - 1. Make box covers accessible.
- G. Paint inside of boxes and box cover per Section 26 05 53.
- H. Identify circuit numbers on inside of box and cover plate.
 - 1. Identification shall be post painting of boxes.
- I. Identification and Labeling
 - 1. As indicated in Section 26 05 53.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Identification for Electrical Systems, as indicated, in accordance with provisions of Contract Documents.
- B. Provide the following:
 - 1. Identification for raceways.
 - 2. Identification for conductors.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Equipment identification labels.
 - 6. Miscellaneous identification products.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American National Standards Institute (ANSI):
 - a. ANSI A13.1 Standard for the Identification of Pipes.
 - b. ANSI Z535.4 Safety Labels.
 - 2. ASTM International (ASTM):
 - a. ASTM D882 Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - 3. NFPA 70 National Electrical Code.
 - 4. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910.144 Safety Color Code for Marking Physical Hazards.
 - b. 29 CFR 1910.145 Specifications for Accident Prevention Signs and Tags.
 - 5. UL 969 Compliance Guidelines for Marking and Labeling Systems.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer literature for each electrical identification product indicated.
- B. Project Information:
 - 1. Identification Schedule:
 - a. Index of all electrical equipment and system components on project of identification signs and labels. Include appropriate colors of both lettering and label background.

1.4 COORDINATION

- A. Identification required in this section applies to equipment furnished in other Divisions.
- B. Coordinate identification names and abbreviations with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, operation manuals, maintenance manuals, code requirements, standards, and 29 CFR 1910.145.
 - 1. Use consistent designations throughout Project.
 - 2. Equipment identification shall be same as designation indicated on plans.

- C. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- D. Coordinate installation of identifying devices with location of access panels and doors.
- E. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer of materials meeting required standards.

2.2 MATERIALS

- A. Power and Control Raceway Identification Materials:
 - 1. Colors for Raceways Carrying Circuits at 600 V or Less:
 - a. As scheduled below.
- B. Conductor Identification Materials:
 - 1. Conductor jacketing shall be color-coded as scheduled below.
- C. Underground-Line Warning Tape:
 - 1. Tape:
 - a. Suitable to permanently identify and locate underground electrical and communications utility lines.
 - b. Tape and ink:
 - 1) Chemically inert.
 - 2) Unaffected when exposed to acids, alkalis, and other destructive substances found in soil.
 - 2. Color and Printing:
 - a. Comply with applicable referenced standards.
 - b. Inscriptions for Red-Colored Tapes with Black Lettering: ELECTRIC LINE, HIGH VOLTAGE.
 - c. Inscriptions for Orange-Colored Tapes with Black Lettering: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.
 - 3. Construction:
 - a. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Non-detectable tape:
 - 1) Thickness: 4 mils 0.1 mm.
 - 2) Weight: 18.5 pound/1000 SQ FT. 9.0 kg/100 sq. m.
 - 3) Width: 3 inches 75 mm.
- D. Warning Labels and Signs:
 - 1. Comply with applicable referenced standards.
 - 2. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
 - 3. Warning label and sign shall include, but are not limited to, the following legends:
 - a. Arc Flash Warning: "WARNING – ARC FLASH HAZARD."
 - b. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

- E. Equipment Identification Labels:
 - 1. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting.
 - a. Colors as indicated in Identification Schedule below.
 - b. Letters:
 - 1) 7 mm 1/4 inches high for equipment with cover plate less than 305 mm 12 inches wide.
 - 2) 13 mm 1/2 inches high for equipment with cover plate over 305 mm 12 inches wide:
- F. Miscellaneous Identification Products:
 - 1. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
 - 2. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
- G. Floor Marking Tape:
 - 1. 2 inches 50 mm wide, 5-mil 0.125 mm pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
 - 1. Coordinate all signage with Owner's facility-wide standard nomenclature, if applicable.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches 300 mm below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches 400 mm overall.
- G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Identify with self-adhesive vinyl label applied in bands. Install labels at 30 feet 10 M maximum intervals.
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, manholes, and handholes, use color-coding conductor tape to identify the phase.
- C. Boxes: Color code the covers of each junction and pull box.
- D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for both direct-buried conduit as well as conduits in ductbank.

- E. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting:
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- G. Nameplates: Provide engraved laminated nameplates for electrical equipment.
 - 1. Panelboard nameplates:
 - a. Center nameplate near top of each section (including sections of multi-section panels). Label text to include:
 - 1) Equipment name, e.g., "Panel XXXX".
 - 2) Source, e.g., "Source - Switchboard XXXX", or "Source – Panel XXXX via Transformer XXXX" as appropriate.
 - 2. Disconnect switches, contactors, thermal element switches, starters, capacitors, etc. nameplates:
 - a. Center nameplate near top of face plate or cover. Label text to include:
 - 1) Description of load, e.g., "Load - AHU-XXX".
 - 2) Source, e.g., "Source - MCC-XXXX".
 - 3. Fire alarm, public address and other system control cabinet nameplates:
 - a. Center nameplate near top of cover. Label text to include:
 - 1) Description of system, e.g., "Fire Alarm System Control Panel".
 - 4. Lighting Control Panel nameplates:
 - a. Center nameplate near top of cover. Label text to include:
 - 1) Equipment name and branch, e.g., "Lighting Control Panel XXXX - Normal Branch".
 - 2) Control Power Source, e.g., "Control Power – Panel XXXX".
- H. Flash Hazard Warning Signs:
 - 1. Provide for switchboards, panelboards, and motor control centers per NEC Article 110.
- I. Device Plates:
 - 1. Color as scheduled in table below and label text as required under Section 26 27 26.
- J. Boxes & Enclosures:
 - 1. Paint outlet boxes, junction boxes and enclosures, except switchboard and panelboard enclosures, as scheduled in Table below.
 - 2. Paint outside of boxes and box cover plates when boxes are above an accessible ceiling or access panel.
 - 3. Paint inside of boxes and box cover plates when box is recessed in wall or ceiling, or when fully exposed in an architectural space.

4. Identify circuit numbers on inside of box and cover plate. Identification shall be post-painting of boxes.
- K. Conduit:
1. Provide permanently color-coded conduit, color as indicated in Table below. Conduits sized as follows:
 - a. Minimum of 1 inch and smaller shall be fully factory painted.
 - b. Larger than 1 inch shall be fully factory painted, or painted 2 inches wide band 10 feet on center, or provided with 2 inches wide pressure sensitive, color impregnated tape 10 feet on center.
- L. Provide color-coding of devices and equipment as indicated in Table below.

Electrical Device and Covers	Generator (Upstream of ATS)	Fire Alarm	BMS	Low Voltage Voice/Data
Boxes (Outlet, Junction)	Black	Red	Purple	White
Conduit/Paint/Taping	Black	Red	Purple	White
Labeling - Nameplate and Device Plate Background	Black	Red	Purple	Refer to Section 27 05 32
Labeling - Nameplate and Device Plate Lettering	White	White	White	

Electrical Wiring and Cabling	120/208 Volt	277/480 Volt	Fire Alarm	BMS	Low Voltage Voice/Data	Low Voltage Control
Wire - Ground	Green	Green	Refer to Section 28 31 00 for Wiring Color	Refer to Section 25 50 00 for Wiring Color	Refer to Section 27 05 32 for Cable Color	
	Green w/ Yellow Stripes	Green w/ Yellow Stripes				
Wire - Neutral	White	Gray				
Wire - Phase 1	Black	Brown				
Wire - Phase 2	Red	Orange				
Wire - Phase 3	Blue	Yellow				
0-10V Control Wire	N/A	N/A	N/A	N/A	N/A	Gray and Purple

END OF SECTION

SECTION 26 09 23
LINE VOLTAGE LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Lighting Control Devices, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 REFERENCES

- A. Referenced Standards:
 - 1. Underwriter's Laboratories (UL):
 - a. UL 20 Standard for Safety for General-Use Snap Switches.
 - b. UL 514D Cover Plates for Flush-Mounted Wiring Devices.
 - 2. National Electric Manufacturers Association (NEMA):
 - a. WD-1 General Color Requirements for Wiring Devices.
 - b. WD-6 Wiring Devices - Dimensional Requirements.
 - 3. US Federal Specifications:
 - a. Federal Specification switches (WS-896E).
 - b. Federal Specification device plates (W-P-455).

1.3 SUBMITTALS

- A. Product Data:
 - 1. Technical data on each type of device.
 - 2. Manufacturer's wiring and installation information.
- B. Shop Drawings:
 - 1. Occupancy sensor layout.
 - a. Submit a lighting plan clearly marked by manufacturer showing occupancy sensor type, location and proper orientation.
 - b. Submit any applicable interconnection diagrams.
- C. Contract Closeout Information:

1. Warranty.

1.4 WARRANTY

- A. Minimum five year warranty for wall-box dimmer switches.
- B. Minimum five year warranty for occupancy sensors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Standard Toggle Switches:
 - 1. Base:
 - a. Hubbell.
 - 2. Optional:
 - a. Cooper.
 - b. Leviton.
 - c. Pass & Seymour / Legrand.

- B. Line Voltage Occupancy Sensors:
 - 1. Base:
 - a. WattStopper.
 - 2. Optional:
 - a. Eaton Greengate.
 - b. Hubbell.
 - c. Leviton.
 - d. Lutron.
 - e. Sensor Switch
- C. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Toggle Switches:
 - 1. Toggle switches shall be of the same manufacturer providing receptacles.
 - a. See Section 26 27 26.
 - 2. Lighting switches:
 - a. Specification grade, quiet-operating toggle-type with back and side wiring, 120-277 volts, AC only, 20 amp rated unless otherwise indicated.
 - 1) Listed per UL 20 and certified by UL to Federal Specification W-S-896E and visibly marked "Fed Spec W-S-896 inches".
 - 2) Equip with a green grounding terminal.
 - 3. Refer to Symbol Legend for types.
 - 4. Color: Grey.
 - 5. Toggle-type switch:
 - a. Single-pole: Hubbell HBL1221.
 - b. Three-way: Hubbell HBL1223.
- B. Occupancy Sensors:
 - 1. Refer to Symbol Legend for types.
 - 2. All sensors shall be manufactured by same company and shall be aesthetically compatible with similar models from the same product line or generation of products.
 - 3. Refer to table at end of Section 26 05 53 for device colors of occupancy sensors and wall plates.
 - 4. Line Voltage Passive Infrared Wall Switch Sensor:
 - a. Self-contained control system that replaces a standard toggle switch and capable of detecting presence in the control area by detecting changes in the infrared energy.
 - b. The Passive Infrared (PIR) technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.
 - c. Coverage up to 1,050 square feet for walking motion, with a field view of 180 degrees.
 - d. Sensor shall be able to control incandescent, magnetic low voltage, electronic low voltage, LED, and fluorescent loads.
 - e. No minimum load requirement and shall be capable of switching from 0 to 1000 Watt ballast, LED and tungsten or 1/4 hp at 120 VAC, 50/60Hz, and 0 to 1200 Watt ballast and LED or 1/4 hp at 230/277 VAC, 50/60Hz.

- f. Include walk-through mode, where lights turn OFF 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by a DIP switch.
 - g. Automatic-ON (occupancy) or Manual-ON (vacancy) operation adjustable with DIP switch.
 - h. Time delay feature adjustable from 5 to 30 minutes, set by DIP switches.
 - i. In automatic mode, sensor shall be capable to automatically return to Automatic-ON after lights are turned off manually.
 - j. LED indicator that remains active at all times in order to verify detection within the area to be controlled.
 - k. Sensor shall not protrude more than 3/8 inches from the wall.
 - l. Time delay shall be set at 5 minutes with relay in Manual ON (vacancy) mode.
 - m. WattStopper model no. PW-301.
5. Line Voltage Dual Technology Wall Switch Sensor:
- a. Self-contained control system that replaces a standard toggle switch which detects presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes and utilizes dual sensing verification for coordination between both technologies to reduce likelihood of false operations.
 - b. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall automatically adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout the controlled space.
 - c. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.
 - d. Factory preset in a default mode in which both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting ON, and detection by either technology shall turn lights back ON after lights were turned OFF for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.
 - e. Selection of technologies for initial, maintain, and re-trigger shall be done with DIP switches.
 - f. Coverage up to 1,050 square feet for walking motion, with a field view of 180 degrees.
 - g. Control incandescent, magnetic low voltage, electronic low voltage, LED, and fluorescent loads.
 - h. No minimum load requirement and capable of switching from 0 to 1000 Watt ballast, LED and tungsten or 1/4 hp at 120 VAC, 50/60Hz, and 0 to 1200 Watt ballast and LED or 1/4 hp at 230/277 VAC, 50/60Hz.
 - i. Include walk-through mode, where lights turn OFF 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by a DIP switch.
 - j. Automatic-ON (occupancy) or Manual-ON (vacancy) operation adjustable with DIP switch.
 - k. Time delay feature adjustable from 5 to 30 minutes, set by DIP switches.
 - l. In automatic mode, sensor shall be capable to automatically return to Automatic-ON after lights are turned off manually.
 - m. LED indicator that remains active at all times in order to verify detection within the area to be controlled.
 - n. Sensor shall not protrude more than 3/8 inches from the wall.

- o. Time delay shall be set at 5 minutes and high PIR sensitivity with relay in Manual ON (vacancy) mode.
 - p. Wattstopper model no. DSW-301.
6. Low Voltage Dual Technology 360-degree Ceiling Sensor:
- a. Capable of detecting presence in control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes.
 - b. Ultrasonic sensing shall be volumetric in coverage with frequency of 40 KHz. It shall automatically adjust the detection threshold dynamically to compensate for changing levels of activity and airflow throughout controlled space and shall provide volumetric coverage without gaps in coverage within controlled areas.
 - c. Temperature compensated PIR with dual element sensor and multi-element Fresnel lens.
 - d. Coordinate between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting ON.
 - e. Retrigger feature in which detection by either technology shall retrigger the lighting system ON within 5 seconds of being switched OFF.
 - f. Ceiling mounted with a flat, unobtrusive appearance and provide 360-degree coverage.
 - g. Sensor shall operate at 24 VDC/VAC and utilize a power pack.
 - h. The lens shall cover up to 1000 square feet of walking motion.
 - i. Time delay feature that is adjustable from 5 to 30 minutes, set by DIP switch.
 - j. Include walk-through mode, where lights turn OFF 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.
 - k. Built-in light level sensor that works from 10 to 300 foot-candles.
 - l. Parallel wiring capability to allow for coverage of large areas.
 - m. Additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.
 - n. Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.
 - o. Time delay shall be set at 5 minutes and high PIR sensitivity with relay in Automatic ON mode.
 - p. Time delay shall be set at 15 minutes and high PIR sensitivity with relay in Automatic ON mode.
 - q. WattStopper model no. DT-300.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate devices as indicated and as scheduled in Section 26 00 10.
- B. Center devices with regard to paneling, furring and trim.
- C. Set devices plumb or horizontal and extending to finished surface of wall, ceiling or floor as case may be without projecting beyond same.
- D. Route neutral conductor and grounding wire to every junction box containing a line voltage switch.

E. Occupancy Sensors:

1. Verify sensor type, quantity, location, aiming and sensitivity with manufacturer's recommendations.
 - a. Set time delays and sensitivities of devices, if applicable, per specifications and as appropriate to usage of room.
2. Test controlled spaces to insure 90- to 100 percent coverage of controlled space.
 - a. If test fails, adjust sensitivity, re-aim, relocate, and/or add sensors.
3. Exact locations of control unit hardware boxes shall be based on observing good installation practices. Installation shall conform to manufacturer's written installation recommendations.
4. Control unit hardware shall be installed in a manner which minimizes aesthetic impact of hardware on appearance of affected rooms. Control unit hardware shall be completely contained within a suitable NEMA enclosure, with no exposed wiring other than low-voltage Class 2 wiring.
5. Size and install system raceways as indicated and in accordance with manufacturer's requirements for installation of system's wiring. Tag conductors at junction and terminal points.
6. Protect exposed wiring above hung ceiling construction from physical damage where necessary by using conduit, pipe, guard strips or other approved means. Install drops to wall devices in conduit. Properly support low-voltage cables off ceiling construction and secure by approved staples, straps or similar approved fittings so designed and installed so as not to injure cable. Secure cable in place at intervals not exceeding 4.5 feet and within 12 inches from every cabinet, box or device.
7. Install low voltage Class 2 wiring within air handling plenum ceiling areas in rigid raceways, EMT minimum, and extend 3 feet beyond and outside of plenum barriers and walls or provide plenum rated cable.
8. Locate sensors minimum of four feet away from supply and return air registers.
9. Mount sensors so they will not receive light directly from a light source or reflecting surface.
10. Where bi-level switching or manual on/off switching is indicated, provide sensors and/or power packs suitable for low voltage manual switching or provide line voltage series switching as required.
11. For bi-level occupancy sensors, set the first relay for auto-on/ auto-off and the second relay for manual-on/auto-off operation.
12. Provide training to familiarize Owner's personnel with operation and proper adjustment of occupancy sensing devices and systems.
13. Locate power supplies and auxiliary relay units above accessible ceilings.

3.2 CLEANING

- A. Remove paint spatters and other spots, dirt and debris from equipment.
- B. Clean equipment and devices internally and externally using methods and materials recommended by manufacturer.
- C. Correct improperly located devices.

END OF SECTION

SECTION 26 24 16 PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Panelboards, as indicated, in accordance with provisions of Contract Documents.
- B. Provide distribution panelboards and lighting and appliance panelboards as specified and indicated on schedules and drawings.
- C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. System Standards:
 - 1. NEMA PB-1 – Panelboards.
 - 2. NEMA PB-1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards rated 600 volt or less.
 - 3. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
 - 4. UL 50 – Enclosures for Electrical Equipment.
 - 5. UL 67 – Panelboards.
 - 6. CSA Standard C22.2 No. 29-15– Panelboards and Enclosed Panelboards.
 - 7. Federal Specification W-P-115C – Type I Class 1.
 - 8. Federal Specification W-P-115C – Type II Class 1.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Identify panelboards by alphanumeric designation with branch circuit breaker sizes and types indicated in panelboard schedules or one-line-diagram.
- B. Product Data:
 - 1. Technical data on each type of panelboard.
- C. Contract Closeout Information:
 - 1. Operating and maintenance data.

1.4 DEFINITIONS

- A. Lighting and appliance branch circuit: Branch circuit that has a connection to the neutral of the panelboard and that has overcurrent protection of 30 amperes or less in one or more conductors.
- B. Lighting and appliance branch-circuit panel boards: Panelboard having more than 10% of its overcurrent devices protecting lighting and appliance branch circuits.
- C. Power Panelboard: Panelboard having 10% or fewer of its overcurrent devices protecting lighting and appliance branch circuits. The terms “power panelboard” and “distribution panelboard” will be used interchangeably.
- D. Load Center: Panelboard used in residential or light commercial applications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Panelboards:

1. Base:

- a. Eaton.
- b. ABB/General Electric.
- c. Schneider Electric/Square D.
- d. Siemens.

B. Other manufacturers desiring approval comply with Section 01 61 00.

1. Eaton types listed for quality and performance reference.

2.2 MATERIALS

A. Panelboards:

1. Dead front type.

2. Provide with non-insulated equipment grounding terminal strip located in top or bottom gutter including main grounding lug and individual terminals for at least 50% of panel circuits including spare circuits and space provisions; increase gutter space accordingly for grounding strip.
3. Provide lighting panelboards with branch circuit connection to main bus arranged for sequence phasing.
4. Provide feed-thru lugs or sub-feed lugs for 2 and 3 section panels.
5. Equip bus bars for panelboard with main lugs, main fused switch or main circuit breaker, capacity as required or indicated.
6. Panelboard bussing to be tin-plated aluminum.
7. Provide special features such as split bus, lighting contactors, extra-width gutters as required.
8. Provide panelboard busses fully rated for specified interrupting rating. Series rating of panelboards and overcurrent protective devices is not acceptable.
9. Provide full length bussing including areas indicated as space only.
10. Provide integral surge protection per Section 26 43 13 where indicated on plans or schedules.

B. Circuit Breaker Panelboards:

1. Provide bolted-on circuit breaker type (or breakers equipped with an integral mounting bracket). Plug-in circuit breakers not acceptable.
2. Do not install feeder or branch circuit breakers in sub-feed section of panel.
3. Main circuit breaker shall not be located in branch circuit section of panel unless specifically indicated.
4. Provide main busses and back panels which permit changing of circuit breakers without additional machining, drilling or tapping.
5. All multi-pole breakers provide single handle with common trip.
6. All multi-pole breakers, 100A rated and larger shall include means for padlocking in "OFF" position.
7. Include provisions for locking specific circuit breakers in the "ON" position where indicated.
8. Provide shunt trip mechanism on breakers where indicated.
9. Provide ground fault protection as indicated coordinated with upstream devices.

10. Design so a combination of one, two and three pole circuit breaker can readily be assembled in the same panelboard.
 11. Circuit breakers operable in horizontal or vertical position and removable from front of panelboard without disturbing adjacent units.
 12. Tandem or half-size circuit breakers not allowed.
 13. Panelboard ratings:
 - a. In 120/240 V panelboards: Minimum 10,000 AIC symmetrical, as indicated on drawings, or as required by power systems studies, whichever is greatest.
 14. Lighting and appliance branch-circuit panelboards:
 - a. Types PRL1a, PRL2a and PRL3a.
 15. Distribution panel boards (circuit breaker type):
 - a. Type PRL4B.
- C. Circuit breakers: Thermal-magnetic type unit construction, employing quick-make and quick-break toggle mechanisms for manual operation as well as automatic operation.
- D. Handles with three positions: "OFF", "ON", and "TRIPPED".
1. When circuit breaker opens on overload or short circuit, operating handle shall automatically assume "TRIPPED" position and clearly indicate abnormal condition of circuit.
- E. Ground fault circuit interrupter circuit breakers:
1. Operate on differential transformer principle; rated 20A, 120V or 240V, Class A fault-trip sensitivity of 5 milliamperes, UL approved, with built-in testing switch and ON-OFF switch.
 2. Provide in panelboards in lieu of standard circuit breakers to serve circuits in wet areas.
 3. Provide separate neutral for each interrupter circuit where neutral is required.
- F. Cabinets:
1. Galvanized sheet steel, code thickness.
 2. Lighting and appliance panel boards 5-3/4 inches 145 mm deep by 20 inches 508 mm wide minimum.
 3. Provide door in door with locks on inner and outer door.
 4. Multi-section panels shall have equal height enclosures in finished areas.
 5. Fasten trim to cabinet by means of adjustable clamps.
 6. Equip door with chrome-plated combination lock and catch; supply two milled keys with each lock; key locks alike.
 7. Provide directory frame on inside of door.
 8. Identify all circuit locations in each respective panel with load and location served.
 - a. Directory shall be typed.
 - b. Typed directory database (Microsoft Excel file, Microsoft Word file, or equivalent) to be given to Owner to incorporate future circuit changes.
 - c. Mechanical equipment identified in directory shall be same as designation indicated on plans.
 - d. Room names and numbers in directory shall be final building room names and numbers as identified by Owner and not necessarily the name or number indicated on plans.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated and in accordance with manufacturer's recommendations and instructions.
- B. Panelboard Cabinet Supports:
 - 1. Gypsum Wall Board walls:
 - a. Attach to studs via unistrut cross members or metal backing bolted or welded to studs where not otherwise shown.
 - 2. Masonry or concrete walls:
 - a. Attach to wall via unistrut cross members.
- C. Wall mounted panelboards shall be installed 153mm 6 inches above floor minimum.
 - 1. Large panels that rest on floor shall be mounted on house-keeping pads per Section 26 00 10.
- D. Provide spare conduits into accessible ceiling space from all flush wall mounted panelboards.
 - 1. Provide one spare 3/4 inches conduit for each 3 spare and/or space branch circuit poles or fraction thereof but no less than two spare 3/4 inches conduits.

3.2 LABELING

- A. Provide panelboard labeling as specified in Section 26 05 53.
- B. Permanently post, at each panelboard, the conductor color coding scheme specified in Section 26 05 53.

END OF SECTION

SECTION 26 27 26 WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Wiring Devices, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Provide wiring devices conforming to the following standards:
 - 1. Underwriter's Laboratories (UL).
 - a. UL 498 – Standard for Attachment Plugs and Receptacles.
 - b. UL 514D – Cover Plates for Flush-Mounted Wiring Devices.
 - c. UL 943 – Standard for Safety for Ground-Fault Circuit-Interrupters.
 - 2. National Electric Manufacturers Association (NEMA).
 - a. WD-1 – General Color Requirements for Wiring Devices.
 - b. WD-6 – Wiring Devices – Dimensional Requirements.
 - 3. US Federal Specifications.
 - a. Fed Spec receptacles (WC-596F).
 - b. Fed Spec device plates (W-P-455).

1.3 SUBMITTALS

- A. Product Data:
 - 1. Technical data on each type of device.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Wiring Devices:
 - 1. Base:
 - a. Hubbell.
 - 2. Optional:
 - a. Eaton.
 - b. Leviton Manufacturing.
 - c. Pass & Seymour (Legrand).
 - 3. All wiring devices shall be provided by the same manufacturer.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Duplex and Single Receptacles:
 - 1. Flush, grounding convenience outlets for side wiring, or side and back wiring.
 - 2. Listed per UL 498 for general use and certified by UL to Fed Spec WC-596F, and shall be visibly marked with the "UL-FS" mark to confirm certification.
 - a. Constructed with impact resistant nylon or polyester face and body.
 - b. 0.050 inches brass nickel-plated back strap with one piece (non-riveted) ground design.
 - c. 0.040 inches brass nickel-plated contacts.

3. Refer to Symbol Legend on Drawings for types.
4. Color: Grey.
5. Receptacles:
 - a. Specification grade for general use.
 - b. 20A, 125V, 2 pole, 3-wire grounding, duplex, specification grade, NEMA 5-20R; Hubbell HBL5362.
 - c. 20A, 125V, 2 pole, 3-wire grounding, single, specification grade, NEMA 5-20R; Hubbell HBL5361.
6. Ground Fault Circuit Interrupter (GFCI) type receptacle:
 - a. With built-in ground fault interruption, 4 to 6 mA trip sensitivity, 0.025 second trip time, 10,000 A maximum interrupting capacity, self-testing technology, indicator and reset.
 - b. 20A, 125V, 3-wire duplex, specification grade, NEMA 5-20R; Hubbell GFRST20.
7. Tamper resistant (safety-type) receptacles.
 - a. NEC Article 406.12 compliant.
 - b. 20A, 125V, hospital grade, 2 pole, 3-wire, grounding, duplex, safety type: NEMA 5-20R; Hubbell HBLSLG-63H.
8. USB charger duplex receptacles:
 - a. Combination USB ports, one type A, one type C, 5 amp, 5 volts DC.
 - b. Complies with battery charging specification USB BC1.2.
 - c. Compatible with USB 1.1/2.0/3.0 devices, including Apple products.
 - d. Complies with Part 15 of the FCC rules.
 - e. 20A, 125V, 3-wire duplex, specification grade, NEMA 5-20R; Hubbell USB20AC5.
- B. Special Purpose Receptacles:
 1. Straight Blade:
 - a. NEMA 14-30R receptacle: 30A, 125/250V, 3 pole, 4 wire, 1 phase grounding, single, black; Hubbell HBL9430A.
- C. Device Plates:
 1. Device plates for concealed wiring: Same manufacturer as devices to suit device covered; single, or ganged, in one piece with beveled edges that match faces of plates.
 - a. Flush, brushed-finish, type 304 stainless steel.
 2. Labeling:
 - a. General:
 - 1) Where labeling of device plates is required, provide clear adhesive labels.
 - a) Label inside of device plates with panelboard and circuit number supplying the devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate devices as indicated and as scheduled in Section 26 00 10.
- B. Center outlets with regard to paneling, furring, trim, tile, etc.
- C. Where several outlets occur in a room, symmetrically arrange them.

- D. Any outlet which is improperly located must be corrected at Contractor's expense.
- E. Set outlets plumb or horizontal and flush with face of finished surface of wall, ceiling, or floor.
- F. Install receptacles indicated on wood trim, cases or other fixtures symmetrically. Where necessary, set with long dimension of plate horizontal, or gang in tandem.
- G. GFCI receptacles shall be connected so that downstream devices on same circuit are not protected by the GFCI receptacle.

END OF SECTION

SECTION 26 28 16 ENCLOSED SAFETY SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Enclosed Safety Switches, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Provide fuses in fusible-type devices by same manufacturer.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Technical data on each type of disconnect switch.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - a. See Section 01 78 23.

1.4 EXTRA MATERIAL

- A. Extra Fuses:
 - 1. 10% or minimum of three (3) of each type and rating of installed fuses.
 - 2. See Section 01 78 43.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Enclosed Safety Switches:
 - 1. Eaton.
 - 2. General Electric.
 - 3. Schneider Electric/Square D.
 - 4. Siemens.
- B. Fuses:
 - 1. Bussmann
 - 2. Ferraz Shawmut
 - 3. Brush Fuses
 - 4. Littelfuse
- C. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 SAFETY SWITCHES

- A. Safety Switches:
 - 1. Fusible and non-fusible type, NEMA Type HD Heavy Duty construction, unless otherwise indicated.
 - 2. Enclosure: NEMA 1 unless otherwise indicated.
 - 3. Provide weatherproof disconnect switches as required by Section 26 00 10.
 - 4. Switch blades fully visible in OFF position with door open.
 - 5. Contact operation quick-make and quick-break.
 - 6. Switches for motor circuits to be horsepower rated.

7. Switches for motor circuits controlled by Variable Frequency Drives (VFD) shall include one N.O. and one N.C. contact which operate with the initial movements of the switch and prior to the opening of the main switch.
8. Provide padlocking provisions, with a minimum capacity of 1 padlocks, in OFF position.
9. Finish: Baked enamel over rust-inhibiting primer.
10. Fuses for fusible switches: See Section 26 28 00.
11. Switches shall have interlock with cover in closed position.

B. Fuses

1. UL Class RK-5 fuses: Dual-element time-delay and current-limiting rejection types fuses; UL Class RK-5 listed for 200,000 rms AIC symmetrical, 0-600A; Bussmann "Fusetron", 250 V FRN-RK and 600 V FRS-RK.
2. Use for motor feeder and branch circuit devices where fuses are indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated and in accordance with manufacturer's instructions and recommendations.
- B. Switches for motor circuits controlled by VFD's shall be electrically interlocked to the controlling VFD via contacts provided in switch.
- C. Provide labeling per Section 26 05 53.

END OF SECTION

SECTION 26 33 23
EMERGENCY LIGHTING INVERTER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Uninterruptible Emergency Lighting Inverter System, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Outline drawings of assembly.
 - 2. One line diagrams and wiring diagrams for assembly and components.
 - 3. Interconnection wiring diagrams.
- B. Product Data:
 - 1. Technical data on all components.
- C. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - 2. Owner instruction report.
 - 3. Warranty.

1.3 WARRANTY

- A. Prorated battery warranty reimbursing for remaining portion of rated battery life for failure to provide specified output in use or testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Uninterruptible power source:
 - 1. Base:
 - a. Controlled Power Company.
 - b. Dual-Lite.
 - c. Emergi-Lite.
 - d. Evenlite.
 - e. Lithonia.
 - f. Philips Chloride.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. General:
 - 1. Design:
 - a. Stand-by PWM inverter type utilizing IGBT technology with 2ms transfer time.
 - 2. Control:
 - a. Microprocessor controlled, 2 x 20-character display with touch pad controls and functions.
 - b. Five (5) LED indicators and alarm with ring-back feature.

3. Metering:
 - a. Input and output voltage.
 - b. Battery voltage.
 - c. Battery & Output Current.
 - d. Output VA.
 - e. Temperature.
 - f. Inverter Wattage.
 4. Communications:
 - a. RS-232 port (DB9).
- B. Electrical:
1. Input:
 - a. Voltage.
 - 1) 120 or 277 VAC, 1-phase, 2-wire, +10 percent, - 15 percent.
 - b. Input Power.
 - 1) Limiting inrush current to less than 125 percent, 10 times for 1 line cycle.
 - c. Input Frequency.
 - 1) 60Hz, ± 3 percent.
 - d. Harmonic Distortion.
 - 1) Less than 10 percent.
 - e. Power Factor.
 - 1) 0.5 lag/lead.
 - f. Protection.
 - 1) Input Circuit Breaker.
 2. Output:
 - a. Voltage 120 VAC, 1-phase, 2-wire.
 - b. Characteristics:
 - 1) Static:
 - a) Load current change ± 2 percent, battery discharge ± 12.5 percent.
 - 2) Dynamic:
 - a) ± 2 percent for ± 25 percent load step change.
 - b) ± 3 percent for a 50 percent load step change, recovery within 3 cycles.
 - c. percent Rating:
 - 1) [] KVA
 - d. Output Frequency.
 - 1) 60Hz ± 0.05 Hz during emergency mode.
 - e. Harmonic Distortion:
 - 1) Less than 3 percent THD for linear load.
 - f. Crest Factor:
 - 1) 2.8.

- g. Load Power Factor:
 - 1) 0.5 lag to 0.5 lead.
 - h. Inverter Overload:
 - 1) 115 percent for 10 minutes, 125 percent for 5 minutes, 150 percent for 12 cycles.
 - i. Protection:
 - 1) Distribution Circuit Breakers:
 - a) Maximum of twelve unsupervised single pole 20 amp circuit breakers.
- C. Inverter:
 - 1. Using IGBT/PWM technology the inverter converts the DC voltage supplied by the batteries to AC voltage of a precise stabilized amplitude and frequency.
 - 2. True sinusoidal output waveform with low distortion (less than 3 percent for linear loads).
 - 3. Overload capability of up to 150 percent for 12 line cycles.
- D. Charger:
 - 1. Fully automatic, temperature compensated, microprocessor controlled charger recharges fully discharged batteries in maximum of 24 hours at nominal AC input voltage.
 - 2. AC input current limiting and over-voltage protection included.
- E. Battery:
 - 1. 10 year, maintenance free, sealed valve regulated, front terminals Lead Calcium batteries.
 - 2. 90 minute standard discharge time at full load under normal operating temperature.
 - 3. Low voltage disconnect protection included. No special ventilation required.
- F. Self-Diagnostics:
 - 1. Automatic self-tests consist of a 5-minute monthly and 90-minute annual function.
 - 2. Front-mounted control panel includes 5 LED indicators, a 2-line 20-character LCD display, and a keypad to control and monitor the internal operation of the system.
 - 3. RS232 diagnostic interface.
- G. Alarms:
 - 1. High/Low Battery Charger Voltage.
 - 2. High/Low AC Input Voltage.
 - 3. Near Low Battery.
 - 4. Low Battery.
 - 5. Load Reduction Fault.
 - 6. Output Overload.
 - 7. High Ambient Temperature.
 - 8. Inverter Fault.
 - 9. Output Fault.
 - 10. Output Circuit Breaker Trip.

H. Cabinets:

1. Modular design, freestanding NEMA Type 1 steel powder coated cabinets.
2. Front-access through hinged lockable doors requiring 39 inches front clearance and 12 inches top clearance.
3. Top and left side conduit entry with knockouts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated and in accord with manufacturer's recommendations and instructions.

END OF SECTION

SECTION 26 43 13
SURGE PROTECTIVE DEVICES (SPD)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Surge Suppression Devices, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 DESCRIPTION

- A. This specification includes surge protective devices that clamps transient voltage, diverts surge current and attenuates high-frequency electrical line noise.
- B. Surge protective devices shall be located at service entrance equipment and where indicated on Drawings or Panelboard Schedules.
- C. Surge protective devices shall be internally mounted within the protected equipment enclosure where indicated on the drawings.
- D. Surge protective devices shall be externally mounted in its own separate enclosure adjacent to the enclosure of the protected equipment where indicated on the drawings.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Engaged in design and manufacturer of specified system for a minimum of five (5) years.
 - 2. SPD manufacturer shall be same as manufacturer of protected equipment.
- B. Design, manufacture, test, and install SPD equipment in compliance with latest edition of following standards:
 - 1. American National Standards Institute and Institute of Electrical and Electronic Engineers:
 - a. ANSI/IEEE-C62.41.1 Guide on the Surge Environment in Low Voltage AC Power Circuits.
 - b. ANSI/IEEE-C62.41.2 Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits.
 - c. ANSI/IEEE-C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits.
 - 2. American National Standards Institute and Underwriters Laboratories:
 - a. ANSI/UL-50 Enclosures for Electrical Equipment.
 - b. ANSI/UL-67 Panelboards.
 - c. ANSI/UL-845 Motor Control Centers.
 - d. ANSI/UL-857 Busway.
 - e. ANSI/UL-891 Dead Front Switchboards.
 - f. ANSI/UL-1283 Electromagnetic Interference Filters.
 - g. ANSI/UL 1449 Fourth Edition, Surge Protective Devices.
 - h. ANSI/UL 1558 Metal Enclosed Low Voltage Power Circuit Breaker Switchgear.
 - 3. National Fire Protection Association:
 - a. NFPA-70 National Electrical Code.
 - b. NFPA-780 Lightning Protection Systems.

- 4. Military Standards
 - a. MIL STD 220C Method of Insertion Loss Measurement.
- 5. Underwriters Laboratories:
 - a. UL 96A Lightning Protection Systems.
- C. Internally mounted SPD equipment shall be UL-1449 and UL-1283 Listed or shall be UL-1449 and UL-1283 component recognized as a surge protective device and electromagnetic interference filter. The protected equipment including the SPD shall be fully tested and certified to the applicable switchgear, switchboard, motor control center, busway and/or panelboard UL Standard.
- D. Externally mounted SPD equipment shall be UL-1449 and UL-1283 listed as a surge protective device and electromagnetic interference filter.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit unit dimensions, weights, mounting provisions, connection details and layout diagrams of each SPD application.
 - 2. Indicate location with respect to protected bus and connection characteristics to bus including material type, length, and routing.
- B. Product Data:
 - 1. Copy of UL 1449 Certification under Category VZCA or VZCA2 with applicable model numbers highlighted and indicating following information:
 - a. Model number.
 - b. Product Type.
 - c. Voltage.
 - d. Phase.
 - e. Voltage protection rating per mode.
 - f. Nominal discharge current rating per mode.
 - g. Maximum continuous operating voltage rating per mode.
 - 2. Standard catalog data sheets indicating:
 - a. Modes of protection.
 - b. Surge current capacity per mode.
 - c. Surge current capacity per phase.
 - d. Short circuit current rating.
 - e. Filter attenuation.
 - f. Diagnostics and monitoring features.
- C. Contract Closeout Information:
 - 1. Operation and Maintenance Data.
 - a. See Section 01 78 23.
 - 2. Warranty.

1.5 WARRANTY

- A. Manufacturer's Limited Ten-Year Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation, and maintenance instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Surge Suppression Devices:

1. Base:
 - a. Eaton/Cutler-Hammer – SPD Series.
2. Optional:
 - a. Square D/Surgellogic – IMA/EMA Series
 - b. Siemens Energy & Automation/Sentron – TPS3 Series.
 - c. General Electric – TR7000 Series.
3. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

A. Environmental Requirements:

1. Operating temperature range shall be minus 40 degrees F to plus 122 degrees F.
2. Relative humidity range shall be 5% to 95% non-condensing.
3. Capable of operation at altitudes up to 16,000 feet above sea level.
4. No audible noise.
5. No appreciable emissions of EMI/RFI fields.

B. General Electrical Requirements:

1. SPD shall be a combination of a solid state, parallel connected surge suppression device and an electromagnetic interference filter.
2. The surge suppression elements shall be Metal Oxide Varistor (MOV).
3. Each MOV shall be provided with individual over-current and thermal over-temperature protection.
4. Surge current shall be equally distributed to all components to ensure equal stressing and maximum performance.
5. Nominal operating voltage: as indicated on the drawings or panelboard schedules.
6. Nominal operating frequency: 60 Hz.
7. Protection modes: provide directly connected suppression elements between line and neutral (L-N), line and ground (L-G), and neutral and ground (N-G).
8. Maximum Continuous Over Voltage (MCOV) shall equal or exceed the following:
 - a. 120/240 volt systems:
 - 1) L-N: 150.
 - 2) L-G: 150.
 - 3) N-G: 150.
 - 4) L-L: 300.
9. Voltage Protection Rating (VPR) shall not exceed the following:
 - a. 120/240 volt systems:
 - 1) L-N: 800.
 - 2) L-G: 800.
 - 3) N-G: 800.
 - 4) L-L: 1200.

10. Nominal discharge current rating: 20kA.
11. Short circuit current rating (SCCR): 200kA.
12. EMI/RFI filter shall provide minimum 50 dB noise attenuation at 100 kHz using MIL-STD-220A insertion loss test method.
13. Diagnostics and monitoring:
 - a. Solid state monitoring of each mode and power loss in any phase.
 - b. Externally visible green/red LED operational status indicator lights for each protection mode. Absence of a green light and presence of red light shall indicate which mode(s) or phase(s) have been damaged.
 - c. Audible alarm with silence switch shall sound if any fault condition occurs.
 - d. Form C dry contacts (1 NO/1 NC) for remote status monitoring. Contacts shall change state if any fault condition occurs.
 - e. Test switch shall test SPD's diagnostics and monitoring system.
 - f. Surge counter with LCD display shall indicate the quantity of transients recorded. Count shall be stored in non-volatile memory. Provide reset pushbutton with two second duration to reset.

C. Specific Electrical Requirements by Application/Location:

1. Internally mounted within branch circuit panelboards:
 - a. UL Labeled as Type 2, or Type 4 investigated by UL for use in Type 2 applications.
 - b. Tested and suitable for use in ANSI/IEEE C62.41 Category B environments.
 - c. Surge current capacity:
 - 1) Maximum surge current rating per phase shall be minimum 100kA.
 - 2) Maximum surge current rating per mode shall be minimum 50kA.
 - d. Factory installed.
 - 1) SPD equipment shall be located within the panelboard enclosure and installed in the factory of the panelboard manufacturer.
 - 2) SPD equipment shall be connected directly to the protected equipment bus on the load side of the main circuit breaker if provided. Neutral and ground leads shall be kept as short and straight as possible. Leads shall be minimum #8 conductors and twisted with a minimum of three twists per foot (ten twists per meter) in the conductors to minimize impedance. Tie wrap twisted conductors at 4-inch spacing.
 - 3) Provide a window in the panelboard cover to allow the diagnostics panels to be visible from outside the enclosure.
 - e. SPD mounting shall not limit the use of through-feed lugs, sub-feed lugs or sub-feed breakers.
 - f. Panelboards shall be capable of being placed back in re-energized service upon removal of the SPD.
2. Externally mounted at service entrance equipment:
 - a. UL Labeled as Type 2.
 - b. Tested and suitable for use in ANSI/IEEE C62.41 Category C environments.

- c. Surge current capacity:
 - 1) Maximum surge current rating per phase shall be minimum 250kA.
 - 2) Maximum surge current rating per mode shall be minimum 125kA.
 - d. Separately mounted in NEMA 1 enclosure. Diagnostics shall be visible from outside the enclosure.
- D. Factory-test SPD equipment prior to shipment, including but not be limited to:
 - 1. Quality assurance checks.
 - 2. MCOV and let-through voltage verification tests.
 - a. MCOV testing shall consist of units burned-in at applicable MCOV for a minimum of one hour.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install SPD equipment per manufacturer's recommendations.
- B. Externally mounted SPD equipment:
 - 1. Mount as close as practical to the protected bus. For panelboard applications, wall mount the SPD immediately adjacent to the circuit breaker serving it.
 - 2. Conductors shall be as short and straight as possible between SPD and circuit breaker.
 - 3. Conductor size shall be minimum #8 in minimum 1 inch 25 mm conduit. Provide larger conductors and conduit as recommended by the manufacturer.
 - 4. Provide a minimum of three twists per foot (ten twists per meter) in the conductors to minimize impedance. Tie wrap twisted conductors at 4-inch 100 mm spacing.
 - 5. Seal conduit after placement of conductors.
- C. Do not energize SPD's until distribution system has been energized, stabilized, and tested.
- D. Disconnect SPD's during distribution system insulation resistance testing.

END OF SECTION

SECTION 26 51 13
BUILDING LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Building Lighting, as indicated, in accordance with provisions of Contract Documents.
- B. Section includes interior luminaires and building mounted exterior luminaires, including luminaire accessories, lamps, LED modules, power supplies, and drivers.
- C. See Section 26 56 00 for exterior luminaires not mounted to building.
- D. Completely coordinate with work of other trades.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C62.41.2 IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000 V and less) AC Power Circuits.
 - 2. ANSI C78.377: Specifications for the Chromaticity of Solid State Lighting Products.
 - 3. ANSI C82.77: Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment.
- B. Federal Communications Commission (FCC):
 - 1. Code of Federal Regulations (CFR), Title 47, Part 18, Industrial, Scientific, and Medical Equipment.
 - 2. Code of Federal Regulations (CFR), Title 47, Part 15 Class B: Radio Frequency Devices, Commercial Rated.
- C. International Electrotechnical Commission (IEC):
 - 1. IEC 61000-3-2: Limits for harmonic current emissions (equipment input current $\leq$ 16 A per phase)
 - 2. IEC 61347-1: General and Safety Requirements for Lamp Control Gear.
 - 3. IEC 61347-2-13: Particular Requirements for DC or AC. Supplied Electronic Control gear for LED Modules.
 - 4. IEC 61547: Equipment for general lighting purposes - EMC Immunity Requirements.
 - 5. IEC 62384: DC or AC Supplied Electronic Control Gear for LED Modules - Performance Requirements.
- D. Institute of Electrical and Electronic Engineers (IEEE):
 - 1. IEEE C62.41-91: Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits.
 - 2. IEEE 1789: Recommended Practice for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers.
- E. Illuminating Engineering Society of North America (IESNA):
 - 1. IES LM-28: Approved Method: Guide for the Selection, Care and Use of Electrical Instruments in the Photometric Laboratory.
 - 2. IES LM-37: Approved Method: Guide for Determination of Average Luminance (Calculated) for Indoor Luminaires
 - 3. ANSI/IES LM-48: Testing Calibration of Locking Type Photoelectric Control Devices
 - 4. ANSI/IES LM-58: Approved Method: Spectroradiometric Measurement Methods for Light Sources.

5. ANSI/IES LM-63: ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information.
6. ANSI/IES LM-72: Approved Method: Directional Positioning of Photometric Data.
7. ANSI/IES LM-75: Approved Method: Goniophotometer Types and Photometric Coordinates.
8. ANSI/IES LM-77: Approved Method: Intensity Distribution Measurement of Luminaires and Lamps Using Digital Screen Imaging Photometry.
9. ANSI/IES LM-78: Approved Method: Total Luminous Flux Measurement of Lamps using an Integrating Sphere Photometer.
10. ANSI/IES LM-79: Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.
11. ANSI/IES LM-80: Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.
12. ANSI/IES LM-82: Approved Method: Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature.
13. ANSI/IES LM-84: Approved Method: Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines and Luminaires.
14. ANSI/IES LM-85: Approved Method: Electrical and Photometric Measurements of High-Powered LEDs.
15. ANSI/IES LM-88: Approved Method: Optical and Electrical Measurements of AC-LED Packages and Arrays or Modules.
16. ANSI/IES LM-90: Approved Method: Measuring Luminous Flux Waveforms for Use in Temporal Light Artifact (TLA) Calculations.
17. ANSI/IES TM-15: Luminaire Classification System for Outdoor Luminaires.
18. ANSI/IES TM-21: Technical Memorandum: Projecting Long Term Lumen Maintenance of LED Light Sources.
19. ANSI/IES TM-25: Technical Memorandum: Ray File Format for the Description of the Emission Properties of Light Sources.
20. ANSI/IES TM-26: Technical Memorandum: Projecting Catastrophic Failure Rate of LED Packages.
21. ANSI/IES TM-27: Technical Memorandum: Standard Format for the Electronic Transfer of Spectral Data.
22. ANSI/IES TM-28: Technical Memorandum: Projecting Long-Term Luminous Flux Maintenance of LED Lamps and Luminaires.
23. ANSI/IES TM-30: IES Method for Evaluating Light Source Color Rendition.
24. ANSI/IES TM-31: Technical Memorandum: Measurement Uncertainty for Lighting Equipment Calibration Using Integrating Spheres.
25. ANSI/IES TM-33: Standard File Format for the Electronic Transfer of Luminaire Optical Data.
26. ANSI/IES TM-35: Technical Memorandum: Projecting Long-Term Chromaticity Coordinate Shift of LED Packages, Arrays, and Modules.
27. ANSI/IES TM-38: Technical Memorandum: Photometric and Electrical Measurements of Tunable-White Solid-State Lighting Products.
28. ANSI/IES LS-2: Lighting Science: Concepts and Language of Lighting.
29. ANSI/IES RP-27: Recommended Practice: Photobiological Safety for Lighting Systems.

- F. National Electrical Manufacturer's Association (NEMA):
 - 1. NEMA SSL1: Electronic Drivers for LED Devices, Arrays, or Systems.
 - 2. NEMA SSL3: High-Power White LED Binning for General Illumination.
 - 3. NEMA SSL7A: Phase Cut Dimming for Solid State Lighting: Basic Compatibility.
 - 4. NEMA 410: Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
- G. National Fire Protection Association (NFPA):
 - 1. NFPA 70: National Electrical Code (NEC)
 - 2. NFPA 101: Life Safety Code.
- H. UL International (UL):
 - 1. UL 1310 Standard for Class 2 Power Units.
 - 2. UL 8750 Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. For continuous pattern luminaires, indicate layout, individual section lengths, and LED/driver module quantities.
 - a. Show details of connections, emergency driver and module placement, corners and extensions, end plates, and mounting. Include pendant or bracket locations and show remote transformers/power supplies/drivers.
 - b. Provide field-measured overall dimensions in wall-to-wall and wall-to-corner applications.
 - 2. Details of luminaire flange, special construction, accessories, and finishes.
- B. Product Data:
 - 1. Identify luminaires by Lighting Equipment Schedule designation.
 - a. For each luminaire, provide cut sheets indicating following information:
 - 1) Name of manufacturer, model, and complete catalog number.
 - a) Include product data details for catalog number references to explain special construction, accessory or finish, and photometric data.
 - 2) Photometric Data:
 - a) Collected by an independent testing laboratory.
 - b) Indicate optical performance developed using methods of Illuminating Engineering Society of North America (IESNA) as follows:
 - (3) Candlepower data presented graphically and numerically, in maximum 10 degree increments.
 - (4) Develop data for up and down quadrants that are normal, parallel, and at 45 degrees to lamp if light output is asymmetric.
 - (5) Zonal lumens stated numerically in 10 degree increments as above.
 - (6) Fixture efficiency.

2. Solid state Luminaires:
 - a. LED Luminaires:
 - 1) Total input wattage.
 - 2) Luminaire voltage.
 - 3) Delivered lumens.
 - 4) Color temperature.
 - 5) Color rendering index (CRI), color fidelity (Rf), color gamut (Rg), and where requested, individual R-values measured in accordance with ANSI/IESNA TM 30 standards.
 - 6) Rated life, measured in accordance with IESNA standards.
 - 7) Total harmonic distortion (THD).
 - 8) Submit in tabular format the characteristics of submitted fixture per the technical information categories of the Lighting Equipment Schedule. Deviations from specified criteria shall be identified by a plus or minus percentage.
 - 9) Submit the rated lumen maintenance life of LED luminaires. Life shall be reported based upon the light source's L70 rating in accordance with IESNA standards.
 - b. LED Drivers:
 - 1) Driver manufacturer and model number.
 - 2) Driver rated life.
 - 3) Driver dimensions.
 - 4) Driver type (0-10V, constant voltage, constant current).
 - 5) If applicable, include lumen management protocols.
 - 6) Dimming range and control device compatibility list.
 - 7) Wiring Diagrams – as needed for special operation or interaction with other systems.
3. Coordinate ballasts/drivers used with lamping/LED modules, lamp sockets, and control devices prior to submitting Shop Drawings.
4. For product substitutions, provide calculations performed in AGI32 in specific spaces as identified by Lighting Designer where product is used.
5. Coordinate luminaires with ceiling construction.
 - a. Confirm clearances and fixture flange compatibility with construction.
- C. Project Information:
 1. Manufacturer's installation instructions.
 2. Warranties.
- D. Refer to Section 01 81 33 - Cyber Security Requirements for required cyber security related submittals.
- E. Contract Closeout Information:
 1. Inventory of driver/module replacement stocks.
 2. At time of Substantial Completion as defined by the Engineer, submit all installation and maintenance tools received from various luminaire vendors clearly and permanently tagged with Manufacturer's name and relevant luminaire type(s) to the Owner's Representative.
 3. Maintenance and Operating Manuals.
 - a. See Section 01 78 23.

- F. Review of shop drawings and product data does not waive the Contractor of their obligations.

1.4 QUALITY ASSURANCE

- A. Where the Lighting Equipment Schedule identifies multiple fixture types using the same manufacturer and product family, the manufacturer and product family shall remain consistent for all fixture types. Final installation shall consist of same design standard or alternate manufacturer's equipment across groupings for consistency of color and quality of light, finishes, aesthetics, and similarity of maintenance procedures.
 - 1. Mixing/matching across groups is unacceptable except where manufacturers do not offer products compliant with specifications for all luminaire types.
 - 2. Mixing/matching across multi-phased projects is unacceptable, except where products have subsequently been discontinued or significantly redesigned in size, appearance, lamping, or gear.
- B. Advise Engineer of discrepancies between luminaire catalog references shown or specified and actual ceiling construction, prior to submission of shop drawings.
 - 1. Failure to do so will require correction at no additional cost.
- C. Coordinate ballasts/drivers used with lamping/LED modules, lamp sockets, and control devices prior to submitting shop drawings.
- D. Each luminaire shall be listed with nationally recognized testing laboratory including but not limited to, UL, CSA, ETL, under UL 1598 and UL 8750, or an equivalent standard from recognized testing laboratory, and manufactured in accordance with NEC.
- E. Materials and installations shall be in accordance with latest revision of National Electrical Code and any applicable Federal, State, and local codes and regulations.
- F. Luminaires shall comply with relevant and current ANSI, CBM, ESTA, FCC, IEC, IEEE, IESNA, NEMA, NFPA, and UL standards and practices.

1.5 WARRANTIES

- A. Manufacturer's Warranty shall be from date of Substantial Completion.
 - 1. Include labor allowance for full cost of component replacement.
 - 2. Provide warranties, as specified, for the following equipment:
 - a. Finish.
 - b. Lenses.
 - c. Housings.
 - d. Lamps.
 - e. Transformers.
 - f. LED Drivers/Power Supplies.
 - g. LED Luminaires.
- B. Warrant LED drivers for a minimum of five years from Date of Substantial Completion.
 - 1. Include labor allowance for full cost of driver installation.
- C. Warrant the luminaire and all of its components to be free from defect in operation or finish for a minimum of five years from the date of Date of Substantial Completion.
 - 1. Warrant LED modules during this period for color and lumen maintenance (percent shift +/- degrees Kelvin).
 - 2. As long as luminaire has been operated within the rated voltage range, Contractor is responsible for cost of materials and labor necessary to repair or replace luminaire.
- D. It is the responsibility of the Contractor to manage warranty issues that may arise.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Luminaires:
 - 1. Base:
 - a. As indicated on Lighting Equipment Schedule.
 - 2. Optional:
 - a. As indicated on Lighting Equipment Schedule.
 - 3. Use catalog numbers listed as a guide only. Follow modifications and other requirements shown or specified.
- B. Lamps/LED Modules:
 - 1. GE Lighting.
 - 2. Osram Sylvania.
 - 3. Philips Lighting.
 - 4. Cree.
 - 5. Sora.
 - 6. Xicato.
- C. Power Supply/Drivers:
 - 1. Osram Sylvania.
 - 2. Philips Advance.
 - 3. Mean Well.
 - 4. eldoLED.
 - 5. Hatch.
 - 6. Lutron.
- D. Emergency LED Drivers:
 - 1. Philips Bodine.
 - 2. Iota.
- E. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Refer to Section 01 81 33 - Cyber Security Requirements for cyber security related product requirements.
- B. Luminaires:
 - 1. Resistant to corrosion and thermal and mechanical stresses encountered in normal application. Provide accessory equipment such as starters, sockets and lampholders, approved by UL and ETL, unless otherwise noted.
 - 2. Electrical components of recessed luminaires shall be accessible and removable through luminaire without having to remove luminaire from ceiling.
 - 3. Thermally protect luminaire.
 - 4. Housings:
 - a. Troffer luminaires: Minimum 22 GA 0.76 mm sheet steel; integral end plates and trim flanges to suit ceiling construction. Provide wire way covers with captive retainers to allow access to electrical components without use of tools.

- b. Downlight luminaires: Minimum 22 GA 0.76 mm sheet steel, or minimum 0.0508 inches 1.29 mm sheet aluminum, unless noted otherwise. Provide auxiliary junction box secured to mounting frame.
 - c. Extruded aluminum housings, where scheduled, shall be at least 1/8 inches 3 mm thick.
 - d. Punch and form housings prior to finishing (post-paint).
 - e. Power Supply/Driver surface shall be in complete contact with housing, having the mounting method designed for efficient conduction of heat.
 - f. Fixture shall be properly heat-sinked to assure LED junction temperature ratings are not exceeded. Manufacturer shall provide ambient operating temperature range for which product is warranted.
- 5. Trim:
 - a. For square and rectangular luminaires, miter and continuously weld corners.
 - b. Miter perimeter inverted T-Bar angles at corners.
 - c. Do not butt or overlap squared ends.
 - d. Finish joints smooth.
- 6. Castings:
 - a. Uniform quality, free from imperfections affecting strength and appearance. Exterior surfaces, if not receiving a finish coat, shall be smooth and match adjacent surfaces. At least one coat of clear methacrylate lacquer shall be applied unless a painted finish is specified.
- 7. Fasteners:
 - a. For aluminum or steel luminaires, fastening hardware shall be zinc-nickel plated, stainless steel, or equivalent.
 - b. For stainless steel luminaires, fastening hardware shall be stainless steel.
 - c. For bronze luminaires, fastening hardware shall be bronze or stainless steel.
- 8. Finishes: As selected from manufacturer's standards unless scheduled otherwise.
 - a. Painted surfaces, except as scheduled otherwise:
 - 1) Manufacturer's standard metal pretreatment and baked or air-dried, light-stabilized enamel finish: acrylic, alkyd, epoxy, polyester, or polyurethane.
 - 2) White finishes shall have minimum 85 percent reflectance.
 - b. Unpainted aluminum surfaces:
 - 1) Interior luminaires: Clear anodic coating, satin finish, except as scheduled otherwise.
 - 2) Exterior luminaires: Clear anodic coating.
- 9. Lens/Louver Frames:
 - a. Extruded aluminum with mitered corners unless scheduled otherwise.
 - b. Hinging or other normal motion shall not cause lens or louver to drop out.
 - c. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.

10. Lenses:
 - a. 100 percent virgin, UV stabilized acrylic.
 - b. The lenses shall be held securely in place but must also be removable to clean and service the luminaire.
 - 1) Luminaires with a spread lens shall also include a lens orientation device to ensure that it is not affected during cleaning or relamping.
 - c. There shall be no light leaks between the lens and the luminaire.
 - d. Acrylic lenses and diffusers shall be properly cast, molded, or extruded to meet the intent of the specified optics, and shall remain free of any dimensional instability, discoloration, embrittlement, or loss of light transmittance for the period of the Manufacturer's warranty.
11. Reflectors:
 - a. High-purity No. 12 aluminum reflector sheet, 0.047 inches 1.45 mm or heavier if specified, free from fabrication or assembly damages. No exposed rivets, springs, or other hardware after installation. Shape reflectors in modified elliptical or parabolic contour to produce no apparent brightness.
 - b. Downlights: Any direct image of the light source shall not be visible in 45 degree zone from nadir.
 - c. Downlight reflector and baffle finishes: First-quality Alzak anodized specular or semi-specular finish of color as specified, unless otherwise noted in Lighting Fixture Schedule.
 - 1) Downlight reflectors shall be securely fastened but also removable for cleaning and relamping.
 - d. Troffer reflector finish: integral reflectors shall be painted white after fabrication and shall have a minimum reflectance value of 90 percent.
12. Gaskets: Provide gaskets at face plates or frames of recessed luminaires which serve as ceiling trim, and which allow interior access. Provide moisture seal gaskets at exterior locations and in other areas designated. Secure frames to luminaire bodies with screws or other means, to result in tight installation, without light leaks. See Lighting Equipment Schedule for other types of seals and gaskets.
13. Ventilation: Provide ventilation openings of adequate size and quantity to permit operation of lamps/LED modules and power supply/driver without affecting rated output or life expectancy.
14. Lamp Holders:
 - a. Position holders so that lamps are in optically correct relation to luminaire components.
 - b. LED Module/Array Mountings:
 - 1) Dedicated quick-connect wiring accessories for field replaceable LED modules and arrays.
 - 2) LED modules and arrays shall be secured by screws or clips to assure proper connection to heat sink while permitting field replacement.
15. Wiring:
 - a. Factory wire luminaire to be compatible with project electrical and controls systems.
 - b. Luminaires shall comply with NEC requirements and be supplied with a disconnecting means accessible to qualified persons before servicing or maintaining.

- c. Power supplies and LED modules, unless otherwise specified, shall be field replaceable and shall be serviceable while the fixture is in its normally installed position.

16. Mounting Accessories:

- a. Provide appropriate mounting accessories for each luminaire, compatible with various structural conditions encountered. Provide fastening clips (seismic clips) for luminaires supported from framing members of suspended ceilings.
- b. Luminaires with adjustable beam angles shall have a locking device to ensure that the beam distribution is not affected during relamping or cleaning.
- c. Recessed Luminaires:
 - 1) Plaster frames: Provide frames for luminaires installed in gypsum board and concealed suspension system ceiling tile. Make frames of non-ferrous metal or suitably rustproof after fabrication.
 - 2) Baffles and gaskets: As required to prevent light leakage.
 - 3) Flanged luminaires are required in all ceiling systems unless otherwise noted in Lighting Equipment Schedule.
 - 4) Coordinate fixture flange with ceiling system and ceiling grid contractor.
- d. Luminaire Suspension Material:
 - 1) Unfinished spaces: 13 mm 1/2 inches minimum diameter pendant, unless otherwise noted.
 - 2) Finished spaces: Unless otherwise noted, provide manufactured cable or stem and outlet box canopy; contemporary design with swivel self-aligning features; size canopy to cover outlet box; finished to match luminaire. Coordinate pendant location with ceiling tiles/ceiling grid and submit coordinated mounting accessories as part of Product Data submission.
 - a) Provide luminaires mounted on suspended ceiling grids with outlet box designed for grid mounting with direct cord entry.
- e. Mechanical Safety: Unless otherwise specified, retain luminaire closures (lens doors, trim frame, hinged housings, etc.) in secure manner by captive screws, chains, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- f. LED luminaires shall be manufactured specifically for their respective light source with dedicated electrical connections and with power supplies integral to the fixture, except where remote devices are specified. Assemblies designed to retrofit incandescent luminaires are prohibited except when specifically indicated for use in decorative luminaires designed for LED retrofit lamps.
- g. Design luminaires for lamps specified.
- h. Fit trims, canopies, and escutcheons snugly and securely to the ceiling and/or wall so that no light leaks occur and so that no gaps or uneven waves are evident.

C. LED Modules:

- 1. Color temperature measurement shall have a maximum MacAdam Ellipse boundary of 3 SDCM unless otherwise specified in the Lighting Equipment Schedule.

2. LED light output and efficacy shall be measured in accordance with the following standards:
 - a. IES LM-79
 - b. IES LM-85
 - c. IES LM-88
 - d. IES TM-38
 3. LED life and lumen maintenance shall be measured in accordance with the following standards:
 - a. IES LM-80
 - b. IES LM-84
 - c. IES TM-21
 - d. IES TM-26
 - e. IES TM-28
 - f. IES TM-35
 4. Rated minimum L70 life of 50,000 hours at 25 deg C.
 5. The individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in a light output loss of the entire luminaire.
- D. Power Supplies and Drivers:
1. General:
 - a. Comply with UL and ANSI specifications. Enclosure shall display approval label for compliance with UL standards.
 - b. Contractor shall verify required voltage, frequency, and power factors.
 - c. Comply with US Federal Efficiency Laws.
 - d. Equipment shall not contain PCBs.
 - e. Manufacturer shall have a ten year history of producing electronic ballasts and/or drivers for the North American market.
 2. LED Drivers:
 - a. LED Driver types.
 - 1) 4-Wire (0V to 10V DC Voltage Controlled) Dimming Driver.
 - 2) 2-Wire Switched Driver.
 - b. General.
 - 1) LED dimming shall be equal in range and light quality to a commercial grade incandescent dimmer.
 - a) Free from perceived flicker or visible stroboscopic flicker.
 - b) Smooth and continuous change in level (no visible steps in transitions).
 - c) Stable when input voltage conditions fluctuate.
 - d) Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
 - 2) Driver shall operate from 60 Hz input source of 120V through 277V with sustained variations of +/- 10 percent (voltage and frequency) with no visible change in light output.

- 3) Total Harmonic Distortion less than 20 percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.
- 4) Driver shall have a Power Factor greater than 0.90.
- 5) Driver output shall be regulated to +/- 5 percent across published load range.
- 6) Driver shall have a Class A sound rating.
- 7) Driver shall have a minimum operating temperature of -20 deg C -4 deg F.
- 8) Driver shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
- 9) Driver output ripple current shall be less than 15 percent measured peak-to-average, with ripple frequency greater than 100 Hz.
- 10) Driver must limit inrush current and meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 Amps² – seconds.
- 11) Driver shall withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A for Transient protection.
- 12) Driver shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
- 13) Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements to maintain or deliver improved performance:
 - a) Adjustment of forward LED voltage, supporting 3V through 55V.
 - b) Adjustment of LED current from 200 mA to 1.05A at the 100 percent control input point in increments of 1 mA.
 - c) Adjustment for operating hours in lumen-maintenance drivers to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the luminaire and deliver up to 20 percent energy savings early in the life cycle.
- 14) Driver: UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.
- 15) Drivers shall have a rated life greater than or equal to 150,000 hours.
- 16) LED engine must be compatible with type of driver and perform within the dimming range specified in the Lighting Equipment Schedule. Coordinate prior to submission of shop drawings.

- 17) If driver is remote-mounted, provide maximum allowable distances for secondary wire runs to luminaires. Driver shall be housed in NEMA enclosures so rated for the power supply and located in code-compliant, sound-isolated, well-ventilated, easily accessible areas. Size wire according to run length and LED Manufacturer's size and distance-of-run requirements and in accordance with code requirements.
- 18) LED power supplies shall be suitably sized to accommodate the LED array consistent with industry standards, including IEC standard 60929 Annex E.
- 19) Driver shall be available in an all metal-can construction for optimal thermal performance.
- 20) Driver shall be provided with integral color-coded connectors.
- 21) Provide with mounting hardware as required.

c. Light Quality.

- 1) Over the entire range of available drive currents, driver shall provide step-free, continuous dimming. Driver shall respond similarly when raising.
 - a) The luminaire shall be capable of continuous dimming over a range of 100 percent to 10 percent of rated lumen output unless otherwise noted on Lighting Equipment Schedule.
 - (1) Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
- 2) Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.
- 3) Drivers to track evenly across multiple fixtures at all light levels and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.
- 4) Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index. At all points within the dimming range from 100 to 0.1 percent, luminaire shall have:
 - a) LED dimming driver shall provide continuous step-free, flicker-free dimming similar to incandescent source.
 - b) Flicker index shall be less than 5 percent at all frequencies below 800 Hz.

d. Control Input.

- 1) 4-Wire (0V to 10V DC Voltage Controlled) Dimming Drivers.
 - a) Must meet IEC 60929 Annex E for General White Lighting LED drivers.
 - b) Connect to devices compatible with 0V to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each control output based on voltage drop and control capacity.

- c) Must meet ESTA E1.3 for RGBW LED drivers.
- d) Driver shall utilize fully isolated 0V to 10V control inputs. Input shall be protected from line voltage miswire and shall be immune and output-unresponsive to induced AC voltage on the control leads.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate luminaire mounting and trim type with architectural reflected ceiling plans, suspended ceiling grid and ceiling tile specification, and room finish schedules prior to submission of shop drawings.
 - 1. Advise Engineer of any discrepancies. Failure to do so will result in correction at no additional cost to Owner.
- B. Coordinate required above-ceiling clearances of recessed luminaires with ductwork and piping.
 - 1. In exposed ceiling areas, coordinate luminaire locations, mounting heights, and supports with other trades.
- C. Coordinate, review and approve fixture locations shown on acoustical ceiling shop drawings prior to submission.
 - 1. Notify Engineer of any discrepancies with lighting plans and review coordinated ceiling shop drawing review comments.
- D. Coordinate lighting control devices with fixture power supplies and drivers. Advise Engineer of discrepancies prior to submission of shop drawings. Failure to do so will result in correction at no additional cost to Owner.

3.2 INSTALLATION

- A. Strictly follow the manufacturer's directions for installation and assembly of lighting equipment. Luminaire installation shall include suitable lamps and required equipment, materials, parts, attachments, devices, hardware, cables, supports, frames, and brackets necessary for complete and fully operating installation.
- B. Locate luminaires in accordance with architectural reflected ceiling plans.
 - 1. Where field conflicts exist, coordinate relocation of equipment with Lighting Designer.
- C. Mount luminaires at heights indicated in Section 26 00 10 and as indicated on drawings. Where field conflicts exist, or mounting height is not stated, coordinate with Lighting Designer.
- D. Verify structural support to ensure luminaires are supported to maintain level and alignment.
- E. Support luminaires weighing more than 55 pounds directly from structure with approved hangers.
- F. Ground luminaires per NEC Article 410.
- G. Provide exit sign at exit locations, with mounting type, number of single or double faces, and directional arrows as required for exiting.
 - 1. Where exit signs are pendant mounted, provide manufacturers pendant mount stem kit.
 - 2. Provide proper structural support for junction box and exit sign.
- H. Align horizontally positioned fluorescent lamps or LED circuit boards of luminaires within a single room in same direction unless indicated otherwise. Align the luminaires so that the horizontal bar or element within the luminaire is parallel to the long axis of the space unless otherwise noted. Orientation of luminaires within similar spaces shall remain consistent.

- I. Seal luminaires for wet locations (i.e. knock-outs, pipe and wire entrances) to prevent water wicking.
- J. Luminaire finishes which are disturbed in any way during construction shall be touched up or refinished in a manner satisfactory to the Engineer and which does not void warranty.
- K. Install reflector cones, louvers, baffles, lenses, trims, and other decorative elements after completion of ceiling tile installation, plastering, painting and general cleanup.
- L. Recessed Luminaires:
 - 1. Provide mounting accessories as required for field conditions. Coordinate above ceiling conditions with other trades.
 - 2. Verify mounting details for each space; provide correct luminaire flange type and finish for each installed ceiling system.
 - 3. Support luminaire independently from ceiling system so there is no deflection of ceiling system caused by luminaires.
 - 4. Acoustical Tile Ceilings:
 - a. Fasten luminaires supported by suspended ceiling systems to ceiling framing system with hold-down clips, each capable of supporting the weight of the luminaire.
 - b. In addition to hold-down clips, provide either one of the following:
 - 1) Support hold down clips with 12 GA minimum steel wires connected to structure.
 - 2) Provide two, 12 GA minimum steel wires connected from opposite, diagonal corners of the luminaire housing to structure.
 - c. Additional seismic requirements:
 - 1) For installations located in seismic design categories C, D, E or F, provide the following supplementary supports based on the weight of the individual luminaire:
 - a) Less than 10 pounds: provide one 12 GA minimum slack steel wire connected from the luminaire housing to structure.
 - b) Between 10 and 55 pounds: provide two 12 GA minimum slack steel wires connected from opposite, diagonal corners of the luminaire housing to structure.
 - c) Greater than 55 pounds: provide an independent support directly connection to structure (no slack wires are required).
 - 2) These requirements are in addition to the supplementary hanger wires connected to the ceiling suspension system within 3 inches of each corner of each light fixture installed in categories D, E, or F.
 - d. Locate luminaires in exact center of tile and align linear luminaires with edge of ceiling grid unless indicated otherwise. Relocate misplaced luminaires and replace damaged ceiling materials.
 - e. Support downlights and exit signs with rails spanning between runners of suspension system.

5. Gypsum Wallboard Ceilings:
 - a. Support troffers in gypsum board ceilings from structural framed openings with adjustable lugs on side of luminaire or yoke mounting as recommended by luminaire manufacturer.
 - 1) Where structural framed openings are not provided, luminaires must be independently supported from structure.
 - 2) Additional seismic requirements:
 - a) For installations located in seismic design categories C, D, E or F, provide the following supplementary supports based on the weight of the individual luminaire:
 - (1) Less than 10 pounds: provide one 12 GA minimum slack steel wire connected from the luminaire housing to structure.
 - (2) Between 10 and 55 pounds: provide two 12 GA minimum slack steel wires connected from opposite corners of the luminaire housing to structure.
 - (3) Greater than 55 pounds: provide an independent support directly connection to structure (no slack wires are required).
 - 3) Suspended grid systems for gypsum board ceilings are not approved structural support systems for luminaires.
 - b. Support downlights and troffers in metal pan and gypsum board ceilings from plaster frames.
 - c. Provide access panels for recessed luminaires that require access for maintenance when such access is not provided for in design of luminaire.
 - 1) See Section 26 00 10.
 - d. Coordinate trimless or flangeless luminaires with other trades to achieve a trimless or flangeless installation.
 - 1) Provide a level 5 finish at drywall or plaster ceilings and walls unless otherwise directed by Engineer.
6. Use unwired or pre-wired luminaires as required.
 - a. Do not use pre-wired luminaires for through-wiring unless UL approved for the purpose.
7. Wherever recessed luminaires are installed in insulated ceiling systems, it is the responsibility of the Contractor to construct above-ceiling enclosures around non-insulation-contact-rated equipment to provide at least 3 inches of airspace on each side of the luminaire.
8. Trims shall fit plumb and flush with ceiling or wall surface.
9. There shall be no light leak around interface between lens door or holder trim flanges and ceiling or wall.
10. Field apply silicone sealant between luminaire housing flange and hard ceiling. Application of sealant shall not prohibit opening of door frame or servicing of luminaire.

M. Surface-Mounted and Pendant-Hung Luminaires:

1. Attach surface-mounted lighting luminaires to ceiling system with positive clamping devices that completely surround supporting members.
 - a. Attach safety wires between clamping device and adjacent ceiling hanger or to structure above.

- b. Do not exceed design carrying capacity of supporting member for luminaire load.
- c. Additional seismic requirements:
 - 1) For installations located in seismic design categories C, D, E or F, provide the following supplementary supports:
 - a) Support pendant-hung lighting luminaires directly from structure above, using 9 GA steel wire, without relying on ceiling suspension system for support.
- 2. Pierce ceiling material for hangers and outlet boxes as required.
- 3. Do not remove ceiling material above surface-mounted luminaires.
- 4. Hang luminaires plumb with continuous rows in alignment.
- 5. Unless otherwise noted, suspend luminaires in each room or area at same height regardless of varying clear height conditions.
 - a. Provide stem lengths as required.
 - b. The canopy portion of a pendant-hung luminaire installed in a finished space with an exposed-to-structure ceiling shall be installed directly to the bottom of the structural deck unless otherwise noted on the plans. Extending Unistrut, all-thread or similar means from the exposed deck down to a lower mounting height in order to suspend the box/canopy is not acceptable. Notify Engineer immediately if on-site conditions will result in a mounting conflict.
- 6. Cord of pendant-hung fixtures must enter directly into approved wiring box without passing through plenum, in accordance with NEC.
- 7. Provide suspended luminaires with flexible cord.
 - a. Flexible cord shall connect to a junction box located directly above luminaire feed point.
 - b. Flexible metal conduit and luminaire whips are not allowed for suspended luminaires.
 - c. Trim cords to length and attach to suspension cable at regular intervals.
 - d. Do not coil flexible connections.
- 8. Surface or pendant luminaires mounted end-to-end shall have flat end caps to assure flush alignment and shall be UL listed for through wiring.
- 9. In exposed ceiling areas, install drivers and auxiliary equipment non-integral to luminaire in accessible, permanently installed NEMA-rated metal cabinets or housings. Field paint exposed cabinets or housings to match adjacent surfaces.
- 10. Provide pendant-hung cylinder luminaires with swivel hangers which allow luminaire to swing in any direction but not permit stem to rotate.
- 11. In mechanical, electrical and storage spaces, pendant-mounted luminaires, not in continuous rows, shall be supported by conduit or metal channel, similar to Unistrut, and All Thread.
 - a. Pendant-mounted luminaires in continuous rows shall be fastened to each other or mounted on continuous metal channel.
 - b. Provide alignment clips on linear luminaires mounted in continuous rows.
- 12. Contractor shall provide and/or coordinate additional bracing in wall or above ceiling as required to support fixture in accordance with manufacturer's recommendations.

N. Continuous Luminaire Patterns:

1. Fasten sections together for continuously aligned appearance, with no dimpling or light leakage.
 - a. Provide end extensions where required.
2. Where luminaires run continuously around inside or outside corners, provide prefabricated illuminated corner pieces.
 - a. Run luminaire lenses, baffles, or louvers continuously with luminaire.
 - b. Miter or fan at corners as directed.
3. Where lenses are used, open gaps shall not be visible.
 - a. Solid-state luminaires shall utilize mitered or rabbited lenses to prevent direct view of modules.
 - b. Maximum visible gap between the edge of lens and the end of luminaire trim is 1/16 inches 1.6 mm, and not allow direct view of solid state modules.
4. Only where continuous runs do not end at a wall or fascia, provide a finished end plate, with no visible holes and concealed fasteners.
5. Provide a continuous light appearance over total length of assembly.
 - a. The luminaire shall run continuously wall-to-wall or wall-to-corner without a gap at either end of the fixture when located adjacent to a wall or corner. The maximum permitted non-illuminated length at either end shall not exceed 6 inches.
6. It is the responsibility of the Contractor to provide field held dimensions to the luminaire manufacturer. Field held dimensions shall be used to produce shop drawings. The contractor is responsible for the accuracy of the dimensions used.
7. Cove luminaires in architectural coves shall be installed continuously with no visible gaps between luminaires.
8. Coordinate installation and requirements of undercabinet luminaires with casework installation.
 - a. Provide separate segments of luminaires if luminaires cannot run continuously beneath cabinet.
 - b. Conceal wiring and conduit to luminaires.

3.3 COMMISSIONING

- A. Coordinate lighting operations, including support from Luminaire and Controls Manufacturers, with commissioning and controls.
- B. Synchronize fully functional lighting and lighting controls systems to address lighting operation in complete and code compliant manner.
- C. Provide documentation related to commissioning, including record drawings identifying luminaire control loops and addresses with respect to specific luminaire types and Initial Preset Schedule Spreadsheet.

3.4 ADJUSTABLE FIXTURES

- A. Aiming shall occur upon Substantial Completion of project including, but not limited to, installation of artwork, millwork, furniture, and plantings.
- B. Aim adjustable fixtures as directed. Make final adjustments in presence of Lighting Designer.
- C. Perform this work at night, outside of normal working hours, with no light from stray sources.
- D. Use light meter to obtain as even a distribution as possible.
- E. Aiming shall occur upon substantial completion of project including, but not limited to, installation of artwork, millwork, furniture, and plantings.

- F. Coordinate a time with Engineer and Owner, to make final adjustments to aiming.
- G. Provide ladders, scaffolding, lifts, and tools required for accessing and aiming fixtures, and coordinate this activity based on site availability of Lighting Designer.

3.5 ADJUSTING, RELAMPING AND CLEANING

- A. Perform final focusing of adjustable luminaires in presence of Owner's Representative, including times outside regular working hours. Furnish ladders scaffolding and rigging, as required, for focusing and adjustment of luminaires.
- B. Replace inoperable luminaires prior to final acceptance.
- C. Replace LED modules and LED arrays if any individual module is not properly functioning.
- D. Replace noisy and malfunctioning luminaires prior to final acceptance.
- E. Replace luminaires, drivers, or control devices where necessary to eliminate strobing and flicker.
- F. Align luminaires and remove paint splatters, dirt, and debris.
- G. Touch up any visible damages to luminaire finish.
- H. Wipe clean luminaire reflectors, lenses, and housings after installation.
- I. Install luminaires with caution to avoid fingerprints or smudges on surfaces of louvers and downlight reflectors.
 - 1. Use cleaning materials and methods that will not damage finish.
 - 2. Where fingerprints or smudges cannot be adequately removed, replace affected luminaire.
- J. Install architectural cove luminaires after cove has been painted.
 - 1. Vacuum construction debris from cove to ensure a dust-free reflector surface prior to date of Substantial Completion.

3.6 SPECIAL PROTECTION

- A. Remove protective covers immediately prior to date of Substantial Completion.

3.7 CLOSEOUT ACTIVITIES

- A. Refer to Section 01 81 33 - Cyber-Security Requirements for cyber security related closeout requirements.

3.8 FIELD MODIFICATIONS STOCK

- A. To facilitate the addition of extra exit signs due to unforeseen deficiencies in satisfying life safety egress requirements, provide the following:
 - 1. 5 percent of each exit sign type.

3.9 REPLACEMENT STOCK

- A. Warranty replacements are not to be taken from replacement stock.

END OF SECTION

SECTION 27 10 00
STRUCTURED CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for the structural cabling system such as:
 - a. Cabinets, racks, frames and enclosures.
 - b. Patch panels.
 - c. Cable management and cable pathways.
 - d. Horizontal cabling.
 - e. Patch cords.

B. Related Sections include but are not necessarily limited to:

1. Section 07 84 13 – Penetration Firestopping.
2. Section 26 05 00 - Electrical - Basic Requirements.
3. Section 26 05 26 - Grounding and Bonding.
4. Section 26 05 33 - Raceways and Boxes.
5. Section 26 05 36 - Cable Tray.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Building Industry Consulting Service International (BICSI).
2. Electronics Components Industry Association (ECA):
 - a. 310, Cabinets, Racks, Panels and Associated Equipment.
3. National Electrical Manufacturers Association (NEMA):
 - a. WC 66, Standard for Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables (With Or Without An Overall Shield) For Use In LAN Communication Wiring Systems.
4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
5. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
 - a. 568-C.0, Generic Telecommunications Cabling for Customer Premises.
 - b. 568-C.1, Commercial Building Telecommunications Cabling Standard.
 - c. 568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
 - d. 569-C, Telecommunications Pathways and Spaces.
 - e. 606-B, Administration Standard for Telecommunications Infrastructure.
 - f. 607-B, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

B. Qualifications:

1. Telecommunications Contractor:
 - a. Shall be regularly and professionally engaged in the business of the applications, installation, and testing of telecommunications systems and equipment.

- b. Include three references of similar scope jobs completed in the last two years.
 - c. Supervisors and installers shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level.
 - d. In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have:
 - 1) A minimum of five years experience in the installation of the specified copper and fiber optic cable and components.
 - 2) Factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.
2. Manufacturer:
- a. Company specializing in manufacturing products specified in this Section with minimum 10 years documented experience in the manufacturing, assembly, and factory testing of components which comply with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3.

1.3 SYSTEM DESCRIPTION

- A. The building telecommunications cabling and pathway system shall include:
 - 1. All permanently installed horizontal cabling.
 - 2. Horizontal pathways.
 - 3. Work area pathways.
 - 4. Telecommunications outlet assemblies.
 - 5. Cabinets.
 - 6. Conduit.
 - 7. Raceway.
 - 8. Patch panels.
 - 9. Terminating and interconnecting cabling necessary to transport voice and data between equipment items in a building.
- B. All components required for the above shall be provided for a fully tested operational system per the latest TIA/EIA/ANSI Standards.
- C. Provide and install all components per this Specification for the Structured Cabling System.
- D. Active equipment including switched hubs, routers, data switch(es) for fiber/copper shall be provided by others under a separate contract.
- E. Patch cords connected to active equipment shall be installed by others.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide product technical data including:
 - a. Submittal data for all products specified in PART 2 of this Specification.
 - b. See Specification Section 26 05 00 for additional requirements.
 - 2. Fabrication and/or layout drawings, sealed and approved by a registered communications distribution designer (RCDD):
 - a. Building area drawings:
 - 1) Drop locations and cable identifications in accordance with TIA-606.

- b. Telecommunications space drawings:
 - 1) Telecommunication rooms plan views, pathway layout, mechanical/electrical layout, and cabinet, rack, backboard and wall elevations.
 - c. Typical detail drawings:
 - 1) Faceplate labeling, faceplate types, and firestopping.
 - 3. Certificates:
 - a. Telecommunications Contractor and Installers qualifications.
 - b. Key Personnel qualifications.
 - c. Manufacturer qualifications.
 - 4. Test reports:
 - a. Testing plan and procedures.
 - b. Telecommunications cabling test results.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to installation.
 - 1. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.
 - 2. Components shall be UL or third-party certified.

2.2 EQUIPMENT CABINET

- A. Floor mounted enclosure to mount active and passive network equipment in a horizontal configuration.
 - 1. 4 post enclosed.
 - 2. Lockable full height front perforated single hinged door.
 - 3. Lockable full height rear split hinge doors.
 - 4. Two horizontal side panels on each side.
 - 5. 42 RU of active and passive equipment.
 - 6. Adjustable equipment rails.
 - 7. Full height PDU bracket and PDU.
 - 8. Enclosure overall dimensions 81 IN high, 32 IN wide, 40 IN deep.

2.3 TELECOMMUNICATIONS OUTLET BOXES

- A. Electrical boxes for telecommunication outlets shall be 4-11/16 IN square by 2-1/8 IN deep with minimum 3/8 IN deep single or two gang plaster ring as required.
 - 1. Provide a minimum 1 IN conduit from each outlet box to the telecommunication cabinet.

2.4 EQUIPMENT MOUNTING BACKBOARD

- A. Plywood backboards shall be provided where indicated on the drawings.

2.5 PATCH PANELS

- A. Patch panels mounted in equipment racks with sufficient ports to accommodate all installed cable plus 25% spare:
 - 1. Copper Patch Panel:
 - a. Modular jack (2U maximum), with rear mounted type 110 insulation displacement connectors. Quantity of ports as indicated on the drawings.
 - b. Panel shall have incoming cable strain relief and cable management guides.
 - c. Jack pin/pair configuration shall be T568B.
 - d. Jacks shall be unkeyed.
 - 2. Fiber Optic Patch Panel:
 - a. Panel shall accommodate quantity of single mode duplex connectors as indicated on the drawings.
 - b. Panel shall have cable management tray, incoming cable strain relief and cable management guides.
 - c. Connectors shall be duplex LC.
 - d. Connectors shall be unkeyed.
 - e. Provide dust covers for unused connectors.

2.6 HORIZONTAL CABLING SYSTEM

- A. Horizontal Copper Cable:
 - 1. Category 6.
 - 2. Cable shall be label-verified.
 - 3. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.
 - 4. Conductors shall be solid untinned copper 24 AWG.
 - 5. Cable shall be rated CMP per NFPA 70.
- B. Telecommunications Outlets:
 - 1. General wall and desk outlet plates shall come equipped with two modular jacks.
 - 2. Wall telephone outlet plates shall come equipped with one modular jack type.
 - 3. Modular jacks shall be the same category as the cable they terminate.
 - 4. Modular copper jack pin/pair configuration shall be T568B.
 - 5. Modular jacks shall be unkeyed.
 - 6. Wallplates:
 - a. Brushed stainless steel.
 - 7. Outlet assemblies used in the premises distribution system shall consist of modular jacks in outlet assemblies mounted in single or double gang covers as specified in this Section and as indicated on the Drawings.

2.7 LABELING AND COLOR CODING

- A. Labels shall be developed by the contractor and approved by the Owner.
 - 1. Labels shall be machine printed on opaque or clear tape, stenciled onto adhesive labels.
 - 2. Handwritten labeling is unacceptable.
- B. Cable and Jacks:
 - 1. Data: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown.
- B. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be coordinated with the local communications provider(s).
- C. Components shall be labeled in accordance with TIA/EIA/ANSI 606.
- D. Penetrations in fire-rated construction shall be firestopped.
- E. Wiring shall be installed in accordance with TIA/EIA/ANSI Standards.
 - 1. Wiring, and terminal blocks and outlets shall be marked in accordance with TIA/EIA/ANSI 606.
- F. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with AC power cables.
- G. Equipment Cabinets:
 - 1. Cabinets shall be bolted to the floor.
 - 2. Cable guides shall be bolted or screwed to racks.
 - 3. Cabinets shall be installed level.
- H. Rack Mounted Equipment: Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.
- I. Pathway System:
 - 1. Provide in accordance with TIA 569 and NFPA 70.
 - 2. Provide conduits in accordance with 26 05 33 - Raceways and Boxes.
 - 3. Provide grounding of raceways in accordance with TIA 607 and NFPA 70.
- J. Unshielded Twisted Pair Patch Panels:
 - 1. Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus 25% spares.
 - 2. Cable guides shall be provided above, below and between each panel.
- K. Fiber Optic Patch Panels:
 - 1. Patch panels shall be mounted in equipment racks with sufficient connectors to accommodate the installed cable plant plus 25% spares.
 - 2. Cable guides shall be provided above, below and between each panel.
- L. Horizontal Distribution Cable:
 - 1. Cable pulling tension shall not be exceeded.
 - a. 110N (25 LBF) for copper cabling.
 - 2. Cable shall not be stressed such that twisting, stretching or kinking occurs.
 - 3. Cable shall not be spliced.
 - 4. All horizontal cable shall be installed in conduit.
 - 5. Cable shall not be run through structural members or in contact with conduits, pipes, ducts, or other potentially damaging items.
 - 6. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 IN shall be maintained when such placement cannot be avoided.
 - 7. Cables shall be terminated; no cable shall contain unterminated elements.

8. Minimum bending radius shall not be exceeded during installation or once installed.
 9. Only fabric hook and loop fasteners shall be used to wrap cables, 1/2 IN width minimum. Plastic or nylon cable ties shall not be used.
- M. Telecommunications Outlets:
1. Faceplates: As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.
 2. Cables:
 - a. Unshielded twisted pair cables shall have a minimum of 12 IN of slack cable loosely coiled into the telecommunications outlet boxes.
 - b. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.2 TERMINATION

- A. Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles.
1. Manufacturer's minimum bending radius shall not be exceeded.
 2. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.
 3. Unshielded Twisted Pair Cable:
 - a. Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels.
 - b. No cable shall be unterminated or contain unterminated elements.
 - c. Pairs shall remain twisted together to within the proper distance from the termination as specified in the TIA/EIA/ANSI 568B Series.
 - d. Conductors shall not be damaged when removing insulation.
 - e. Wire insulation shall not be damaged when removing outer jacket.
 4. Fiber Optic Cable:
 - a. Each fiber strand shall be terminated with appropriate connectors.
 - b. No fiber strands shall be unterminated or contain unterminated elements.

3.3 GROUNDING

- A. Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with TIA/EIA/ANSI J-STD-607.
1. Equipment racks shall be connected to the electrical safety ground.

3.4 LABELING

- A. All cables will be labeled using color labels on both ends per TIA/EIA/ANSI 606.
- B. All workstation and patch panel connections will be labeled using color coded labels per TIA/EIA/ANSI 606.

3.5 TESTING

- A. Testing shall conform to the TIA/EIA/ANSI Standards for all test parameters.
1. All test data sheets shall be downloaded from the tester, printed out and provided to the Owner.
 2. Provide Owner with all test results as Electronic Documents (in portable document format, PDF files) by Electronic Means.
 3. Tester shall be capable of testing parameters for the warranted system.

- B. Materials and documentation to be furnished under this Specification are subject to inspections and tests.
 - 1. All components shall be terminated prior to testing.
 - 2. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.
- C. Category 6Circuits:
 - 1. Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA-568-C.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.
 - 2. Cables which contain failed circuits shall be replaced and retested to verify the standard is met.

END OF SECTION

SECTION 28 23 00
VIDEO SURVEILLANCE (FIXED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. Section 27 10 00 "Structured Cabling System"

1.2 DESCRIPTION

- A. This Section includes Video Surveillance System (VSS) equipment consisting of the necessary infrastructure (raceways, boxes and wiring) to support new video surveillance cameras indicated on the drawings as well as cameras, lenses, mounts, VMS, NVR's, viewing stations programming and installation thereof.
- B. The Video Surveillance System described herein shall pertain only those cameras designated for the rest areas indicated on the drawings.

1.3 GENERAL CONDITIONS

- A. Documentation to be submitted by Contractor upon completion of system installation:
 - 1. Upon completion of installation, the Contractor shall prepare Record (or "as-built") drawings of the system. Drawings shall be AutoCAD (2010 or more recent). Drawings shall include:
 - a. Floor and Site plan(s) indicating exact device locations, panel terminations, cable routes, and wire numbers as tagged and color-coded on the cable tag.
 - b. Point-to-point wiring diagrams of each type of device
 - 2. Documentation of software configuration, changes or additions.
 - 3. Operation and maintenance manuals: Two (2) sets.
 - a. All approved Submittals
 - b. Manufacturers Operation and maintenance documents for each component

1.4 DEFINITIONS

- A. AGC: Automated gain control
- B. IP: Internet protocol.
- C. LAN: Local area network.
- D. NVR: Network Video Recorder
- E. PC: Personal computer.
- F. POE: Power over Ethernet
- G. PTZ: Pan-tilt-zoom.
- H. RAID: Redundant array of independent disks.
- I. TCP: Transmission control protocol - connects hosts on the Internet.
- J. UPS: Uninterruptible power supply.
- K. VMS: Video Management System
- L. VSS: Video Surveillance System
- M. WAN: Wide area network.

1.5 SUBMITTALS

- A. Proposal Delta: It is the duty of the contractor to provide a working system. Any omissions or errors or differences between this document and the contractor's submitted proposal shall be clearly outlined in a separate document labeled "[COMPANY NAME] Proposal Deltas".
- B. Qualification Statements
 - 1. Manufacturer
 - a. Submit confirmation and details of manufacturer's warranty, extended warranty, and replacement policies.
 - b. Submit proceeding 3 years financial statements for the equipment manufacturer.
 - c. Submit list of available manufacturers provided, fee based professional services available to the contractor or the owner including but not limited to: training, installation, commissioning, remote diagnostics and integration with 3rd party software and hardware systems.
 - 2. Contractor
 - a. General:
 - 1) This scope of work must be followed by the winning bidder, sub-contractor and Lessor.
 - 2) All requirements must be adhered to, including notification of project award, discussion of the project prior to start and providing a project schedule.
 - b. Documentation:
 - 1) Submit confirmation that contractor is licensed to install video surveillance and security equipment as required by the authority having jurisdiction.
 - 2) Submit history of contractor certification(s) for items in this section.
 - 3) Submit references with contact information where contractor has installed items in this section.
 - 4) Submit confirmation that installer who will install this equipment or who will supervise installation of this equipment has received manufacturer training and is certified by the manufacturer on this equipment and that the training the installer received is current.
- C. Product Data: Submit manufacturer technical specifications, typical installation drawings, system overview drawings and sample images of items included in this section.
- D. Shop Drawings: For video surveillance system and accessories. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Include scaled drawings for master station that detail built-in equipment.
 - 3. Wiring Diagrams: For power, signal, and control wiring.
 - a. Identify terminals to facilitate installation, operation, and maintenance.
 - b. Single-line diagram showing interconnection of components.
 - c. Cabling diagram showing cable routing.
- E. Equipment List: Complete bill-of-materials indicating all products being furnished and installed under the project.
- F. Field quality-control reports.

- G. Configuration and testing plan.
- H. Operation and maintenance data.
- I. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- J. Warranty: Sample of project warranty and service agreement.

1.6 QUALITY ASSURANCE

- A. All equipment, systems, and materials furnished and installed under this section shall be installed in accordance with the applicable standards of:
 - 1. National codes: NEC and NFPA
 - 2. Approvals and Listings: UL
 - 3. TIA Telecommunications wiring standards
 - 4. Local Authorities Having Jurisdiction
- B. Contractor Certification:
 - 1. The Contractor shall be a factory-authorized dealer of the both the VMS and camera system provided. The contractor will be factory-trained and certified to install, maintain, and repair the highest (Enterprise) level of the system.
 - a. This certification must be in place at time of Bidding and remain so throughout project.
 - 2. Contractor performing video surveillance system installation shall have on the project team at a minimum one (1) Certified Installer trained by the manufacturer(s) of the system installed under this project.
- C. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
 - 2. Interior, Uncontrolled Environment: System components installed in non-air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 3R enclosures.
 - 3. Exterior Environment: Unless stated otherwise in specifications, system components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph and snow cover up to 24 inches thick. Use NEMA 250, Type 3R enclosures.
 - 4. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
 - 5. Corrosive Environment: System components subject to corrosive fumes, vapors, and wind-driven salt spray in coastal zones. Use NEMA 250, Type 4X enclosures.
 - 6. Security Environment: Camera housing for use in high-risk areas where surveillance equipment may be subject to physical violence.

1.7 GUARANTEE OF WORK

- A. All components, parts, and assemblies supplied by the Manufacturers and installed by the Contractor shall be warranted against defects in material and workmanship for a period of at least two (2) years (parts and labor), commencing upon date of acceptance by Owner.
 - 1. Warranty service shall be provided by a factory-trained service representative.
 - 2. Warranty shall include all parts, labor and necessary travel.
- B. At the end of the warranty period, Contractor shall provide detailed documentation of corrective maintenance performed from date of acceptance. Documentation shall include:
 - 1. Description of symptoms, diagnoses and subsequent actions taken.
 - 2. Recommended changes in routine preventive maintenance procedures shall also be included.
- C. Contractor shall provide a preventive maintenance outline for all equipment included in this project.
- D. The Contractor shall provide, at no additional cost, all software and/or firmware revisions and updates during the warranty period. The Contractor shall verify proper operation of the video surveillance system after incorporation of each update. Software updates shall be fully documented.

1.8 SERVICE / MAINTENANCE

- A. During the warranty period the Contractor shall be responsible for maintenance and repair of the system at no charge to the owner.
 - 1. Includes:
 - a. Labor to troubleshoot and diagnose system problems,
 - b. Labor to replace workmanship defects failed devices and/or software problems.
 - c. Materials
 - d. Travel time and expenses.
 - 2. Provide 24-hours daily, 7-days per week including holidays.
 - 3. Repair service shall be provided within 24 hours of notification.
- B. The Contractor will provide a cost for a five (5) year maintenance contract. The cost must clearly define all contractor and manufacturer costs expected. The contract will have the option to be renewed yearly. The maintenance agreement will include:
 - 1. Annual visit to each Rest Area included in project documents
 - a. Maintenance agreement will also include three existing sites currently utilizing Exacqvision Software.
 - 1) Rest Area 51
 - 2) Rest Area 52
 - 2. Software upgrades
 - 3. Camera Maintenance
 - a. Operation verification
 - b. Lens/dome cleaning
 - c. Field of view verification
 - 4. Labor rate for any repairs needed.
- C. All repairs shall be made by a qualified service representative (fully trained in the servicing of the video surveillance systems).

- D. All test adjustments or replacements shall be made in the presence of owner's technician, or other person designated by the owner.
- E. Upon completion of each call a report will be provided to clearly indicate any replacements or adjustments and any evidence of tampering.

1.9 EXTRA MATERIALS

- A. Extra materials shall be housed in an environment and condition recommended by the manufacturer and shall be clearly labeled with "SPARE: DO NOT REMOVE", manufacturer part number, and date of delivery to the owner.
- B. All packaging for spares must be kept in good condition and used as appropriate for any Returns to Manufacturer (RMA).

PART 2 - PRODUCTS

2.1 VIDEO SURVEILLANCE SYSTEM

- A. The Video Surveillance System will include new Video Management System and new video surveillance cameras within the scope of the project.
- B. The Video Surveillance System will consist of separate Network Video Recorders at each site that will operate independently but have the capability of being networked together.
- C. Systems which meet the specifications below shall be considered. The contractor shall furnish a point-by-point comparison of the proposed system against the specifications below. Each point shall be identified as 'does not meet', 'meets' or 'exceeds'.

2.2 SYSTEM REQUIREMENTS

- A. Per Division 27 specifications for Horizontal Cabling.
- B. Per manufacturer's recommendations for all field device wiring and cabling.
- C. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.
- D. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

2.3 SIGNAL TRANSMISSION COMPONENTS

- A. Where available, the system will be connected to Owner's network. Connection to network requires coordination with Owner for IP addressing scheme, port configuration as necessary and physical connection location(s).
 - 1. Install any necessary cables as required for owner network connection.
- B. Refer to Division 27 section 27 20 00 for signal transmission components.

2.4 VIDEO MANAGEMENT SYSTEM

- A. Network Video Recording: Manufacturers: NVR and VMS System will be capable of being an extension of the existing ExacqVision Enterprise DOT system. 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. ExacqVision Enterprise (Basis of design)
 - 2. Approved Equal
- B. Description:
 - 1. System shall provide delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.
 - 2. System shall be pre-loaded with VMS Enterprise level server software.
 - 3. System for each site shall include 16 IP Camera inputs.

4. System shall have seamless integration of all video surveillance and control functions.
5. The VMS shall have a client/server-based architecture that can be configured as a standalone VMS with the client software running with equal functionality on the server hardware and/or the client running on any network-connected TCP/IP workstation.
6. User Interfaces – The VMS shall support installed client and web client interfaces
7. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions, two-way audio communication, alarm monitoring and control, and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.
8. Include three years of software upgrades.
9. System design shall include all necessary compression software for dual-stream, H.264/MJPEG video.
10. Unit shall provide connections for all video cameras, bidirectional audio, discreet sensor inputs, and control system outputs.
11. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video management software.
12. System shall place video, audio and data network stream that can be managed from multiple workstations on the user's LAN or WAN.
13. All system interconnect cables, servers, network storage and network intermediate devices shall be provided for full performance of specified system.
14. System shall allow for open architecture supporting IP cameras and encoders and access control systems from multiple manufacturers.
15. System client software to allow remote access to live and recorded video, including access from mobile devices

C. NVR (Network Video Recorder)

1. 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. Exacqvision LC Series Una (Basis of Design)
 - b. Approved equal
2. The PoE NVR shall be an appliance to power and to acquire, record, store and display video signals from 16 IP network video cameras.
3. The NVR shall be pre-loaded with VMS Enterprise Level server software.
4. Power:
 - a. POE+ (per IEEE 802.3at)
 - b. 25 Watts per port
 - c. Maximum: 240 Watts total for 16 ports
5. Network Interface Card: 1x1 Gbps
6. RAM: Minimum 4 GB
7. USB 2.0 Ports: Minimum 8
8. Video and audio recording over TCP/IP network.
9. Video recording of H.264, and MJPEG streams.
10. Video recording storage rate of 150 Mbps.
11. Duplex operation: Simultaneous recording and playback.

12. Continuous and alarm-based recording.
13. Full-featured search capabilities: Search based on camera, time, or date.
14. Automatic data replenishment to ensure recording even if network is down.
15. Digital certification by watermarking.
16. Capacity: Storage capacity shall be sized to accommodate 7 days of storage. All calculations for storage capacity must be approved by owner, including compression rate and frames per second.
17. Full integration with LAN, Intranet, or Internet through standard Web browser or video management software.
18. Integrated Web server FTP server functionality.
19. Export Options
 - a. DVD
 - 1) Provide USB External DVD Read/Write for each NVR
 - a) Exacqvision 5000-0500
 - b) Or approved equal
 - b. .AVI or EXE file

2.5 IP CAMERAS

- A. Interior Varifocal Camera: 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. AXIS M4216-LV (Basis of design)
 2. Hanwha-Techwin XND-6081RV
 3. Approved equal
 - a. Description:
 - 1) Image sensor: 1/2.8" RGB CMOS progressive scan.
 - 2) Lens: VariFocal
 - 3) Minimum: 2.8mm
 - 4) Maximum: 12mm
 - 5) Minimum illumination:
 - 6) Color: .26 lux at 50 IRE F2.0
 - 7) B/W: .05 lux at 50 IRE F2.0
 - 8) Shutter time: 1/10000 s to 1/5 s.
 - 9) Video Compression: H.264, H.265, MPEG-4, MJPEG.
 - 10) Resolution (pixels): 2048X1536.
 - 11) Frame rate: 25/30 frames per second (fps).
 - 12) Video Streaming: Multiple, in H.264 and MJPEG formats.
 - 13) Pan/Tilt/Zoom (PTZ): Digital.
 - 14) Image settings:
 - a) Compression
 - b) Color
 - c) Brightness
 - d) Sharpness
 - e) Contrast

- f) White balance
 - g) Exposure control
 - h) Exposure zones
 - i) Backlight compensation
 - j) Fine tuning of behavior at low light
 - k) WDR – dynamic contrast
 - l) Text and image overlay
 - m) Mirroring of images,
 - n) Privacy mask
 - o) Rotation 0,90,180,270, including Corridor Format
 - b. Audio: None.
 - c. PoE power. Compliant with IEEE 802.3af/802.3at
 - d. IR illumination: 850 nm IR LED
 - e. Storage: MicroSD onboard.
 - f. Operating temp. 32 deg. F to 113 deg. F, with 15 – 100% RH, non-condensing.
 - g. Casing: Polycarbonate transparent cover dehumidifying membrane. IP42 rated, IK08 impact-resistant.
- B. Exterior Panoramic Cameras (180): 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. Axis Q3819-PVE (Basis of design)
 - 2. Hanwha PNM-9000VQ
 - 3. Or approved equal.
 - a. Basis of Design:
 - 1) Image sensor:
 - a) 180-degree: 3 x 1/1.8" CMOS, progressive scan.
 - 2) Lens:
 - a) 180-degree: 3 x Fixed, 5 mm.
 - 3) Minimum illumination:
 - a) 180-degree: .3 lux in color mode and 0.4 lux in night mode.
 - 4) Shutter time:
 - a) 180-degree: 1/71500 s to 1 s
 - 5) Video Compression: H.264, MJPEG.
 - 6) Resolution (pixels):
 - a) 180-degree: 3 x (2560X1920)
 - 7) Frame rate:
 - a) 180-degree: 3 x 5 MP
 - 8) Video Streaming: Multiple, in H.264 and MJPEG formats.
 - 9) Pan/Tilt/Zoom (PTZ): Digital, with preset positions.

- 10) Image settings:
 - a) Compression
 - b) Color
 - c) Brightness
 - d) Sharpness
 - e) Contrast
 - f) White balance
 - g) Exposure control
 - h) Exposure zones
 - i) Backlight compensation
 - j) Fine tuning of behavior at low light
 - k) WDR – dynamic contrast
 - l) Text and image overlay
 - m) Mirroring of images,
 - n) Privacy mask
- 11) Audio:
 - a) None.
- 12) PoE power:
 - a) 180-degree: Compliant with IEEE 802.3at
- 13) IR illumination: None.
- 14) Storage: SD/SDHC/SDXC slot
- 15) Operating temp.: -40 deg. F to 131 deg. F, with 10 – 100% RH, non-condensing.
- 16) Casing: Polycarbonate transparent cover with aluminum inner camera module with encapsulated electronics, IK10, IP66 and NEMA-4X rated.

C. Exterior Varifocal Cameras: 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. Axis P3268-LVE (Basis of design)
2. Hanwha PNV-9080R
3. Or approved equal.
 - a. Basis of Design:
 - 1) Image sensor:
 - a) 1/1.8" RGB CMOS Progressive Scan
 - 2) Lens:
 - a) Varifocal 3.5-10 mm
 - 3) Shutter time:
 - a) 1/71500 s to 2 s
 - 4) Video Compression: H.264, MJPEG.
 - 5) Resolution (pixels):
 - a) 3840x2160

- 6) Frame rate:
 - a) 25/30 fps with power line frequency 50/60 Hz
 - b) 50/60 fps with power line frequency 50/60 Hz
- 7) Video Streaming: Multiple, in H.264 and MJPEG formats.
- 8) Pan/Tilt/Zoom (PTZ): Digital, with preset positions.
- 9) Image settings:
 - a) Compression
 - b) Color
 - c) Brightness
 - d) Sharpness
 - e) Contrast
 - f) White balance
 - g) Exposure control
 - h) Exposure zones
 - i) Backlight compensation
 - j) Fine tuning of behavior at low light
 - k) WDR – dynamic contrast
 - l) Text and image overlay
 - m) Mirroring of images,
 - n) Privacy mask
- 10) Audio:
 - a) None
- 11) PoE power:
 - a) Typical 8.6 Max 14.5
- 12) IR illumination: 850 nm IR LEDs
- 13) Storage: SD/SDHC/SDXC card supporting up to 64GB.
- 14) Operating temp.: -40 deg. F to 122 deg. F, with 10 – 100% RH, non-condensing.
- 15) Casing: Polycarbonate transparent cover with aluminum inner camera module with encapsulated electronics, IP66, IP67, IK10+ and NEMA-4X rated.

2.6 POWER SUPPLIES

- A. Not Applicable; all camera power is derived via PoE (Power over Ethernet) provided by Ethernet switch or Midspan equipment.

2.7 UNINTERRUPTIBLE POWER SUPPLY

- A. The Uninterruptible Power Supply (UPS) be a rack-mounted unit with a battery runtime of 10 minutes, capable of backing up the entire load of the Video Surveillance System plus a spare capacity of 20%, including but not limited to:
 - 1. Video management System
 - 2. Network switch(es)

B. Basis of Design product: APC Smart-UPS 3000VA.

1. Description:
 - a. Adjustable voltage sensitivity.
 - b. Audible alarms.
 - c. Battery failure notification.
 - d. User hot-swappable batteries.
 - e. Sequenced shutdown and reboot.
 - f. Network manageable.
 - g. USB connectivity to VMS server.
 - h. Monitoring and alerting software.
 - i. Multiple 15A and 20A output receptacles.
2. UPS input voltage shall be 120VAC.
3. UPS input current shall be 30A.

2.8 VIDEO MONITORING STATION

A. The video monitoring station will be utilized for the viewing and monitoring of video via the Video Management System.

B. Basis of design:

1. ExacqVision C-Series
2. Or Approved Equal
- a. Description:
 - 1) Video Streams supported: 16
 - 2) Frame Rate supported: 15 fps per stream
 - 3) Compatible with VMS software
 - 4) Monitor Output: HDMI, DP
 - 5) Network: 1GbNIC

2.9 MONITORS

A. 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. Bosch UML 223-90 (Basis of design)
2. Approved equal

B. Description: The monitor shall provide a high-resolution picture, high quality; thin film transfer LED panel; rear panel controls; built-in speaker; connections for video including DVI-D, HDMI separate, composite, Y-C connectors for S-VHS input; automatic color switching system for PAL/NTSC. The color monitor shall meet or exceed the following specifications.

1. The monitor shall provide a thin film transfer LCD flat panel.
2. The monitor shall provide an on-screen display for setup and adjustment of the monitor viewing parameters.
3. The monitor shall meet NTSC/PAL standards.
4. The monitor shall provide DVI input.
5. Shall provide 500 TV lines of resolution in composite video mode.
6. The monitor shall provide digital resolution of 1920x1080 pixels.
7. The monitor shall operate in a range of 90 to 260 VAC, 60/50 Hz or 12 VDC and shall consume a maximum of 30 watts.

8. The monitor shall provide an automatic color switching system between NTSC/PAL formats.
9. The monitor shall accept 1.0 V p-p composite video and provide 75 ohms of input/output impedance.
10. The monitor shall provide a base for placing the unit on a flat surface.
11. The monitor shall provide tint, color, brightness, contrast, volume, and power on/off controls on the front panel.
12. The monitor shall provide 16.7 million colors, a contrast ratio of 1000:1
13. The monitor shall have an operating temperature range of 32° to 122°F (0° to 50° C) and an operating humidity range of 20% to 85% relative, non-condensing.

2.10 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 18 by 18 inches.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 18 by 18 inches.

C. Laminated-Acrylic or Melamine-Plastic Signs:

1. Engraved legend.
2. Thickness:
 - a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
 - b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
 - c. Retain first option in first subparagraph below for instruction signs; retain second option for identification signs.
 - d. Engraved legend with black letters on white face.
 - e. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
 - f. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

PART 3 - EXECUTION

3.1 GENERAL

- A. Maintain the integrity and operational status of existing video surveillance system, including head-end (server) equipment, storage devices and cameras.
- B. Coordinate all system outages (partial or otherwise) with owner a minimum of two working days prior to outage.
- C. Provide and configure all necessary components to expand the existing VMS as indicated on the drawings and as defined in this specification.
- D. In meetings with Engineer and Owner, present planning documents and review, adjust, and prepare final setup documents. Use final documents to configure and program system software.

3.2 PROTECTION

- A. Maintain security during the installation of equipment and software.
- B. Keep confidential all details of the installation, configuration and programming of the video surveillance system. Comply with all local and federal regulations regarding the distribution of sensitive security information.

3.3 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.
- B. Examine roughing-in for LAN and IP network before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION

- A. Install all equipment and materials in accordance with the current recommendations of the manufacturer.
- B. The work shall also be in accordance with:
 - 1. Installation criteria defined in these specifications and in the construction documents.
 - 2. Approved submittals.
 - 3. Applicable requirements of the referenced standards.

3.5 CABLING AND WIRING

- A. All wiring shall be in conduit or otherwise concealed and protected against harm.
- B. Comply with TIA-569 C, "Commercial Building Standard for Telecommunications Pathways and Spaces."
- C. Comply with NECA 1, "Good Workmanship in Electrical Contracting."
- D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- E. Install cables using techniques, practices, and methods that are consistent with rating of components and that ensure manufacturer recommended performance of completed and linked signal paths, end to end.
- F. Install cables without damaging conductors, shield, or jacket.
- G. Where installed indoors, boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
- H. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.
- I. For communication wiring, comply with Division 27 specifications Structured Cabling and Horizontal Cabling.

3.6 SYSTEM HARDWARE INSTALLATION

- A. Install cameras level and plumb.
- B. Install cameras with 84-inch-minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.
- C. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.

- D. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.
- E. Camera Views
 - 1. All camera field of views to be verified with owner. Below descriptions will serve as a guide for camera set up.
 - a. Rest Areas
 - 1) Vestibule Cameras:
 - a) Field of view to capture pedestrian traffic as they enter facility.
 - 2) Lobby Cameras:
 - a) Field of view to serve as an overall view of pedestrian traffic in lobby.
 - 3) Exterior Entrance 180 degree cameras:
 - a) Field of view to capture entrance to facility as well as sidewalk
 - 4) Exterior Building Corner Cameras
 - a) Field of view to capture Parking lots and walkways up to facility.

3.7 GROUNDING

- A. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."
- B. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- C. Bond shields and drain conductors to ground at only one point in each circuit.
- D. Signal Ground:
 - 1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
 - 2. Bus: Mount on wall of main equipment room with standoff insulators.
Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.8 IDENTIFICATION

- A. Label all hardware and cable.
- B. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the device as shown.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.
- C. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.
 - 1. Video Surveillance Signs to be installed at each public entrance and in lobby area.

3.9 CONFIGURATION

- A. Configure the VMS and each new camera in the server. Coordinate camera naming with the Owner.
- B. Assign any new software licenses to owner.

3.10 TESTING

- A. Operational Testing: The contractor shall perform thorough operational testing and verify that all system components are fully operational.
- B. Acceptance Test Plan Form: An acceptance test plan form shall be prepared/provided by the contractor prior to the acceptance walk through.
- C. This form shall include separate sections for each device/panel/unit as well as a column indicating the manufacturer's performance allowance/margin, a column indicating the result of the testing performed by the contractor (pass/fail), and an empty column for recording finding during the walk-through.

3.11 COMMISSIONING

- A. The Contractor shall certify completion in writing and schedule the commissioning walk-through. The contractor shall provide all the tools and personal needed to conduct an efficient commissioning process.

3.12 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
 - 2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. At a minimum prepare video surveillance system equipment for acceptance and operational testing as follows:
 - a. Prepare equipment list described in "Submittals" Article.
 - b. Verify operation of auto-iris lenses.
 - c. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
 - d. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
 - e. Set and name all preset positions; consult Owner's personnel.
 - f. Set sensitivity of motion detection; consult Owner's personnel.
 - g. Set event recording; consult Owner for parameters and schedule.
 - h. Connect and verify responses to alarms.
 - i. Verify operation of control-station equipment.
 - 3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - 4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

- B. New video surveillance system equipment shall be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.13 TRAINING

- A. Conduct group and/or individual training sessions, as required by the owner, for the proper operation and maintenance of all systems installed.
 - 1. The purpose of the training is to fully prepare the staff for complete operational responsibility of the newly installed equipment.
- B. All training shall be conducted by a manufacturer authorized trainer with expertise in each listed component.
- C. At minimum, the Training shall cover:
 - 1. System Overview including Overall System Design, Features and Capabilities
 - 2. System Operation and Maintenance
 - 3. Component Labeling
 - 4. Test Documentation (methods & interpretation of results)
 - 5. Facility Tour (locations that demonstrate typical configurations)
- D. Training shall:
 - 1. Include a total of at least four (4) hours of instruction.
 - 2. Be performed at the site
 - 3. Be presented at time(s) arranged with the owner.
 - 4. Include training materials for up to (6) students.
- E. The Session(s) may be recorded (by the Owner and the tenant) for use as future refresher materials for Owner and tenant technical staff.

3.14 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:
 - 1. Check cable connections.
 - 2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
 - 3. Adjust all preset positions; consult Owner's personnel.
 - 4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
 - 5. Provide a written report of adjustments and recommendations.

3.15 CLEANING

- A. Clean installed items using methods and materials recommended in writing by manufacturer.
- B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

END OF SECTION

**20. Picnic Shelter Large Item SPV.0060.11;
Picnic Shelter Small, Item SPV.0060.12.**

A Description

Furnish and construct large and small picnic shelters according to the Rest Area Building, General Construction specifications.

B (Vacant)

C (Vacant)

D Measurement

The department will measure Picnic Shelters (size) as each individual installation, acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.11	Picnic Shelter Large	EACH
SPV.0060.12	Picnic Shelter Small	EACH

Payment is full compensation for furnishing and installing all materials and equipment.

21. Pitless Adapter, Item SPV.0060.13.

A Description

Furnish and install a Pitless Adapter to the 8-inch well casing and pressure test the Pitless Adapter.

B Materials

The following Pitless Adapter, or equal, will be acceptable:

- Maass Midwest, Huntley, IL, Model J Weld-On, Pitless Adapter, 8-Inch;
- Advance-Morrison, Milwaukee, WI, Weld-On Pitless Adapter; or
- Whitewater Manufacturing, Whitewater, WI, Model F Weld-On, Pitless Adapter.

C Construction

Install according to the applicable sections of the current Wisconsin Administrative Code. The pitless adapter shall be tested and proven watertight under a pressure not less than 14 psig for a minimum of 30 minutes according to Wis. Adm. Code, s. NR 812.31(2)(c). The pump installer shall notify the WDNR at least 48 hours before testing so that WDNR may witness the test (See Figure 29 from Wis. Adm. Code).

D Measurement

The department will measure Pitless Adapter as each unit, complete in place and accepted.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.13	Pitless Adapter	EACH

Payment is full compensation for furnishing and installing all materials; and testing the adapter

22. Well System Controls, Item SPV.0060.14.

A Description

Furnish and install a control panel and related accessories for an alternating lead/lag system for the two new wells. The control panel and pressure tank shall be located in the Equipment Room of the rest area building. The system shall monitor water system pressure near the pressure tank in the same room.

B Materials

B.1 Well System Functional Description

The well pumps shall be controlled by a programmable controller activated by a pressure transducer.

The lead well pump shall pump, with varying speed, to maintain a pressure of 70 psi as determined by the transducer that shall monitor the water system pressure.

Well pumps shall be automatically alternated on a daily basis or after a preset run time. Provide a human operator interface to manually operate and alternate pumps.

B.2 Control Panel

Control panel shall have NEMA 1 enclosure and shall be assembled in compliance with Underwriters Laboratories (UL) industrial control panels 508 listing. Panel shall be a rigid, wall mounted panel sized to accommodate the required power, control, and supervisory devices.

The following alarms shall be transmitted to the auto-dialer mounted in the Equipment Room of the rest area building over #14 wire pairs: Pump Failure —Low Urgency; Low Pressure — High Urgency.

Provide a green pilot light on the control panel for each pump to indicate when the pump is running.

Provide a run time meter for each pump. Meters shall be non-reset-able 0-9,999.9 hours.

Provide a pressure gauge or indicator to show water system pressure.

B.3 PLC System

Provide a programmable logic controller (PLC) system in control panel to control well pumps.

The system supplier shall provide all the programming and software necessary to make the system function as specified. The system supplier shall document and annotate the programs, update them as required at start-up, and turn the programs over to the owner in the form of a USB flash drive.

B.4 Pressure Transducer

Provide a submersible pressure transducer connected to water distribution system to sense system pressure.

Transducer shall be suitable for a pressure range of 0-200 psi. Provide all accessories and hardware required to tap water distribution piping and mount transducer.

B.5 Pressure Tank

Provide a pressure tank meeting requirements of Wisconsin Administrative Code NR 812.33, sized for a CONSTANT PRESSURE SYSTEM and meeting the pump manufacturer's specifications including requirements for minimum pump run time. Provide sample tap at pressure tank, piping and fittings for a complete installation.

C Construction

Install well system controls according to manufacturer's recommendations. All work shall comply with the state electrical code. The installation shall be complete in every detail so as to provide automatic and uninterrupted water service to the rest area and maintenance buildings.

D Measurement

The department will measure Well System Controls as a unit of work for each system, acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.14	Well System Controls	EACH

Payment is full compensation for furnishing and installing all materials.

23. Well Pump, Item SPV.0060.15.

A Description

Furnish and install one submersible water well pump for each well, piping and electrical cable from pump to finished grade, and all the necessary pipes, and attachments for the well.

This installation shall be complete in every detail so as to provide automatic and uninterrupted water service to the building.

B Materials

Pump: The well shall be capable of producing 100 gpm of acceptable water. Furnish a pump that is capable of producing a minimum of 100 gpm, at 70 psi at the building entrance.

Furnish pumps manufactured by Franklin Electric, Fort Wayne, Indiana; A.Y. McDonald Mfg. Company, Dubuque, Iowa; Sta-Rite Pump (div. of Pentair), Delevan, Wisconsin; Grundfos USA, Olathe, Kansas; or approved equal.

Provide the pump with a pump cable from the pump unit to finished grade sized to match the electrical conductor feeding the well. Provide electrical conduit at grade and connect to vermin proof well cap.

Coordinate installation with electrical contractor.

C Construction

Install according to the applicable sections of the current Wisconsin Administrative Code. At Rest Area 51, the well pumps shall be located approximately 100-120 feet below grade. At Rest Area 52, the well pumps shall be located approximately 125-145 feet below grade.

Thoroughly test the entire installation for conformance with all operating and capacity specifications mentioned hereafter.

D Measurement

The department will measure Well Pump by each unit, complete in place and accepted.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.15	Well Pump	EACH

Payment is full compensation for furnishing and installing all materials.

24. Construction Staking, Water System, Item SPV.0060.16.

A Description

Furnish and set construction stakes or control points and make all calculations required that are necessary to establish the horizontal and vertical position of the water system (includes water mains, valves, air release valves, wells, horizontal deflection, and vertical bends of the piping system), as the case may be, according to the plans or as directed by the engineer. The work also includes checking horizontal and vertical position of water system for accuracy with existing field conditions. Immediately notify the engineer of any errors and apparent discrepancies for correction or interpretation prior to proceeding with the work.

B (Vacant)

C Construction

C.1 General

Obtain or calculate from data in the plans all benchmark data, grades, and alignment; verify the data, grades, and alignment with the engineer prior to beginning the work. The engineer will furnish horizontal alignment, horizontal alignment ties, and control point data. This work shall include re-establishing the plan horizontal roadway alignment, alignment ties, and control points. Obtain prior approval of the engineer for methods of survey and staking prior to beginning the work. The degree of accuracy used in the survey work shall be consistent with third order, Class II. Establish additional benchmarks and control points as necessary or as directed by the engineer. Check plan dimensions, alignment, and elevations for

accuracy with existing field conditions. Any errors and apparent discrepancies shall be called to the engineer's attention immediately for correction or interpretation prior to proceeding with the work.

Maintain neat, orderly and complete survey notes and computations used in establishing the lines and grades. Make the survey notes and computations available to the engineer within 24 hours upon request as the work progresses.

C.2 Water System

Set and maintain construction stakes for water system as necessary to achieve the required accuracy and to satisfy the contractors' method of operations. Locate all water system construction stakes to within 0.02 feet of the true horizontal position and establish the grade elevation to within 0.01 feet of the true vertical position. Place construction stakes for water system elements at water mains, valves, air release valves, wells and at every horizontal deflection in the water system. In addition, place stakes at 100-foot intervals along the water line.

D Measurement

The department will measure Construction Staking, Water System by each system, acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.16	Construction Staking, Water System	EACH

Payment is full compensation for furnishing and installing all materials.

25. Construction Staking, Building, Item SPV.0060.24.

A Description

Furnish and set construction stakes or control points and make all calculations required that are necessary to establish the horizontal and vertical position of rest area buildings according to the plans.

B (Vacant)

C Construction

C 1 General

Obtain or calculate from data in the plans all benchmark data, grades, and alignment; verify the data, grades, and alignment with the engineer prior to beginning the work. The engineer will furnish horizontal alignment, horizontal alignment ties, and control point data. This work shall include re-establishing the plan horizontal alignments, alignment ties, and control points. Obtain prior approval of the engineer for methods of survey and staking prior to beginning the work.

The degree of accuracy used in the survey work shall be consistent with third order, Class II. Establish additional benchmarks and control points as necessary or as directed by the engineer. Check plan dimensions, alignment, and elevations for accuracy with existing field conditions. Any errors and apparent discrepancies shall be called to the engineer's attention immediately for correction or interpretation prior to proceeding with the work. Maintain neat, orderly and complete survey notes and computations used in establishing the lines and grades. Make the survey notes and computations available to the engineer within 24 hours upon request as the work progresses.

C.2 Building Staking

Set and maintain construction stakes for building line and grade as necessary to achieve the required accuracy and to satisfy the contractors' method of operations. Locate all building construction stakes to within 0.02 feet of the true horizontal position and establish the grade elevation to within 0.01 feet of the true vertical position. Place construction stakes for each building at the needed points to define line and grade.

D Measurement

The department will measure Construction Staking, Building by each, acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.24	Construction Staking, Building	EACH

Payment is full compensation for performing the survey work necessary to locate and set building corners and lines; for resetting damaged or missing construction stakes.

26. Coring Manhole, Item SPV.0060.25.

A Description

Core into existing manhole or inlets to allow for connection into the sanitary sewer system or storm sewer system.

B (Vacant)

C Construction

Cut through wall of existing manhole with equipment that creates a clean and smooth cut. Fill the annular space between the pipe and the structure wall with a flexible seal meeting ASTM C923, Kor-N-Seal or equal, to create a watertight seal. Modify/construct concrete flowline to direct flow from new connection to existing outlet.

D Measurement

The department will measure Coring Manhole by the unit, acceptably completed in place.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.25	Coring Manhole	EACH

Payment is full compensation for furnishing all materials; for coring and sealing; for disposing of all excavated and surplus material.

27. Underground Copper Water Line, 3-Inch, Item SPV.0090.01; Underground Copper Water Line, 1-Inch, Item SPV.0090.02.

A Description

Furnish and install copper water line, of the diameter shown, from within 5 feet of the rest area building to each well, as shown on the plans and as hereinafter provided.

B Materials

Underground pipe shall be new Type K annealed copper tubing conforming to ASTM B88. All fittings shall be flared type for underground use.

C Construction

Excavate trenches to a minimum depth of 7.5 feet, as required to install the copper waterline as indicated on the plans. Install according to the applicable sections of the current Wisconsin Administrative Code.

Backfill the copper waterline according to standard spec 607.3.5 except as hereinafter modified. Lay the waterline in a 12-inch envelope of sand backfill, backfill the remainder of the trench with the native excavated material.

D Measurement

The department will measure Underground Copper Water Line, (size) by the linear feet, complete in place from within 5 feet of the rest area building and within 5 feet of the maintenance building, measured along the centerline of the pipe.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.01	Underground Copper Water Line, 3-Inch	LF
SPV.0090.02	Underground Copper Water Line, 1-Inch	LF

Payment is full compensation for furnishing and installing the water pipe; for excavation, backfill and properly disposing of surplus materials.

28. Sanitary Sewer PVC, 6-Inch, Item SPV.0090.03; Sanitary Sewer PVC, 8-Inch, Item SPV.0090.04.

A Description

Furnish and install the sanitary sewer, of the diameter shown, with all fittings, caps, plugs, and granular backfill as shown on the plans and as hereinafter provided. This work begins at the locations shown on the plans.

B Materials

B.1 PVC Pipe

All pipe and fittings shall comply with applicable standards of the Wisconsin Plumbing Code and be of one manufacturer. The sanitary sewer shall be polyvinyl chloride (PVC) sewer pipe conforming to ASTM D3034, SDR-35. Joints shall be elastomeric gasket type meeting the requirements of ASTM D3034.

Sanitary wyes and fittings shall be incidental.

B.2 Granular Material

Granular material used for bedding of the sanitary sewer pipe shall consist of particles ranging from fine to coarse in a substantially uniform combination. Sufficient fine material shall be present to fill all the voids of the coarse material. No stone over 75-mm sieve size shall be present. Some fine clay or silt particles are desirable but shall not be present in the form of lumps. Granular material shall conform to the grading requirements as follows:

Sieve Size	% Passing by Weight
2"	95-100
No. 4	35-60
No. 200	5-15

B.3 Insulation

Provide foam insulation board in the locations shown on the drawings. Extruded closed-cell polystyrene, 2-inch minimum thickness, with integral high-density skin complying with ASTM C578, Type VI, minimum 40-psi compressive strength, 0.3% max. water absorption, thermal resistance (R-value at 40 deg. F) of 5.4 per 2-inch thickness. Each location shall receive two 4- foot by 8-foot pieces of 2-inch thick insulation board to protect the forcemain or as provided for Zone B per SPS 382.30.

C Construction

Make any changes in grade or direction at manholes or other structures. Placement and depth of bedding shall conform to the details shown on the plans. Bedding shall be compacted by hand or mechanically to 90% of the Standard Proctor density (ASTM D698) for the material used. Prior to backfilling, test each section of sewer according to standard spec 607.3.5 and compact to the density of the surrounding undisturbed soils.

D Measurement

The department will measure Sanitary Sewer, PVC (size) by the linear foot, complete in place and accepted. The length to be paid shall not include the construction into or through manholes or other structures.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.03	Sanitary Sewer PVC, 6-Inch	LF
SPV.0090.04	Sanitary Sewer PVC, 8-Inch	LF

Payment is full compensation for excavating, backfilling, and compacting; for furnishing and placing all materials, including fittings, frost protection, and granular backfill; for connecting to existing piping; for testing; and for supplying all necessary labor, tools, equipment, and incidentals necessary to complete the contract work.

Contract unit prices shall apply without adjustment to the quantities of sanitary sewers constructed at elevations not in excess of 12-inches above or below the elevations shown on the plans. Pipe sewers or portions thereof constructed by order of the engineer at elevations in excess of 12-inches above or below the elevations indicated on the plans will be considered and paid for as provided in standard spec 109.4, Extra Work.

Any work involved in forming a satisfactory foundation at depths of 12-inches or less below the bottom of the pipe will be considered incidental and will not be paid for as Extra Work. Any work required at depths greater than 12-inches below the bottom of the pipe will be paid for as Extra Work according to standard spec 109.4.

29. Construction Staking Sanitary Sewer System, Item SPV.0090.05.

A Description

Furnish and set construction stakes or control points and make all calculations required that are necessary to establish the horizontal and vertical position of sanitary sewer system (includes sanitary sewer pipe, manholes, cleanouts, air release valves, comminutor, sanitary lift station, valve vault, horizontal deflection, and vertical bends of the sanitary sewer system), as the case may be, according to the plans or as directed by the engineer. The work also includes checking horizontal and vertical position of sanitary sewer structures, sanitary sewer pipe for accuracy with existing field conditions. Immediately notify the engineer of any errors and apparent discrepancies for correction or interpretation prior to proceeding with the work.

B (Vacant)

C Construction

C.1 General

Obtain or calculate from data in the plans all benchmark data, grades, and alignment; verify the data, grades, and alignment with the engineer prior to beginning the work. The engineer will furnish horizontal alignment, horizontal alignment ties, and control point data. This work shall include re-establishing the plan horizontal roadway alignment, alignment ties, and control points. Obtain prior approval of the engineer for methods of survey and staking prior to beginning the work. The degree of accuracy used in the survey work shall be consistent with third order, Class II. Establish additional benchmarks and control points as necessary or as directed by the engineer. Check plan dimensions, alignment, and elevations for accuracy with existing field conditions. Any errors and apparent discrepancies shall be called to the engineer's attention immediately for correction or interpretation prior to proceeding with the work.

Maintain neat, orderly and complete survey notes and computations used in establishing the lines and grades. Make the survey notes and computations available to the engineer within 24 hours upon request as the work progresses.

C.2 Sanitary Sewer System

Set and maintain construction stakes for sanitary sewer system as necessary to achieve the required accuracy and to satisfy the contractors' method of operations. Locate all sanitary sewer system construction stakes to within 0.02 feet of the true horizontal position and establish the grade elevation to within 0.01 feet of the true vertical position. Place construction stakes for sanitary sewer at every sanitary sewer structure, (manholes, cleanouts, air release valves, comminutor, sanitary lift station, valve vault) and at every horizontal deflection and vertical bend in the sanitary sewer. In addition, place stakes at 50-foot intervals along the sanitary sewer.

Determine that sanitary sewer structures, bends and deflections of the sanitary sewer pipe match existing field elevations and provide this information to the engineer 14 calendar days prior to the contractor ordering manholes, cleanouts, air release valves, comminutor, sanitary lift station, valve vault, and sanitary sewer pipe.

D Measurement

The department will measure Construction Staking, Sanitary Sewer System by the linear foot, acceptably completed, along the centerline of the pipe including sanitary sewer structures.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.05	Construction Staking, Sanitary Sewer System	LF

Payment is full compensation for performing the survey work necessary to locate and set all manholes, cleanouts, air release valves, comminutor, sanitary lift station, valve vault, and sanitary sewer pipe structures, and sanitary sewer pipe for accuracy with existing field conditions; for resetting damaged or missing sanitary sewer structure and sanitary sewer pipe construction stakes.

ADDITIONAL SPECIAL PROVISION 3

DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM IMPLEMENTATION

Authority

Wisconsin Department of Transportation (WisDOT) is a recipient of funds from the US Department of Transportation's Federal Highway Administration. The DBE program is a federal program applicable on all contracts administered by WisDOT that include federal-aid highway funds. The authority for the DBE program is the Transportation Bill as approved by Congress periodically. DBE program guidance and requirements are outlined in the Code of Federal Regulations at 49 CFR Part 26. This contract is subject to DBE provisions because it is financed with federal-aid-highway funds. Additionally, this contract is subject to the *State of Wisconsin Standard Specifications for Highway and Structure Construction* and all applicable contract documents.

Requirements

Pursuant to the federal DBE program regulation at 49 CFR Part 26, a contractor's failure to comply with any provision of the DBE program regulatory provisions will be considered a material breach of contract. This is nonnegotiable.

If a contractor fails to carry out the DBE program requirements and/or the Required Contract Provisions for Federal Aid Contracts (FHWA 1273) referenced in this document, sanctions will be assessed depending upon the facts, reasoning, severity, and remedial efforts of the contractor that may include: termination of contract, withholding payment, assessment of monetary sanctions, and/or suspension/debarment proceedings that could result in the disqualification of the contractor from bidding for a designated period of time.

- (1) The Commitment to Subcontract to DBE (Form DT1506 or digital submittal), Attachments A, and Good Faith Effort Documentation (Form DT1202) will be submitted as described in Section 2.
- (2) Any change to DBE Commitments thereafter must follow modification of DBE subcontracting commitment as described in Section 9.
- (3) The Department requires this list of DBE subcontractors from all bidders at time of bid to ensure the lowest possible cost to taxpayers and fairness to other bidders and subcontractors. Bid shopping is prohibited.
- (4) The contractor must utilize the specific DBE firms listed in the approved DBE Commitment to perform the work and/or supply the materials for which the DBE firm is listed unless the contractor obtains written consent in advance from WisDOT. The contractor will not be entitled to payment for any work or materials on the approved DBE Commitment that is not performed or supplied by the listed DBE without WisDOT's written consent.

Description

The Wisconsin Department of Transportation is committed to the compliant administration of the DBE Program. The DBE provisions work in tandem with FHWA 1273 and WisDOT's *Standard Specifications for Highway and Structure Construction* and *Construction and Materials Manual*. The WisDOT Secretary is signatory to assurances of department-wide compliance.

The Department assigns the contract DBE goal as a percentage of work items that could be performed by certified DBE firms on the contract. The assigned DBE goal is expressed on the bid proposal as a percentage applicable to the total contract bid amount.

- (1) WisDOT identifies the assigned DBE goal in its contract advertisements and posts the contract DBE goal on the cover of the bidding proposal. The contractor can meet the assigned contract DBE goal by subcontracting work to a DBE firm or by procuring services or materials from a DBE firm.

- (2) Under the contract, the prime contractor should inform, advise, and develop participating DBE firms to be more knowledgeable contractors who are prepared to successfully complete their contractual agreement through the proactive provision of assistance in the following areas:
 - Produce accurate and complete quotes
 - Understand highway plans applicable to their work
 - Understand specifications and contract requirements applicable to their work
 - Understand contracting reporting requirements
- (3) The Department encourages contractors to assist DBE subcontractors more formally by participating in WisDOT's Business Development program as a mentor, coach, or resource. For comprehensive information on the Disadvantaged Business Enterprise Program, visit the Department's Civil Rights and Compliance Section website at: <http://wisconsindot.gov/Pages/doing-bus/civil-rights/dbe/default.aspx>

1. Definitions

Interpret these terms, used throughout this additional special provision, as follows:

- a. **Assigned DBE Contract Goal:** The percentage shown on the cover of the Highway Work Proposal that represents the feasible level of DBE participation for each contract. The goal is calculated using the Engineer's Estimate and DBE Interest Report. Goal assignment includes review of FHWA funds, analyzes bid items for subcontract opportunity and compatibility with DBE certified firm work codes. Additional factors considered include proximity, proportion, and regulations.
- b. **Bid Shopping:** In construction law, bid shopping is the practice of divulging a subcontractor's bid to another prospective contractor(s) before or after the award of a contract to secure a lower bid.
- c. **DBE:** Disadvantaged Business Enterprise – A for-profit small business concern where socially and economically disadvantaged individuals own at least a 51% interest and control management and daily business operations.
- d. **DBE Commitment:** The DBE Commitment is identified in the Commitment to Subcontract to DBE (Form DT1506) and is expressed as the amount of DBE participation the prime contractor has secured. The DT1506, a contract document completed by the bidder, is required to be considered a responsive bidder on an FHWA-funded contract that has an assigned DBE goal. The prime contractor will have the option to submit the DT1506 digitally, as an entry with the bid in Bid Express, or as an attachment to the bid.
- e. **DBE Utilization:** The actual participation of a DBE subcontractor on a project. WisDOT verifies DBE utilization through review of the DBE Commitment, payments to subcontractors, and contract documentation. The Prime Contractor receives DBE credit for payments made to the DBE firms performing the work listed on the approved DBE Commitment, and those submitted after approved commitment with Attachment A.
- f. **Good Faith Effort:** Legal term describing a diligent and honest effort taken by a reasonable person under the same set of facts or circumstances. For DBE subcontracting, the bidder must show that it took all necessary and reasonable steps to achieve the assigned DBE goal by the scope, intensity, and appropriateness of effort that could reasonably be expected for a contractor to obtain sufficient DBE participation.
- g. **Manufacturer:** A firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract.
- h. **Reasonable Price:** Contractors are expected to assess reasonable price by analyzing the contract scope for DBE subcontract feasibility and comparing common line items in DBE and non-DBE subcontract quotes for the same work. Per federal regulation, reasonable price is not necessarily the lowest price.
- i. **Supplier:** A firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles, or equipment required under the contract are bought, kept in stock, and regularly sold or leased to the public.
- j. **Tied quote:** Subcontractor quote that groups multiple bid/line items at a bundled/package price with a notation that the items within the quote will not be separated.

2. WisDOT DBE Program Compliance

a. Documentation Submittal

- The Commitment to Subcontract to DBE (Form DT1506 or digital submittal) must be submitted at the time of bid (Tuesday) by all prime contractors.
- Attachments A OR quotes from all DBEs included in the Commitment must be submitted at bid (Tuesday) **OR**
- Within one-hour following bid submittal by ALL prime contractors via eSubmit (Tuesday).
- If only DBE quotes were submitted, all remaining signed Attachments A must be submitted within 24-hours of bid closing via eSubmit (Wednesday).
- If the assigned DBE contract goal is not met, Documentation of Good Faith Effort (Form DT1202) and supporting documentation must be submitted within 24-hours of bid closing (Wednesday) via eSubmit. [Instructions for eSubmit.](#)

****Bidders have the option of submitting the DBE Commitment at the time of bid via direct entry through Bid Express OR with attachment of Form DT1506 (Commitment to Subcontract to DBE). The DBE Commitment entered with bid is the digital form of the DT1506. Separate submission of Form DT1506 is not required if the DBE Commitment is entered in Bid Express. Form DT1202, if applicable, is no longer required to be submitted at time of bid; submit DT1202 within the 24-hour supplemental time frame following bid closing.**

The DBE Office will not certify Good Faith Effort and the Bureau of Project Development will consider the bid nonresponsive if the contractor fails to furnish the DBE Commitment (digitally entered into the bid OR Form DT1506 as an attachment), Attachments A, and Form DT1202 if applicable, as required. See sample forms in the Appendix.

b. Verification of DBE Commitment

The documentation related to DBE subcontract commitment submitted prior to contract award is evaluated as follows:

(1) DBE Goal Met

If the bidder indicates that the contract DBE goal is met, the Department will evaluate the DBE Commitment submitted with bid OR Form DT1506, and Attachments A to verify the actual DBE percentage calculation. If the DBE Commitment is verified, the contract is eligible for award with respect to the DBE Commitment.

(2) DBE Goal Not Met

- a) If the bidder indicates a bid percentage on the DBE Commitment that does not meet the assigned DBE contract goal, the bidder must request alternative evaluation of good faith effort through submission of Form DT1202 (Documentation of Good Faith Effort) within 24-hours of bid including narrative description. Supplementary documentation of good faith effort that supports the DT1202 submission is also due within 24-hours of bid submission and prior to bid posting. The Department will review the bidder's DBE Commitment and evaluate the bidder's good faith efforts submission.
- b) Following evaluation of the bidder's Good Faith Effort documentation the bidder will be notified that the Department intends to:
 1. *Approve* the request (adequate documentation of GFE has been submitted) - no conditions placed on the contract with respect to the DBE Commitment;
 2. *Deny* the request (inadequate documentation of GFE has been submitted) - the contract is viewed as non-responsive per Wisconsin Standard Specifications for Highway and Structure Construction and will not be executed.

- c) If the Department denies the bidder's request, the contract is ineligible for award. The Department will provide a written explanation for denying the request to the bidder. The bidder may appeal the Department's denial (see Section 4).

Supplemental good faith effort documentation must be submitted through eSubmit.

3. Department's Criteria for Good Faith Effort Documentation

The Federal-aid Construction Contract Provision, referenced as FHWA-1273, explicitly states that the prime contractor shall be responsible for all work performed on the contract by piecework, station work, or subcontract.

The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of the contract including assurances of equal employment opportunity laws, DBE regulations, and affirmative action. Compliance encompasses responsible and responsive action, documentation, and good faith effort.

Contractually, all contractors, subcontractors, and service providers on the contract are bound by FHWA 1273 and DBE program provisions. **Prime contractors should encourage subcontractors to utilize DBE firms whenever possible to contribute to the assigned DBE contract goal.**

Bidders are required to document good faith effort. Per 49 CFR Part 26.53, good faith effort is demonstrated in one of two ways. The bidder:

- (1) Documents that it has obtained enough DBE participation to meet the goal; OR
- (2) Documents that it made adequate good faith efforts to meet the goal, even though it did not succeed

Appendix A of 49 CFR Part 26 provides guidance concerning good faith efforts. WisDOT evaluates good faith effort on a contract basis just as each contract award is evaluated individually.

The efforts employed by the bidder should be those that WisDOT can reasonably expect a bidder to take to actively and aggressively obtain DBE participation sufficient to meet the DBE contract goal. The Department will only approve demonstration of good faith effort if the bidder documents the quality, quantity, and intensity of the variety of activities undertaken that are commensurate with expected efforts to meet the stated goal.

The Department, in conjunction with industry stakeholders, has developed the following guidance for contractor good faith effort activity. The guidance and the attached appendices provide a framework for the actions required by all parties in the processing and evaluation of bidder's total efforts to achieve the project specific DBE goal prior to the bid letting date.

a. Solicitation Guidance for Prime Contractors:

- (1) Document all efforts and decisions made toward achieving the DBE goal on the contract. The bidder should use WisDOT-approved DBE outreach tools, including the UCP DBE Directory and the Bid Express Small Business Network to foster DBE participation on all applicable contracts.
- (2) As needed, request assistance with DBE outreach and follow-up by contacting the Department's DBE Support Services Office by phone or email request at least 14 days prior to the bid letting date. Phone numbers are (414) 438-4584 and/or (608) 267-3849; Fax: (414) 438-5392; E-mail: DBE_Alert@dot.wi.gov
- (3) Participate in and document a substantive conversation with at least one DBE firm per Let, to discuss questions, concerns, and any other contract related matters that may be applicable to the DBE firm. Guidelines for this conversation are provided in Appendix A of ASP-3.
- (4) Request quotes by identifying potential items to subcontract and solicit. In their initial contacts, contractors are strongly encouraged to include a single page, detailed list of items for which they are accepting quotes, by project, within a letting. *See attached sample entitled "Sample Contractor Solicitation Letter" in Appendix B.* Prime contractors should also indicate a willingness to accept quotes in areas they are planning to perform themselves, as required by federal rules. In some cases, it might be appropriate to use DBE firms to do work in a prime contractor's area of specialization.

- i. Solicit quotes from certified DBE firms who match possible items to subcontract using all reasonable and available means. Additionally, forward copies of solicitations highlighting the work areas for which quotes are being sought to DBE_Alert@dot.wi.gov
- ii. Acceptable outreach tools include SBN (Small Business Network, see Appendix C): <https://www.bidx.com/wi/main>, postal mail, email, fax, and phone.
 - a. Contractors must ask DBE firms for a response in their solicitations. See *Sample Contractor Solicitation Letter*, Appendix B. This letter may be included as an attachment to the sub-quote request.
 - b. Solicit quotes at least 10 calendar days prior to the letting date to allow DBE firms sufficient time to respond. Prime contractors should contact DBE firms early, asking if they need help organizing their quote, assistance confirming equipment needs, or other assistance supporting their submission of a competitive quote for their services.
 - c. A follow up solicitation should take place within 5 calendar days of the letting date. Email and/or SBN are the preferred method for the solicitation.
- iii. Upon request, provide interested DBE firms with adequate information about plans, specifications, and the requirements of the contract by letter, information session, email, phone call, and/or referral.
- iv. When potential exists, the contractor should advise interested DBE firms on how to obtain bonding, line of credit, or insurance if requested.
- v. Document DBE firm's interest in quoting by taking appropriate steps to follow up initial solicitation with:
 - a. Email to all prospective DBE firms in relevant work areas
 - b. Phone call log to DBE firms who express interest via written response or call
 - c. Fax/letter confirmation
 - d. Signed copy of record of subcontractor outreach effort

b. Guidance for Evaluating DBE quotes

- (1) Quote evaluation practices required to evaluate DBE quotes:
 - i. Reasonable Price: Contractors are expected to assess reasonable price by analyzing the contract scope for DBE subcontract feasibility and comparing common line items in DBE and non-DBE subcontract quotes for the same work. Per federal regulation, reasonable price is not necessarily the lowest price. See 49 CFR Part 26, Appendix A. IV.D(2).
- (2) Documentation submitted by the prime of the following evaluation is required to evaluate DBE quotes by contractors:
 - i. Evaluation of DBE firm's ability to perform "possible items to subcontract" using legitimate reasons, including but not limited to, **a discussion** between the prime and DBE firm regarding its capabilities prior to the bid letting. If lack of capacity is the reason for not utilizing the DBE firm's quote, the prime is required to contact the DBE by phone and email regarding their ability to perform the work indicated in the UCP directory listed as their work area by NAICS code. Only the work area indicated by the NAICS code(s) listed in the UCP directory can be counted toward DBE credit. Documentation of the conversation is required.
 - a. In striving to meet an assigned DBE contract goal, contractors are expected to use DBE quotes that are responsive and reasonable. This includes DBE quotes that are not the low quote.
 - b. Additional evaluation - Evaluation of DBE quotes with tied bid items. Typically, this type of quoting represents a cost saving but is not clearly stated as a discount. Tied quotes are usually presented as an 'all or none' quote. When non-DBE subcontractors submit tied bid items in their quotes, the DBE firm's quote may not appear competitive. In such a case, the following steps are taken in comparing the relevant quotes. These are qualitative examples:

- i Compare bid items common to both quotes, noting the reasonableness in the price comparison.
- ii Review quotes from other firms for the bid items not quoted by the DBE firm to see if combining both can provide the same competitive advantage that the tied bid items offered.

See Appendix D – *Good Faith Effort Evaluation Measures* and Appendix E - *Good Faith Effort Best Practices*.

c. Requesting Good Faith Effort Evaluation At the time of bid- if the DBE goal is not met in full, the prime contractor must indicate they will file form DT1202- Documentation of Good Faith Effort within 24-hours of bid submission. Supplementary documentation of good faith effort that supports the DT1202 submission is also due within 24-hours of bid submission and prior to bid posting. Supporting documentation for the DT1202 is to include the following:

- (1) Solicitation Documentation: The names, addresses, email addresses, and telephone numbers of DBE firms contacted along with the dates of both initial and follow-up contact; electronic copies of all written solicitations to DBE firms. A printed copy of SBN solicitation is acceptable.
- (2) Selected Work Items Documentation: Identify economically feasible work units to be performed by DBEs to include activities such as: list of work items to be performed; breaking up of large work items into smaller tasks or quantities; flexible time frames for performance and delivery schedules.
- (3) Documentation of Project Information provided to interested DBEs: A description of information provided to the DBE firms regarding the plans, specifications, and estimated quantities for portions of the work to be performed by that DBE firm.
- (4) Documentation of Negotiation with Interested DBEs: Provide sufficient evidence to demonstrate that good faith negotiations took place. Merely sending out solicitations requesting bids from DBEs does not constitute sufficient good faith efforts.
- (5) Documentation of Sound Reasoning for Rejecting DBEs and copies of each quote received from a DBE firm and, if rejected, copies of quotes from non-DBEs for same items.
- (6) Documentation of Assistance to Interested DBEs- Bonding, Credit, Insurance, Equipment, Supplies/Materials
- (7) Documentation of outreach to Minority, Women, and Community Organizations and other DBE Business Development Support: Contact organizations and agencies for assistance in contacting, recruiting, and providing support to DBE subcontractors, suppliers, manufacturers, and truckers at least 14 days before bid opening. Participate in or host activities such as networking events, mentor-protégé programs, small business development workshops, and others consistent with DBE support.

If the Good Faith Effort documentation is deemed adequate, the request will be approved and the DBE office will promptly notify the Prime Contractor and Bureau of Project Development.

If the DBE Office denies the request, the Prime Contractor will receive written correspondence outlining the reasons. The Department encourages the Prime Contractor to communicate with DBE staff to clarify any questions related to meeting goals and/or contractor demonstration of good faith efforts.

If the contract is awarded, the Prime Contractor must obtain written consent from the DBE Office to change or replace any DBE firm listed on the approved DBE Commitment. No contractor, prime or subsequent tier, shall be paid for completing work assigned to a DBE subcontractor on an approved DBE Commitment unless WisDOT has granted permission for the reduction, replacement, or termination of the assigned DBE in writing. If a prime contractor or a subcontractor on any tier uses its own forces to perform work assigned to a DBE on an approved DBE Commitment, **they will not be paid for the work**. Any changes to DBE Commitment after the approval of the DBE Commitment must be reviewed and approved by the DBE Office prior to the change (see Section 9).

Additional resources for demonstrating and tracking good faith effort can be found on the “Contracting with a DBE” webpage in the [ASP-3 and Good Faith Effort Guidance](#) section.

4. Bidder's Documentation of Good Faith Effort Evaluation Request Appeal Process

A bidder can appeal the Department's decision to deny the bidder's demonstration of Good Faith Effort through Administrative Reconsideration. The bidder must provide a written justification refuting the specific reasons for denial as stated in the Department's denial notice. The bidder may meet in person with the Department if so requested. Failure to appeal within 5 business days after receiving the Department's written notice denying the request constitutes a forfeiture of the bidder's right of appeal. Receipt of appeal is confirmed by email date stamp or certified mail signed by WisDOT staff. A contract will not be executed without documentation that the DBE provisions have been fulfilled.

The Department will appoint a representative who did not participate in the original good faith effort determination, to assess the bidder's appeal. The Department will issue a written decision within 5 business days after the bidder presents all written and oral information. In that written decision, the Department will explain the basis for finding that the bidder did or did not demonstrate an adequate good faith effort to meet the contract DBE goal. The Department's decision is final.

5. Determining DBE Eligibility

Directory of DBE firms

- a. The only resource for DBE firms certified in the State of Wisconsin is the Wisconsin Unified Certification Program (UCP) DBE Directory. WisDOT maintains a current list of certified DBE firms at: <http://wisconsindot.gov/Documents/doing-bus/civil-rights/dbe/dbe-ucp-directory.xlsx>
- b. The DBE Program office is available to assist with contracting DBE firms:(608) 267-3849.
- c. DBE firms are certified based on various factors including the federal standards from the Small Business Administration that assigns a North American Industrial Classification (NAICS) Codes. DBE firms are only eligible for credit when performing work in their assigned NAICS code(s). If a DBE subcontractor performs work that is not with its assigned NAICS code, the prime contractor should contact the DBE Office to inquire about compatibility with the Business Development Program.

6. Counting DBE Participation

Assessing DBE Work

The Department will only count the DBE usage towards the contract DBE goal if the DBE firm is certified as a DBE by one of the UCP agencies. The Department only counts the value of the work a DBE actually performs towards the DBE goal. The Department assesses the DBE work as follows:

- a. The Department counts work performed by the DBE firm's own resources. The Department includes the cost of materials and supplies the DBE firm obtains for the work. The Department also includes the cost of equipment the DBE firm leases for the work. The Department will not include the cost of materials, supplies, or equipment the DBE firm purchases or leases from the prime contractor or its affiliate, with the exception of non-project specific leases the DBE has in place before the work is advertised.
- b. The Department counts fees and commissions the DBE subcontractor charges for providing bona fide professional, technical, consultant, or managerial services. The Department also counts fees and commissions the DBE charges for providing bonds or insurance. The Department will only count costs the program engineer deems reasonable based on experience or prevailing market rates.
- c. If a DBE firm subcontracts work, the Department counts the value of the work subcontracted to a DBE subcontractor.
- d. The contractor will maintain records and may be required to furnish periodic reports documenting its performance under this item.
- e. It is the Prime Contractor's responsibility to determine whether the work that is committed and/or contracted to a DBE firm can be counted for DBE credit by referencing the work type and NAICS code listed for the DBE firm on the Wisconsin UCP DBE Directory.

- f. It is the Prime Contractor's responsibility to assess the DBE firm's ability to perform the work for which it is committing/contracting the DBE to do. Note that the Department encourages the Prime Contractor to assist and develop DBE firms to become fully knowledgeable contractors to successfully perform on its contracts.
- g. The Prime Contractor will inform the DBE office via email of all DBE subcontractors added to the project following execution of the contract. The Prime Contractor may omit submission of another form DT1506, but must submit signed Attachment A forms for additional DBE firms.
- h. See Section 7 for DBE credit evaluation for Trucking and Section 8 for DBE credit evaluation for Manufacturers, Suppliers, and Brokers

Naming conventions: When emailing files, please use the following language to identify your submission- "Project #, Proposal #, Let date, Business Name, Attachment A" Email: DBE_Alert@dot.wi.gov

*Note: A sublet request is required for DBE work, regardless of subcontract tier, and also for reporting materials or supplies furnished by a DBE.

- Sublet Requests via form DT1925 or WS1925 are required for 1st Tier DBEs
- For all 2nd Tier and below notification of DBE sublet is indicated by the contractor entering them in CRCS

7. Credit Evaluation for Trucking

All bidders are expected to adhere to the Department's current trucking policy posted on the HCCI website at: <http://wisconsindot.gov/Documents/doing-bus/civil-rights/dbe/trucking-utilization-policy.pdf>

The prime contractor is responsible for ensuring that all subcontractors including trucking firms, receive Form FHWA 1273: <https://www.fhwa.dot.gov/programadmin/contracts/1273/1273.pdf>

See Section 8 for Broker credit.

8. Credit Evaluation for Manufacturers, Suppliers, Brokers

The Department will calculate the amount of DBE credit awarded to a prime using a DBE firm for the provisions of materials and supplies on a contract-by-contract basis. The Department will count the material and supplies that a DBE firm provides under the contract for DBE credit based on whether the DBE firm is a manufacturer, supplier, or broker. Generally, DBE credit is determined through evaluation of the DBE owner's role, responsibility, and contribution to the transaction. Maximum DBE credit is awarded when the DBE firm manufactures materials or supplies. DBE credit decreases when the DBE firm solely supplies materials, and minimal credit is allotted when the DBE firm's role is administrative or transactional. It is the bidder's responsibility to confirm that the DBE firm is considered a supplier or a manufacturer before listing them on Commitment to Subcontract to DBE form DT1506 or DBE Commitment submitted with the bid.

a. Manufacturers

- (1) A manufacturer is a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract and of the general character described by the specifications.
- (2) If the materials or supplies are obtained from a DBE manufacturer, **100%** percent of the cost of the materials or supplies counts toward DBE goals.

b. Regular Dealers of Material and/or Supplies

- (1) A regular dealer is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications

and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business.

- (2) If the materials or supplies are purchased from a DBE regular dealer, count **60%** percent of the cost of the materials or supplies toward DBE goals.
- (3) At a minimum, a regular dealer must meet the following criteria to be counted for DBE credit:
 - i. The DBE firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question.
 - ii. The DBE firm must both own and operate distribution equipment for the product--bulk items such as petroleum products, steel, cement, gravel, stone, or asphalt. If some of the distribution equipment is leased, the lease agreement must accompany the DBE Commitment form for evaluation of the dealer's control before the DBE office approves the DBE credit.
- (4) When DBE suppliers are contracted, additional documentation must accompany the DBE Commitment and Attachment A forms. An invoice or bill-of-sale that includes names of the bidder and the DBE supplier, along with documentation of the calculations used as the basis for the purchase agreement, subcontract, or invoice. WisDOT recognizes that the amount on the Attachment A form may be more or less than the amount on the invoice per b.(1) above.
 - i. The bidder should respond to the following questions and include with submission of form DT1506 or the DBE Commitment entered with bid:
 - a. What is the product or material?
 - b. Is this item in the prime's inventory or was the item purchased when contract was awarded?
 - c. Which contract line items were referenced to develop this quote?
 - d. What is the amount of material or product used on the project?
- (5) Supplies purchased in **bulk** from DBE firms at the beginning of the season may be credited to current contracts if submitted with appropriate documentation to the DBE office.
 - i. To ensure that the appropriate credit is assigned, follow the procedure below:
 - a. When DBE suppliers are contracted for bulk supply or commodity purchases, an invoice or bill-of-sale that includes names of the contractor and the DBE supplier should be submitted to the DBE Office via eSubmit (preferred during letting) or the DBE_Alert email box. The supply/commodity credit may be applied during the federal fiscal year (October- September) in which the purchase was made.
 - b. When the contractor intends to apply the credit to a particular project, submit a copy of the original invoice, documentation of the calculations for supplies/commodities to be used on the project, and an Attachment A. Indicate on the Attachment A:
 - c. This supply/commodity is in the prime's inventory or pre-paid in case of commodities
 - d. The full value of the original invoice submitted to the DBE Office, above in (1)
 - e. The amount of material or product used on this project
 - f. Fuel estimate listed on Attachment A will be recorded as a deduction from the full fuel purchase amount shown on the invoice
 - ii. DBE Office Process (Applies only to bulk purchases)
 - a. Supply/Commodity commitment is received
 - b. Engineer verifies amount listed on invoice and enters the full amount into spreadsheet
 - c. The amount of credit applied for each project is updated on the spreadsheet until the bulk purchase is exhausted
 - d. Engineer informs contractor when full amount of bulk purchase has been applied

c. Brokers, Transaction Expeditors, Packagers, Manufacturers' Representatives

- (1) No portion of the cost of the materials, supplies, services themselves will count for DBE credit. However, WisDOT will evaluate the fees or commissions charged when a prime purchases materials, supplies, or services from a DBE certified firm which is neither a manufacturer nor a regular dealer, namely: brokers, packagers, manufacturers' representatives, or other persons who arrange or expedite transactions.
- (2) Brokerage fees are calculated as **10%** of the purchase amount.
- (3) WisDOT may count the amount of fees or commissions charged for assistance in the procurement of the materials and supplies, fees, or transportation charges for the delivery of materials or supplies required on a job site.
- (4) Evaluation of DBE credit includes review of the contract need for the item/service, the sub-contract or invoice for the item/service, and a comparison of the fees customarily allowed for similar services to determine whether they are reasonable.

9. DBE Commitment Modification Policy (Formerly "DBE Replacement Policy")**a. Issuing a Contract Change Order**

Any changes or modifications to the contract once executed are considered contract modifications and as such require a change order. In addition, the DBE office must provide consent for reduction, termination, or replacement of subcontractors approved on the DBE Commitment *in advance* of the modification for the prime contractor to receive payment for work or supplies. Additions to the DBE Commitment do not require advance notification of the DBE office. (see below e. DBE Utilization beyond the approved DBE Commitment)

b. Contractor Considerations

- (1) A prime contractor cannot modify the DBE Commitment through reduction in participation, termination, or replacement of a DBE subcontractor listed on the approved DBE Commitment without prior written consent from the DBE Office. This includes, but is not limited to, instances in which a prime contractor seeks to perform work originally designated for a DBE subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm.
- (2) If a prime contractor reduces participation, replaces, or terminates a DBE subcontractor who has been approved for DBE credit toward its contract, the prime is required to provide documentation supporting its inability to fulfill the contractual commitment made to the Department regarding the DBE utilization.
- (3) The Prime Contractor is required to demonstrate efforts to find another DBE subcontractor to perform at least the same amount of work under the contract as the DBE subcontractor that was terminated, to the extent needed to meet the assigned DBE contract goal. When additional opportunity is available by contract modifications, the Prime Contractor must utilize DBE subcontractors that were committed to equal work items, in the original contract.
- (4) In circumstances when a DBE subcontractor fails to complete its work on the contract for any reason, or is terminated from a contract, the Prime Contractor must undertake efforts to maintain its commitment to the assigned DBE goal.
- (5) The DBE subcontractor should communicate with the Prime Contractor regarding its schedule and capacity in the context of the contract. If the DBE firm anticipates that it cannot fulfill its subcontract, they will advise the Prime Contractor and suggest a DBE subcontractor that may replace their services and provide written consent to be released from its subcontract.
 - i. Before the Prime Contractor can request modification to the approved DBE Commitment, the Prime Contractor must:
 - a. Make every effort to fulfill the DBE Commitment by working with the listed DBE subcontractor to ensure that the firm is fully knowledgeable of the Prime Contractor's expectations for successful performance on the contract. Document these efforts in writing.

- b. If those efforts fail, provide written notice to the DBE subcontractor of the Prime Contractor's intent to request to modify the Commitment through reduction in participation, termination, and/or replacement of the subcontractor including the reason(s) for pursuing this action.
- c. Copy the DBE Office on all correspondence related to changing a DBE subcontractor who has been approved for DBE credit on a contract, including preparation and coordination efforts.
- d. Clearly state the amount of time the DBE firm has to remedy and/or respond to the notice of intent to replace/terminate. The DBE must be allowed five days from the date notice was received as indicated by email time stamp or signed certified mail, to respond, in writing. EXCEPTION: The Prime Contractor must provide a verifiable reason for a response period shorter than five days. For example, a WisDOT project engineer or project manager confirms that WisDOT has eliminated an item the DBE subcontractor was contracted for.
- e. The DBE subcontractor must acknowledge the contract modification with written response to the Prime Contractor and the DBE Office. If objecting to the subcontract modification, the DBE subcontractor must outline the basis for objection to the proposed modification, providing sound reasoning for WisDOT to reject the prime's request.

c. Request to Modify DBE Subcontracting Commitment

The written request referenced above may be delivered by email or fax. The request must contain the following:

- (1) Project ID number
- (2) WisDOT Contract Project Engineer's name and contact information
- (3) DBE subcontractor name and work type and/or NAICS code
- (4) Contract's progress schedule
- (5) Reason(s) for requesting that the DBE subcontractor be replaced or terminated
- (6) Attach/include all communication with the DBE subcontractor to deploy/address/resolve work completion

Naming conventions: When emailing files, please use the following language to identify your submission- "Project #, Proposal #, Let date, Business Name, MODIFICATION" Email: DBE_Alert@dot.wi.gov + Project Engineer

WisDOT will review the request and any supporting documentation submitted to evaluate if the circumstance and the reasons constitute good cause for replacing or terminating the approved DBE subcontractor.

Good Causes to Replace a DBE subcontractor according to the federal DBE program guidelines {49 CFR part 26.53}

- The listed DBE subcontractor fails or refuses to execute a written contract
- The listed DBE subcontractor fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Provided, however, that good cause does not exist if the failure or refusal of the DBE subcontractor to perform its work on the subcontract results from the bad faith or discriminatory action of the prime contractor
- The listed DBE subcontractor fails or refuses to meet the prime contractor's reasonable, nondiscriminatory bond requirements
- The listed DBE subcontractor becomes bankrupt, insolvent, or exhibits credit unworthiness
- The listed DBE subcontractor is ineligible to work on public works projects because of suspension and debarment proceedings pursuant 2 CFR Parts 180, 215, and 1,200 or applicable state law
- The prime has determined that the listed DBE subcontractor is not a responsible contractor
- The listed DBE subcontractor voluntarily withdraws from the project and provides written notice of its withdrawal
- The listed DBE subcontractor is ineligible to receive DBE credit for the type of work required

- A DBE firm owner dies or becomes disabled with the result that the listed DBE subcontractor is unable to complete its work on the contract.

d. Evaluation and Response to the Request

WisDOT's timely response to the Prime Contractor's request for modification of the approved DBE Commitment will be provided to the prime and the WisDOT project engineer via email.

If WisDOT determines that the Prime Contractor's basis for reduction in participation, replacement, or termination of the DBE subcontractor is not consistent with the good cause guidelines, the DBE office will provide a response via email within 48-hours of receipt of request from the Prime Contractor as indicated by email time stamp. The communication will include: the requirement to utilize the committed DBE, actions to support the completion of the contractual commitment, a list of available WisDOT support services, and administrative remedies, including withholding payment to the prime, that may be invoked for failure to comply with federal DBE guidelines for DBE replacement.

The WisDOT contact for all actions related to modification of the approved DBE Commitment is the DBE Program Engineer who can be reached at DBE_Alert@dot.wi.gov or (414) 335-0413.

e. DBE Utilization beyond the approved DBE Commitment

When the prime or a subcontractor increases the scope of work for an approved DBE subcontractor or adds a DBE subcontractor who was not on the approved form DT1506 or DBE Commitment submitted with bid at any time after contract execution, this is referred to as voluntary DBE contract goal achievement. The contractor must follow these steps to ensure that the participation is accurately credited toward the DBE goal:

- (1) Forward a complete, signed Attachment A form to the DBE Office. A complete Attachment A includes DBE subcontractor contact information, signatures, subcontract value, and description of the work areas to be performed by the DBE. The DBE Office will verify the DBE participation and revise the DBE Commitment based on the email/discussion and the new Attachment A.
- (2) When adding to an existing DBE Commitment, submit a new Attachment A to the DBE Alert mailbox
- (3) OR Submit a final Attachment A to DBE Alert during the Finals Process when Compliance receives notice of "Substantially Complete"

Naming conventions: When emailing files, please use the following language to identify your submission- "Project #, Proposal #, Let date, Business Name, New Attachment A" Email: DBE_Alert@dot.wi.gov

Special note on trucking

- DBE truckers added to the sublets in CRCS *will* be approved without DBE credit (You will see a "N" in CRCS instead of "Y")
- Prime Contractors may enter a "place holder" e.g. \$1000.00, for DBE Trucking in CRCS if the full amount of trucking is unknown for sublet purposes only
- The hiring contractor may obtain the Attachment A with DBE signature included but the **Prime Contractor** must sign the Attachment A before submitting
- DBE truckers need to be added to the DBE commitment once. If the DBE trucker is on the initial commitment (DT1506/E1506) there is no requirement to submit another Attachment A for that trucker for that contract.

10. Commercially Useful Function

- a. Commercially Useful Function (CUF) is evaluated after the contract has been executed, while the DBE certified firm is performing contracted work items.
- b. The Department uses Form DT1011, DBE Commercially Useful Function Review and Certification to evaluate if the DBE is performing a commercially useful function. WisDOT counts expenditures of a DBE toward the DBE goal only if the DBE is performing a commercially useful function on that contract.

- c. A DBE firm is performing a commercially useful function if the following conditions are met:
 - (1) For contract work, the DBE is responsible for executing a distinct portion of the work and is carrying out its responsibilities by actually performing, managing, and supervising that work.
 - (2) For materials and supplies, the DBE is responsible for negotiating price, determining quality and quantity, ordering, and paying for those materials and supplies.
- d. Offsite Hauling – when DBE truck will haul between a pit and plant or location other than the construction site associated with the commitment
 - (1) Indicate Offsite Hauling on Attachment A
 - (2) Discuss offsite hauling at weekly progress meetings with Project Engineer (PE)
 - (3) PE conducts spot checks of pits/plants to verify DBE truck is hauling and/or verifying hauling log
 - (4) Prime should be prepared to submit haul tickets, plant/pit tickets, timecards, and other pertinent documentation if requested by PE or DBE Office

11. Credit Evaluation for DBE Primes

WisDOT calculates DBE credit based on the amount and type of work performed by DBE certified firms for work submitted with required documentation. If the prime contractor is a DBE certified firm, the Department will only count the work that the DBE prime performs with its own forces for DBE neutral credit. The Department will also calculate DBE credit for work performed by any other DBE certified subcontractor, DBE certified supplier, and DBE certified manufacturer on the contract in each firm's approved NAICS code/work areas that are submitted with required documentation. Crediting for manufacturers and suppliers is calculated consistent with Section 8 of this document and 49 CFR Part 26.

12. Joint Venture

A joint venture is an association of a DBE firm and one or more other firms to carry out a single, for-profit business enterprise, for which the parties combine their property, capital, efforts, skills and knowledge, and in which the DBE is responsible for a distinct, clearly defined portion of the work of the contract and whose share in the capital contribution, control, management, risks, and profits of the joint venture are commensurate with its ownership interest. If a DBE performs as a participant in a joint venture, the Department will only credit the portion of the total dollar value of the contract equal to the portion of the work that the DBE performs with its own forces.

13. Mentor-Protégé

- a. If a DBE performs as a participant in a mentor-protégé agreement, the Department will credit the portion of the work performed by the DBE protégé firm.
- b. DBE credit is evaluated and confirmed by the DBE Office for any contracts on which the mentor-protégé team identifies itself to the DBE Office as a current participant of the Mentor-Protégé Program.
 - (1) DBE credit may only be awarded to a non-DBE mentor firm for using its own protégé firm for less than one half of its goal on any contract; and
 - (2) Not award DBE credit to a non-DBE mentor firm for using its own protégé firm for more than every other contract performed by the protégé firm.
- c. A DBE protégé firm may be eligible for conditional NAICS code extension for training with the mentor. Request permission from the DBE Office- Certification area.
- d. Refer to WisDOT's Mentor-Protégé guidelines for guidance on the number of contracts and amount of DBE credit allowed on WisDOT projects.

14. Use of Joint Checks

The use of joint checks is allowable if it is a commonly recognized business practice in the material industry. A joint check is defined as a two-party check between a DBE subcontractor, a prime contractor, and the regular dealer or materials supplier who is neither the prime nor an affiliate of the prime. Typically, the prime contractor issues one check as payor to the DBE subcontractor and to the supplier jointly (to guarantee payment to the supplier) as payment for the material/supplies used by the DBE firm in cases where the DBE subcontractor and materials have been approved for DBE credit. The DBE subcontractor gains the opportunity to establish a direct contracting relationship with the supplier to potentially facilitate a business rapport that results in a line of credit or increased partnering opportunities.

The cost of material and supplies purchased by the DBE firm is part of the value of work performed by the DBE to be counted toward the goal. To receive credit, the DBE firm must be responsible for negotiating price, determining quality and quantity, ordering the materials, and installing (where applicable) and "paying for the material itself." See 49 CFR 26.55(c)(1).

The approval to use joint checks constitutes a commitment to provide further information to WisDOT, upon request by staff. WisDOT will allow the use of joint checks when the following conditions are met:

- a. The Prime Contractor must request permission to use joint checks from the DBE Office by submitting the Application to Use Joint Checks.
 - (1) Request should be made when the DBE Commitment or the Request to Sublet is submitted; the request will not be considered if submitted after the DBE Subcontractor starts its work.
 - (2) Approval/Permission must be granted prior to the issuance of any joint checks.
 - (3) The payment schedule for the supplier must be presented to the DBE office before the first check is issued.
 - (4) The joint check for supplies must be strictly for the cost of approved supplies.
- b. The DBE subcontractor is responsible for furnishing and/or installing the material/work item and is not an 'extra participant' in the transaction. The DBE firm's role in the transaction cannot be limited solely to signing the check(s) to release payment to the material supplier. At a minimum, the DBE subcontractor's tasks should include the following:
 - (1) The DBE subcontractor (not the prime/payor) negotiates the quantities, price, and delivery of materials.
 - (2) The DBE subcontractor consents to sign/release the check to the supplier by signing the [Application to Use Joint Checks](#) after establishing the conditions and documentation of payment within the subcontract terms or in a separate written document.
- c. The Prime contractor/payor acts solely as a guarantor.
 - (1) The Prime Contractor agrees to furnish the check used for the payment of materials/supplies under the contract.
 - (2) The prime contractor/payor cannot require the subcontractor to use a specific supplier or the prime contractor's negotiated unit price.

15. Payment

Costs for conforming to this Additional Special Provision (ASP) and any associated DBE requirements are incidental to the contract.

Appendix A

Substantive Conversation Guidelines

The substantive conversation is critical to all bidders' demonstration of good faith effort to meet the DBE goal prior to bid opening. Relationship building between primes and subcontractors is crucial to DBE goal attainment. Responsible bidders seek to build rapport with potential DBE subcontractors to understand capacity, areas of expertise, and assess contracting feasibility. Bidders who compete for WisDOT contracts are specialty contractors responding to a growing and changing contract environment. Just as these specialists are responsible for care of the roads, they are likewise responsible for contributing to the health of the industry. The substantive conversation drives collaboration that will build industry health and capacity. The following is intended to provide guidance for such discussions but is not an exhaustive list. Contractors are encouraged to incorporate their existing strategies for cultivating business relationships as well.

Prior to Bid Opening- this discussion should happen as early as possible (WisDOT advertisements are released weeks prior to each Let)

1. Determine DBE subcontractor's interest in quoting
2. If response indicates inexperience with quoting- offer support/assistance to the DBE in understanding the industry including fundamentals a subcontractor needs to know, required reading and/or resources.
3. Assess their interest and experience in the road construction industry by asking questions such as:
 - Have you competed for other WisDOT contracts? Ratio of competed/to wins
 - Have you performed on any transportation industry contracts (locally or with other states)?
 - What the largest contract you've completed?
 - Have you worked in the industry: apprentice, journeyman, safety, inspection etc.?
 - Does this project fit into your schedule? Are you working on any contracts now?
 - Have you reviewed a copy of the plans? Are you comfortable performing within the scope and quantity considerations of this contract?
 - What region do you work in? Home base?
 - Which line items are you considering?
 - Have you read/are you familiar with WisDOT Standard Specifications? Construction Material Manual?
 - Do you understand where your work fits in the project schedule, project phases?

Following Bid Opening- this discussion can happen at any time

1. After reviewing their quote, note the following in your discussion:
 - Does the quote look complete? Irregular?
 - Are there errors in the quote? Are items very high or very low?
 - In general, does the quote look competitive?
2. Questions and Advice for the bidder to share with the potential DBE subcontractor:
 - What line items would typically be in a competitive quote for a subcontractor of their specialty?
 - How many employees and what is their role/experience/expertise in your firm?
 - Do you have resources for labor (union member, family-based, community-resourced) and capital (banking relationship, bond agent, CPA)?
 - Where have you worked: cities, states, government, commercial, residential/private sector, etc. Explain similarities or differences.
 - Refer them to reliable, trusted, industry resources that can educate or connect them to relevant resources, education/certification resources, more appropriate contract opportunities.
 - Discussion about prime contract and subcontract liability, critical path items, contract quantities, schedule risks, and potential profit/loss (for upcoming known projects or in general).
 - Discussion of bonding, insurance, and overall business risk considerations.

Appendix B

Sample Contractor Solicitation Letter Page 1

(This sample is provided as a guide, not a formatting requirement)

DBE Solicitation - [Month] [Day], [Year] WisDOT Bid Letting

Attention all DBEs. [Prime Contractor] is actively seeking your quote for the [Month][Day], [Year] Bid Letting. [Prime Contractor] is considering bidding on the projects listed on page 2 as a prime contractor. Please see page 2 for instructions and the sub-contractable opportunities for each proposal.

Does [Prime Contractor] accept quotes in areas we might self-perform? Yes, we do! We support this federal rule and (if needed) we consider areas we might self-perform an opportunity to provide in the field assistance and training if we award your quote.

Where can DBEs find the plans, specifications & addenda? Please visit [Prime Contractor's] plan room [LINK] or on WisDOT's Highway Construction Contract Information HCCI website: [Wisconsin Department of Transportation Highway Construction Contract Information \(wisconsindot.gov\)](https://wisconsindot.gov/HighwayConstructionContractInformation). This same website can be checked for the contract status.

What should your quote include? All the costs required to complete the items you propose to perform including labor, equipment, material, and related bonding or insurance. The quote should also note items that you are DBE certified to perform, tied items, and any special terms. Please use page 2 as your cover sheet for your quote.

Do you have a question regarding bonding, credit, insurance, equipment, or supplies/materials? We welcome all DBE questions! Please call [Prime Contractor] and ask to speak with [Contact]. [Prime Contractor] can provide basic information as well as a referral to a trusted industry partner for insurance and bonding needs.

When are quotes due?

[Month] [Day], [Year] at [Time]. We accept quotes via SBN, email, or fax. Please make every effort to have your quotes in by this time or earlier. Quality check your quote so it includes the correct letting date, project ID, proposal number, unit price and extension.

Who can DBEs contact for questions, information, clarification or for a quote evaluation? [Project Manager Name] [Phone] [Email]. If you are quoting [Prime Contractor] for the first time, we encourage you to come meet with us in person to discuss the project. Our office hours are 7:30 a.m. – 5:00 p.m. On bid day, we are in the office by 6:30 a.m.

Why partner with [Prime Contractor]?

DBE partnership is a core part of [Prime Contractor's] mission. Including DBEs at the beginning of each project is essential in the success of each project. We consider DBEs to be important industry partners who bring dedication and knowledge at various stages during construction. We are proud to be an industry leader with our DBE partnership. Your success as a DBE is our success.

Sample Contractor Solicitation Letter Page 2*(This sample is provided as a guide, not a formatting requirement)***REQUEST FOR QUOTE****[Prime Contractor]****Letting Date: [Month] [Day], [Year]****Project IDs: 1234-56-00 (Proposal #1) & 1234-01-78 (Proposal #6)**

Please check all that apply:

- ☐ Yes, we will be quoting the projects & items listed below
- ☐ No, we are not interested in quoting on the letting or its items referenced below
- ☐ Please take our name off your monthly DBE contact list
- ☐ We have questions about quoting this letting. Please have someone contact me at this number:

Prime Contractor Contact: _____

DBE: _____

Phone: _____

Fax: _____

Email: _____

Please circle the proposals and items you will be quoting below and contact us with any questions

Proposal	1	6
County	Dane County	Crawford County
Clearing & Grubbing	X	X
Dump Truck Hauling	X	X
Curb/Gutter/Sidewalk	X	
Erosion Control Items		X
Excavation	X	X
Pavement Marking		X
Traffic Control	X	
Sawing	X	X
QMP, Base		X
Pipe Underdrain	X	
Landscape		X
Beam Guard	X	
Electrical	X	
Signs/Posts/Markers		X
Survey/Staking		X

Again, please make every effort to have your quotes into our office by **time deadline** prior to the letting date.

Sample Contractor Solicitation Email - Simplified

(This sample is provided as a guide, not a formatting requirement)

ATTENTION DBEs

- [Prime Contractor] specializes in municipal projects in the XX Region(s)
- We have successfully competed for and completed XX WisDOT projects over the past XX years
- Consider [Prime Contractor] your partner on WisDOT Projects

[Prime Contractor] is seeking your subcontractor quote for the XX/XX/20XX WisDOT bid letting on the below projects:

Project	Proposal	County	Region
1234-56-00	2	Dane	SW
1234-01-78	6	Crawford	SW

- Please review the attachments **[attach Solicitation Letter]** and respond with your intent to quote (or not) along with the work items you are interested in performing and respond via fax or email by date. The quote should note items that you are DBE certified to perform, tied items, and any special terms. Please include labor, equipment, material, and related bonding or insurance.
- If you have any questions regarding bonding, credit, insurance, equipment and/or materials/supplies, please feel free to call [Prime Contractor] and ask for [Contact]. **(Include if your company is willing to answer these types of DBE questions)**
- Plans and Specifications can be found: **WisDOT HCCI Website: List webpage where plans are located**
- If you do choose to quote, please make every effort to have your quote into our office by time and date. Make sure the correct letting date, project number, unit price and extension are included in your quote.
- Should you have questions regarding the mentioned project, please call our office at (414) 555-5555 and we will direct you to the correct estimator/project manager.
Our office hours are 7:30 a.m. - 5:00 p.m.

Thank you – we look forward to working with your company on this project!

Prime Contractor
Project Manager

Direct: 414-555-5555

Cell: 414-555-5556

Sample Contractor Solicitation Email to **non-DBE** WisDOT Subcontractors - Simplified

(This sample is provided as a guide, not a formatting requirement)

ATTENTION WisDOT SUBCONTRACTORS

[Prime Contractor] is considering bidding on the below projects for the XX/XX/20XX WisDOT Bid Letting:

Project	Proposal	County	Region	DBE Goal
1234-56-00	2	Dodge	SW	6.00%
1234-01-78	11	Adams	NC	3.00%
1234-00-99	20	Buffalo	NW	5.00%
1234-00-98	33	Portage	NC	6.00%

The above projects have DBE goals and [Prime Contractor] is committed to DBE inclusion with every project. As such, we are requesting:

- All WisDOT Subcontractors to **solicit and utilize** DBEs in your quotes.
- DBE participation can be achieved through purchasing materials from DBE suppliers, using DBE subcontractors and/or DBE trucking firms or any combination of these.
- If there is an opportunity to untie an item in your quote so a DBE can be utilized, please look for those opportunities as well.
- Your quote will be evaluated based on the amount of DBE participation your company is able to provide when compared to other quotes for the same work.

If you do choose to quote, please make every effort to have your quote into our office by **time and date**. Please submit all quotes to [Email]. Make sure the correct letting date, project number, unit price and extension are included in your quote.

Should you have questions regarding the mentioned project, the Project Manager contact is: [Name] [Phone Number] [Email]

Thank you for utilizing DBEs who are trusted industry partners with WisDOT projects.

Prime Contractor
Project Manager

Direct: 414-555-5555
Cell: 414-555-5556

Appendix C

Small Business Network (SBN) Overview

The Small Business Network is a part of the Bid Express® service that was created to ensure that prime bidders have a centralized online location to find subs - including small and disadvantaged business enterprises (DBEs). It is available for prime bidders to use as part of their Basic Service subscription. Within the Small Business Network, **Prime Contractors** can:

1. Easily select proposals, work types and items:
 - a. After adding applicable work types, select items that you wish to quote. Enter the sub-quote quantities and add comments, if desired. Adding or removing items and work types can be done quickly. If needed, you can save the sub-quote for later completion.
2. Create sub-quotes for the subcontracting community:
 - a. Create sub-quotes with ease using the intuitive sub-quote creator. In seven short steps, you can rapidly create a custom sub-quote directed to all subcontractors that bid on the applicable work types. Steps include: provide contact information and sub-quote expiration date, select letting and proposal, add work types and items, specify terms and conditions, upload attachments, and select vendors.
 - b. Create a sub-quote to send to subcontractors or suppliers that lists the items in a proposal that you want quoted
 - c. Create an unlimited number of sub-quotes for items you want quoted, and optionally mark them as a DBE preferred request.
 - d. Add attachments to sub-quotes.
3. View sub-quote requests & responses:
 - a. After logging into the Bid Express service, you can quickly review all of your sub-quote requests and all unsolicited sub-quote requests from subcontractors. To simplify the Small Business Network home screen, sub-quote requests can be hidden with one click if they are not applicable.
 - b. View or receive unsolicited sub-quotes that subcontractors have posted, complete with terms, conditions and pricing.
4. View Record of Subcontractor Outreach Effort:
 - a. For each sub-quote produced, a *Record of Subcontractor Outreach Effort* is generated that shows the response statistics for a particular sub-quote. If accepted by the letting agency, this report may serve as proof of a "Good Faith" effort in reaching out to the DBE community.
 - b. Easily locate pre-qualified and certified small and disadvantaged businesses.
 - c. Advertise to small and disadvantaged businesses more efficiently and cost effectively.
 - d. Document your interactions with subs/DBEs by producing an Outreach Report (may be accepted as proof of DBE outreach at the discretion of each agency).

The Small Business Network help small businesses learn more about opportunities, compete more effectively, network with other contractors and subcontractors, and win more jobs. The DBE will provide free SBN accounts to DBEs when requested. Use DBE_Alert@dot.wi.gov to request an account. **DBE firms can:**

1. View and reply to sub-quote requests from primes:
 - a. After logging into the Bid Express service, you can quickly review all incoming sub-quote requests and all unsolicited sub-quotes created by your company. Receive notifications by selected work type. To simplify on the Small Business Network home screen, sub-quote requests can be filtered by work types relevant to your interests or hidden with one click if they are not applicable.
2. Select items when responding to sub-quote requests from primes:
 - a. You have the freedom to choose and price any number of items when responding to a sub-quote request. Quantities can be modified, and per-item comments are also available.
 - b. View requests for sub-quotes for work that primes have posted for projects they are bidding, add your pricing, terms, and conditions, and submit completed sub-quotes to the requesting primes.
 - c. Add attachments to a sub-quote.
3. Create and send unsolicited sub-quotes to specific contractors:
 - a. Create unsolicited sub-quotes with ease using the intuitive sub-quote creator. In eight short steps, you can rapidly create a custom sub-quote directed at any number of specific vendors of your choosing. Steps include: provide contact information and sub-quote expiration date, select letting and proposal, add work types and items, specify terms and conditions, upload attachments, and select vendors.
4. Easily select and price items for unsolicited sub-quotes:
 - a. After adding applicable work types, select items that you wish to quote. The extended price calculates automatically, cutting out costly calculation errors. Comments can be provided on a per-item basis as well.
 - b. Create an unsolicited sub-quote that lists the items from a proposal that you want to quote, include pricing, terms and conditions, and send it to selected prime/plan holder.
 - c. Add attachments to a sub-quote.
 - d. Add unsolicited work items to sub-quotes that you are responding to.
5. Easy Access to Valuable Information
 - a. Receive a confirmation that your sub-quote was opened by a prime.
 - b. View Bid Tab Analysis data from past bids, including the high, average and low prices of items.
 - c. View important notices and publications from DOT targeted to small and disadvantaged businesses.
6. Accessing Small Business Network for WisDOT contracting opportunities
 - a. If you are a contractor not yet subscribing to the Bid Express service, go to www.bidx.com and select "Order Bid Express." The Small Business Network is a part of the Bid Express Basic Service.

Appendix D

Good Faith Effort Evaluation Measures *by categories referenced in DBE regulations*

Bidders must demonstrate that they took all necessary and reasonable steps to achieve the assigned DBE contract goal. For each contract, all bidders must submit documentation indicating the goal has been met or if falling short of meeting the assigned goal, must request a DBE Goal Waiver and document all efforts employed to secure DBE subcontractor participation on Form DT1202.

DBE staff analyze the bidder's documented good faith efforts to determine if action taken was sufficient to meet the goal. Sufficiency is measured contract-by-contract. WisDOT evaluates active and aggressive efforts, quality, quantity, scope, intensity, and appropriateness of the bidder's efforts as a scale of the principles of Good Faith outlined in 49 CFR Part 26, Appendix A. Additional emphasis is placed on the bidder's demonstration of timely submission of documentation and communication with DBE subcontractors, and business development initiatives undertaken to support DBE firm growth.

The following is a sample of good faith effort activities that are rated according to the accompanying rubric. Contractors are encouraged to identify additional activities that align with their business type(s).

- Personal, tailored solicitation to firms that specialize in work types planned or desired for subcontracting
- Follow up to initial solicitation via email or phone
- Substantive conversation including topics such as contract liability, critical path work items, schedule risks, and potential profit/loss
- SBN utilization including posting quotes
- Review and response to DBE quotes including provision of information about plans, specifications, and requirements as applicable
- Documentation requesting subcontractors support DBE goal by solicitation and inclusion of DBE subcontractor quotes
- Responsive and timely submission of organized documentation
- Analysis of number of DBE firms who do work types that you typically subcontract
- Analysis of number of DBE firms who reside in geographical areas where prime seeks work
- Analysis of firms who express interest in bidding/quoting including the number of firms who declined your solicitation
- Reference check of DBE subcontractor work or training (documentation of questions and response required)
- Number of different efforts undertaken to meet the assigned DBE goal as documented in accompanying Form DT1202
- Submission of all DBE quotes received matched with a variety of work to be performed by DBEs
- Number and names of DBE firms provided written advice, or referral to industry-specific business development resources
- Overall pattern of DBE utilization on all WisDOT contracts which may include contracting with municipalities
- Documentation of resources expended to meet assigned DBE goal (#of hours, staff titles, average pay rate, actions taken)
- Analysis of subcontractable work items to be completed by prime beyond prime contractor's 30%
- Risk analysis of work items that are typically in tied quotes that could be unbundled
- List of contract work items in smallest economically feasible units, identifying schedule impact
- Submission of a Gap Analysis identifying DBE skillset and/or industry needs
- Staff training in EEO and Civil Rights laws as documented in training logs
- Written Capacity Assessment completed with DBE firm documenting its ability to perform the work quoted
- DBE engagement efforts beyond simple solicitation that include a substantive discussion, initiated as early in the acquisition process as possible (*points added for each day prior to letting*)
- Outreach and marketing efforts with minority, women, and veteran-focused organizations at least 10 days prior to bid opening
- Active involvement in WisDOT's Business Development Program, TrANS training, facilitated networking efforts, workshops
- Customized teaching/training efforts for future opportunities with DBE subcontractor, contract specific and/or annually
- Introduction and reference provided for DBE subcontractor to a prime who has not previously contracted with the DBE firm
- Prime utilization of a DBE subcontractor the prime has not contracted with previously
- Written referral/recommendation to bond/insurance agents, manufacturer, supplier
- Documented efforts fostering DBE participation through administrative and/or technical assistance
- Evidence of negotiation with the DBE firm about current and future Let opportunities
- Recommendation of local and state services that support small business and access to opportunity: DOA, SBA, WEDC, WPI, etc.
- Advice on bonding, lines of credit, or insurance as required to complete the items quoted and contract requirements

GFE Evaluation Rubric – Phase 1 – Initial Review

DT1202	Examples	Rating	OBOEC Feedback
Solicitation Documentation	Identify all reasonable and available activities performed to solicit the interest of all certified DBEs who have capacity and ability to perform work on the project. <i>Such as: Updated solicitation letter and email, timely solicitation, and follow-up, and/or utilized various methods to communicate solicitation (ex: letter, email, publication, posting and/or website)</i>		
Selected Work Items Documentation	All work items are broken out into economically feasible units to facilitate DBE participation. <i>Such as: Selected work items are specific to each proposal and clearly identified in all solicitation(s)</i>		
Documentation of Project Information provided to Interested DBEs	Provide interested DBEs with adequate information about the plans, specifications, and any other contractual requirements in a timely manner to assist DBEs in response to solicitation. <i>Such as: Project information is clearly identified in all solicitation(s)</i>		
Documentation of Negotiation with Interested DBEs	Provide sufficient evidence demonstrating that good faith negotiations took place during the bid letting. <i>Such as: Documented attempts with DBEs or on behalf of DBEs to increase DBE participation</i>		
Documentation of Sound Reason for Rejecting DBEs	Provide sufficient evidence demonstrating that DBEs are rejected for sound reasons. <i>Such as: Detailed and thoughtful analysis that considers both the percentage and dollar difference when rejecting a DBE including past performance, relevant business experience and stability, safety record, business ethic and integrity, technical capacity, and other tangible factors.</i>		
Documentation of Assistance to Interested DBEs- bonding, credit, insurance, equipment, supplies/materials	Documented assistance in both solicitation(s) and outreach to DBEs.		
Documentation of Outreach to Minority, Women, and Community organizations and other DBE Business Development Support	Effectively use the services of minority, women, and community organizations as well as contractors' groups, local, state, and federal business assistance offices and organization that provide assistance in recruiting and supporting DBEs, as well participation in activities that support DBE business development. <i>Such as: Variety of activities that translate into meaningful DBE participation</i>		
Documentation of other GFE activities	<i>Such as: Used DT1202 Excel Workbook, Diversity & Inclusion company policy, Mentor-Protégé participant, awarded neutral DBE after bid submission, included company GFE overview/strategy information and/or company website highlights DBE opportunities and participation</i>		
Overall Demonstration of GFE			

GFE EVALUATION RATING LEGEND – PHASE 1 – Initial Review

Documentation provided by bidder is evaluated and rated on the rubric. Bidders should include activities characterized by the following types of effort:

ACTIVE & AGGRESSIVE: Demonstrated through engaged and assertive activity

QUALITY: Demonstrated through essential character of conscientious and serious activity

QUANTITY: Demonstrated through a measurable number of activities

SCOPE & INTENSITY: Demonstrated through a rigorous approach to an appropriate and purposeful range of activities

TIMING: Demonstrated through engagement efforts beyond simple solicitation, initiated early in the process

GFE EVALUATION – PHASE 2 – Team Review**GFE Team completes:**

- Review of activities included on the rubric
- Review of the intent to award and sound reasoning submitted by Prime
- Bid analysis to confirm if any bid submitted met the DBE goal
- Review average of other bidders DBE goal achievement
- Team review of combined efforts documented in Phase 1 and 2 constitute final GFE determination

Rating Scale:

- **GFE Approval:**
Bona Fide = 6 or more categories color coded green.
Genuine effort characterized by sincere and earnest activities – “Solicitation” and “Sound Reasoning” must be green
- **GFE Approval:**
Sufficient = 5 or more categories color coded green or yellow
Adequate effort documented with a variety of quality activities – “Solicitation” and “Sound Reasoning” must be green or yellow
- **GFE Denial:**
Pro Forma efforts = 4 or less categories color coded green or yellow. Perfunctory effort characterized by routine or superficial activities

Green = Exceeds expectations

Yellow = Meets expectations

Red = Areas in need of attention and/or absence of documentation

See OBOEC Rubric Analysis Feedback

Excerpt from Appendix A to 49 CFR Part 26:

V. In determining whether a bidder has made good faith efforts, it is essential to scrutinize its documented efforts. At a minimum, you must review the performance of other bidders in meeting the contract goal. For example, when the apparent successful bidder fails to meet the contract goal, but others meet it, you may reasonably raise the question of whether, with additional efforts, the apparent successful bidder could have met the goal. If the apparent successful bidder fails to meet the goal but meets or exceeds the average DBE participation obtained by other bidders, you may view this, in conjunction with other factors, as evidence of the apparent successful bidder having made good faith efforts. As provided in §26.53(b)(2)(vi), you must also require the contractor to submit copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor was selected over a DBE for work on the contract to review whether DBE prices were substantially higher; and contact the DBEs listed

GFE RUBRIC ANALYSIS	
OBOEC DECISION	APPROVAL OR DENIAL
Prime Contractor	
Proposal	
Project	
Bid Letting	
DBE Goal Amount	
DBE Goal Amount Achieved	
Bid Analysis	
Goal %	Achieved %
Apparent Low Bidder	%
Bidder B	
Bidder C	
Average of OTHER Bidders (Not including Apparent Low Bidder)	
DBE Quotes Received	
DBE Quotes Awarded	
DBE Quote(s) Rejected	Rejected Quote Analysis
DBE Quote(s) Awarded	Awarded DBE Amount

Appendix E

Good Faith Effort Best Practices

This list is not a set of requirements; it is a list of potential strategies

Primes

- Prime contractor open houses inviting DBE firms to see the bid “war room” or providing technical assistance.
- Participate in speed networking and mosaic exercises as arranged by DBE office.
- Host information sessions not directly associated with a bid letting.
- Participate in a formal mentor protégé or joint venture with a DBE firm.
- Participate in WisDOT advisory committees i.e. TRANSAC, or Mega Project committee meetings.
- Facilitate a small group DBE ‘training session’ clarifying how your firm prepares for bid letting, evaluates subcontractors, preferred qualifications, and communication methods.
- Encourage subcontractors to solicit and highlight DBE participation in their quotes to you.
- Quality of communication, not quantity creates the best results. Contractors should be thorough in communicating with DBE firms before the bid and provide any assistance requested to assure best possible bid.

DBE

- DBE firms should contact primes as soon as possible with questions regarding their quotes or bid; seven days prior is optimal.
- Continually check for contract addendums on the HCCI website through the Thursday prior to letting to stay abreast of changes.
- Review the status of contracts on the HCCI website reviewing the ‘apparent low bidder’ list and bid tabs at a minimum.
- Prepare a portfolio or list of related projects and prime and supplier references; be sure to note transportation related projects of similar size and scope, firm expertise and staffing.
- Participate in DBE office assessment programs.
- Participate on advisory and mega-project committees.
- Sign up to receive the DBE Contracting Update.
- Consider membership in relevant industry or contractor organizations.
- Active participation is a must. Quote as many projects as you can reasonably work on; quoting the primes and bidding as a prime with the Department are the only ways to get work.

Appendix F

Good Faith Effort Evaluation Guidance

Appendix A of 49 CFR Part 26

I. When, as a recipient, you establish a contract goal on a DOT-assisted contract for procuring construction, equipment, services, or any other purpose, a bidder must, in order to be responsible and/or responsive, make sufficient good faith efforts to meet the goal. The bidder can meet this requirement in either of two ways. First, the bidder can meet the goal, documenting commitments for participation by DBE firms sufficient for this purpose. Second, even if it doesn't meet the goal, the bidder can document adequate good faith efforts. This means that the bidder must show that it took all necessary and reasonable steps to achieve a DBE goal or other requirement of this part which, by their scope, intensity, and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if they were not fully successful.

II. In any situation in which you have established a contract goal, Part 26 requires you to use the good faith efforts mechanism of this part. As a recipient, you have the responsibility to make a fair and reasonable judgment whether a bidder that did not meet the goal made adequate good faith efforts. It is important for you to consider the quality, quantity, and intensity of the different kinds of efforts that the bidder has made, based on the regulations and the guidance in this Appendix.

The efforts employed by the bidder should be those that one could reasonably expect a bidder to take if the bidder were actively and aggressively trying to obtain DBE participation sufficient to meet the DBE contract goal. Mere pro forma efforts are not good faith efforts to meet the DBE contract requirements. We emphasize, however, that your determination concerning the sufficiency of the firm's good faith efforts is a judgment call. Determinations should not be made using quantitative formulas.

III. The Department also strongly cautions you against requiring that a bidder meet a contract goal (i.e., obtain a specified amount of DBE participation) in order to be awarded a contract, even though the bidder makes an adequate good faith efforts showing. This rule specifically prohibits you from ignoring bona fide good faith efforts.

IV. The following is a list of types of actions which you should consider as part of the bidder's good faith efforts to obtain DBE participation. It is not intended to be a mandatory checklist, nor is it intended to be exclusive or exhaustive. Other factors or types of efforts may be relevant in appropriate cases.

A. (1) Conducting market research to identify small business contractors and suppliers and soliciting through all reasonable and available means the interest of all certified DBEs that have the capability to perform the work of the contract. This may include attendance at pre-bid and business matchmaking meetings and events, advertising and/or written notices, posting of Notices of Sources Sought and/or Requests for Proposals, written notices or emails to all DBEs listed in the State's directory of transportation firms that specialize in the areas of work desired (as noted in the DBE directory) and which are located in the area or surrounding areas of the project.

(2) The bidder should solicit this interest as early in the acquisition process as practicable to allow the DBEs to respond to the solicitation and submit a timely offer for the subcontract. The bidder should determine with certainty if the DBEs are interested by taking appropriate steps to follow up initial solicitations.

B. Selecting portions of the work to be performed by DBEs in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units (for example, smaller tasks or quantities) to facilitate DBE participation, even when the prime contractor might otherwise prefer to perform these work items with its own forces. This may include, where possible, establishing flexible timeframes for performance and delivery schedules in a manner that encourages and facilitates DBE participation.

C. Providing interested DBEs with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation with their offer for the subcontract.

D. (1) Negotiating in good faith with interested DBEs. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBEs that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional Agreements could not be reached for DBEs to perform the work.

(2) A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBEs is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable. Also, the ability or desire of a prime contractor to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Prime contractors are not, however, required to accept higher quotes from DBEs if the price difference is excessive or unreasonable.

E. (1) Not rejecting DBEs as being unqualified without sound reasons based on a thorough investigation of their capabilities. The contractor's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union status) are not legitimate causes for the rejection or non-solicitation of bids in the contractor's efforts to meet the project goal. Another practice considered an insufficient good faith effort is the rejection of the DBE because its quotation for the work was not the lowest received. However, nothing in this paragraph shall be construed to require the bidder or prime contractor to accept unreasonable quotes in order to satisfy contract goals.

(2) A prime contractor's inability to find a replacement DBE at the original price is not alone sufficient to support a finding that good faith efforts have been made to replace the original DBE. The fact that the contractor has the ability and/or desire to perform the contract work with its own forces does not relieve the contractor of the obligation to make good faith efforts to find a replacement DBE, and it is not a sound basis for rejecting a prospective replacement DBE's reasonable quote.

F. Making efforts to assist interested DBEs in obtaining bonding, lines of credit, or insurance as required by the recipient or contractor.

G. Making efforts to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services.

H. Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, State, and Federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBEs.

V. In determining whether a bidder has made good faith efforts, it is essential to scrutinize its documented efforts. At a minimum, you must review the performance of other bidders in meeting the contract goal. For example, when the apparent successful bidder fails to meet the contract goal, but others meet it, you may reasonably raise the question of whether, with additional efforts, the apparent successful bidder could have met the goal. If the apparent successful bidder fails to meet the goal, but meets or exceeds the average DBE participation obtained by other bidders, you may view this, in conjunction with other factors, as evidence of the apparent successful bidder having made good faith efforts. As provided in §26.53(b)(2)(vi), you must also require the contractor to submit copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor was selected over a DBE for work on the contract to review whether DBE prices were substantially higher; and contact the DBEs listed on a contractor's solicitation to inquire as to whether they were contacted by the prime. Pro forma mailings to DBEs requesting bids are not alone sufficient to satisfy good faith efforts under the rule.

VI. A promise to use DBEs after contract award is not considered to be responsive to the contract solicitation or to constitute good faith efforts.

[79 FR 59600, Oct. 2, 2014]

Appendix G
(SAMPLE) Forms DT1506 and DT1202

COMMITMENT TO SUBCONTRACT TO DBE

Wisconsin Department of Transportation

☐ Non-Traditional Project

Proposal #

County: _____

Letting Date: _____

Total \$ Value of _____

Prime Contract: \$

DBE Contract Goal: _____ %

DBE Goal Achieved: 0.00 %

[illegible]

\$	0.00	\$	0.00

Government Use Only Approved Amounts		
A =	\$	%
V =	\$	%
Total =	\$	%

Signature: _____

Date: _____

Good faith effort approved: Yes ☐ No ☐

Prime Representative Signature & Date

DBE Office Signature & Date Approved

**COMMITMENT TO SUBCONTRACT TO DBE
ATTACHMENT A**

CONFIRMATION OF PARTICIPATION

Project I.D.:	Proposal Number:
Letting Date:	

Name of DBE Firm Participating in this Contract:	
Name of the Prime/Subcontractor who hired the DBE Firm: <i>(list all names of tiers if more than one)</i>	
Type of Work or Type of Material Supplied:	
Total Subcontract Value:	Total DBE Credit Value:

FOR PRIME CONTRACTORS ONLY: I certify that I made arrangements with the participating DBE firm to perform the type of work listed or supply the material indicated above for the subcontract value listed above.	Prime Contractor Representative's Signature
	Prime Contractor Representative's Name (Print Name)
	Prime Contractor (Print Company Name)
	Date

FOR PARTICIPATING DBE FIRMS ONLY: I certify that I made arrangements with the Prime Contractor or the Hiring Contractor to perform the type of work or supply the material indicated above for the subcontract value listed above. FOR DBE TRUCKING FIRMS ONLY: I certify that I will utilize, for DBE credit, only trucks listed on my WisDOT approved Schedule of Owned/Leased Vehicles for DBE Credit form and I will be utilizing the number of trucks as listed below.	Participating DBE Firm Representative's Signature	Date
	Participating DBE Firm Representative's Name (Print Name)	
	Participating DBE Firm (Print Company Name)	
	DBE Firm's Address:	

# Owned Trucks	# Leased Trucks	# DBE-Owned Leased Trucks	# Non-DBE-Owned Leased Trucks

☐ Off site Hauling

**DOCUMENTATION OF GOOD FAITH EFFORT**Wisconsin Department of Transportation
DT1202.....3/2020

Project ID *****	Proposal No. *****	Letting *****
Prime Contractor *****	County *****	
Person Submitting Document *****	Telephone Number *****	
Address *****	Email Address *****	

All bidders must undertake necessary and reasonable steps to achieve the assigned DBE contract goal per federal regulatory guidance at 49 CFR Part 26. Bidders use this form to document all efforts employed to meet the assigned goal as a record of contractor good faith efforts (GFE). Refer to ASP3 or 49 CFR Part 26 for guidance on actions that demonstrate good faith effort.

It is critical to list all efforts, attach documentation, and follow the instructions to complete this submission. Documentation of good faith effort includes copies of each DBE and non-DBE subcontractor quote submitted to the bidder for the same line items. Utilize the sample documentation logs to document and organize efforts.

Submit good faith effort documentation per ASP-3 guidelines.

Instructions: Provide a narrative description of all activities pursued to demonstrate good faith efforts, any corresponding documentation, and applicable explanation on separate pages. Include the following items, organized in the order listed below.

1.→ Solicitation Documentation:

a.→ Purpose: To identify all reasonable and available activities the bidder performed to solicit the interest of all certified DBEs who have the capacity and ability to perform work on the project. All solicitation efforts should begin as early as possible to ensure DBEs have ample time to respond and ask questions.

b.→ Action: Identify and list all activities engaged in to solicit DBEs using all reasonable and available means such as written notice and follow-up communications; substantive conversations; pre-bid meetings; networking events; market research; advertising.

2.→ Selected Work Items Documentation:

a.→ Purpose: To ensure that all work items are broken out into economically feasible units to facilitate DBE participation. This must occur even when you prefer to perform the work yourself.

b.→ Action: Identify economically feasible work units to be performed by DBEs to include activities such as: list of work items to be performed; breaking up of large work items into smaller tasks or quantities; flexible time frames for performance and delivery schedules.

3.→ Documentation of Project Information provided to Interested DBEs:

a.→ Purpose: To provide interested DBEs with adequate information about the plans, specifications, and any other contractual requirements in a timely manner to assist DBEs in response to solicitation.

b.→ Action: Provide DBEs access to plans, specifications, and other contract requirements. Early solicitation allows ample opportunity to provide project information, links to Let advertisements, and substantive engagement with DBEs.

4.→ Documentation of Negotiation with Interested DBEs:

a.→ Purpose: To ensure that negotiations with interested DBEs were made in good faith providing evidence as to why agreements could not be reached for DBEs to perform work.

b.→ Action: Provide sufficient evidence to demonstrate that good faith negotiations took place. Merely sending out solicitations requesting bids from DBEs does not constitute sufficient good faith efforts. A bidder using good business judgment considers a number of factors in negotiating with all subcontractors, and the firm's price and capabilities in addition to contract goals are taken into consideration. However, the fact that there may be some additional costs involved in finding and using DBEs is not in itself sufficient reason for failing to meet the DBE goal as long as costs are reasonable. (see 49 CFR Part 26 Appendix A)

5.→ Documentation of Sound Reason for Rejecting DBEs:

a.→ Purpose: To ensure that bidders avoid rejecting DBEs as unqualified without sound reasons. Reasons for rejection must be based on thorough investigation of DBE capabilities.

b.→ Action: Provide sufficient evidence to demonstrate that DBE was rejected for sound reasons such as past performance, relevant business experience and stability, safety record, business ethic and integrity, technical capacity, other tangible factors.

6.→ Documentation of Assistance to Interested DBEs--Bonding, Credit, Insurance, Equipment, Supplies/Materials:

a.→ Purpose: To assist interested DBEs in obtaining bonds, lines of credit, insurance, equipment, supplies, materials, and other assistance or services.

b.→ Action: Assist interested DBEs in obtaining bonding, lines of credit or insurance, and provide technical assistance or information related to plans, specifications, and project requirements. Assist DBEs in obtaining equipment, supplies, materials or other services related to meeting project requirements (excluding supplies or equipment the DBE purchases from the prime).

7.→ Documentation of outreach to Minority, Women, and Community Organizations and other DBE Business Development Support:

a.→ Purpose: To effectively use the services of minority, women, and community organizations as well as contractors' groups, local, state, and federal business assistance offices and organization that provide assistance in recruiting and supporting DBEs, as well as participation in activities that support DBE business development.

b.→ Action: Contact organizations and agencies for assistance in contacting, recruiting, and providing support to DBE subcontractors, suppliers, manufacturers, and truckers at least 14 days before bid opening. Participate in or host activities such as networking events, mentor-protégé programs, small business development workshops, and others consistent with DBE support.

Return to:
 Wisconsin Department of Transportation
 DBE Program Office
 PO Box 7965
 Madison, WI 53707-7965
 DBE_Alert@dot.wi.gov

I certify that I have utilized comprehensive good faith efforts to solicit and utilize DBE firms to meet the DBE participation requirements of this contract proposal, as demonstrated by my responses and as specified in Additional Special Provision 3 (ASP-3).

I certify that the information given in the Documentation of Good Faith Efforts is true and correct to the best of my knowledge and belief.

I further understand that any willful falsification, fraudulent statement, or misrepresentation will result in appropriate sanctions, which may involve debarment and/or prosecution under applicable state (Trans 504) and Federal laws.

		(Bidder/Authorized Representative Signature)

		(Print Name)

		(Title)

Good Faith Effort--Sample Documentation Logs

The sample logs below are provided as guides rather than exhaustive list. See ASP3, Appendix A for additional examples of demonstrable good faith efforts. Attach documentation for each activity listed.

Acceptable forms of documentation include copies of solicitations sent to DBEs, notes from substantive conversations and negotiations with DBEs, copies of advertisements placed, email communications, all quotes received from DBEs and from all subcontractors who were considered alongside DBE quotes, proof of attendance at applicable networking events; flyers for events or workshops for DBEs offered by the prime, and other physical records of good faith efforts activities.

SOLICITATION LOG

Date	Activity	Name of DBE Solicited	Follow-up
4/1/2020	Sent May-Let solicitation	Winterland Electric	Spoke with Mark Winterland on 4/15/20 to ask if he would quote.

SELECTED WORK ITEMS SOLICITED LOG

Work Type	DBE Firm	Contact Person	Date	Contact Mode
Pavement Marking	ABC Marking	Leslie Lynch	4/1/2020	Email; phone
	#1 Marking Co.	Mark Smart	4/1/2020	Email; left VM
Electrical	Winterland Electric	Tabitha Tinker	4/3/2020	Email; left VM
	Superstar Wiring	Jose Huascar	4/3/2020	Email; phone

INFORMATION PROVIDED LOG

Request Date	DBE Firm	Information Requested & Provided	Response Date
4/1/2020	Winterland Electric	Requested info on electrical requirements; provided plan and link to specs	4/3/2020
4/21/2020	Absolute Construction	Wanted to know how and when supplies are paid for by WisDOT; referred to spec that covers stockpiling	4/21/2020

NEGOTIATIONS LOG

Date	DBE Firm	Contact Name	Work Type	Quotes Rec'd?	Considered for project?	If not selected, why?
4/12/2020	ABC Landscape	John Dean	Erosion Control	Yes	No	Cannot perform all items
4/17/2020	Wild Ferns	Sandy Lynn	Erosion Control	Yes	Yes	
4/20/2020	#1 Marking	Mark Smart	Electrical	Yes	Yes	

ASSISTANCE LOG

Date	DBE Firm	Contact Person	Assistance Provided
4/1/2020	ABC Sawing	Jackie Swiggle	Informed DBE on how to obtain bonding
4/17/2020	Supreme Construction	Winston Walters	Provided contact for wholesale supply purchase

OUTREACH & BUSINESS DEVELOPMENT LOG

Date	Agency/Organization Contacted	Contact Person	Assistance Requested
4/1/2020	Women in Construction	LaTonya Klein	Contact information for woman-owned suppliers
4/28/2020	WBIC	Sam Smith	Asked for information to provide to DBE regarding financing programs through WBIC

Official Form DT1202 can be found here: <https://wisconsindot.gov/pages/global-footer/formdocs/default.aspx>

ADDITIONAL SPECIAL PROVISION 4

This special provision does not limit the right of the department, prime contractor, or subcontractors at any tier to withhold payment for work not acceptably completed or work subject to an unresolved contract dispute.

Payment to First-Tier Subcontractors

Within 10 calendar days of receiving a progress payment for work completed by a subcontractor, pay the subcontractor for that work. The prime contractor may withhold payment to a subcontractor if, within 10 calendar days of receipt of that progress payment, the prime contractor provides written notification to the subcontractor and the department documenting "just cause" for withholding payment.

The prime contractor is not allowed to withhold retainage from payments due subcontractors.

Payment to Lower-Tier Subcontractors

Ensure that subcontracting agreements at all tiers provide prompt payment rights to lower-tier subcontractors that parallel those granted first-tier subcontractors in this provision.

Acceptance and Final Payment

Within 30 calendar days of receiving the semi-final estimate from the department, submit written certification that subcontractors at all tiers are paid in full for acceptably completed work.

Additional Special Provision 6 (ASP-6)
Modifications to the standard specifications

Make the following revisions to the standard specifications:

No modifications.

ADDITIONAL SPECIAL PROVISION 7

A. Reporting 1st Tier and DBE Payments During Construction

1. Comply with reporting requirements specified in the department's Civil Rights Compliance, Contractor's User Manual, Sublets and Payments.
2. Report payments to all DBE firms within 10 calendar days of receipt of a progress payment by the department or a contractor for work performed, materials furnished, or materials stockpiled by a DBE firm. Report the payment as specified in A(1) for all work satisfactorily performed and for all materials furnished or stockpiled.
3. Report payments to all first tier subcontractor relationships within 10 calendar days of receipt of a progress payment by the department for work performed. Report the payment as specified in A(1) for all work satisfactorily performed.
4. All tiers shall report payments as necessary to comply with the DBE payment requirement as specified in A(2).
5. DBE firms must enter all payments to DBE and non-DBE firms regardless of tier.
6. Require all first tier relationships, DBE firms and all other tier relationships necessary to comply with the DBE payment requirement in receipt of a progress payment by contractor to acknowledge receipt of payment as specified in A(1), (2), (3) and (4).
7. All agreements made by a contractor shall include the provisions in A(1), (2), (3), (4), (5), and (6), and shall be binding on all first tier subcontractor relationships, all contractors and subcontractors utilizing DBE firms on the project, and all payments from DBE firms.

B. Costs for conforming to this special provision are incidental to the contract.

NOTE: CRCS Prime Contractor payment is currently not automated and will need to be manually loaded into the Civil Rights Compliance System. Copies of prime contractor payments received (check or ACH) will have to be forwarded to paul.ndon@dot.wi.gov within 5 days of payment receipt to be logged manually.

***Additionally, for information on Subcontractor Sublet assignments, Subcontractor Payments and Payment Tracking, please refer to the CRCS Payment and Sublets manual at:

<https://wisconsindot.gov/Documents/doing-bus/civil-rights/labornwage/crcs-payments-sublets-manual.pdf>

ADDITIONAL SPECIAL PROVISION 9

Electronic Certified Payroll or Labor Data Submittal

- (1) Use the department's Civil Rights Compliance System (CRCS) to electronically submit certified payroll reports for contracts with federal funds and labor data for contracts with state funds only. Details are available online through the department's highway construction contractor information (HCCI) site on the Labor, Wages, and EEO Information page at:
<https://wisconsindot.gov/Pages/doing-bus/civil-rights/labornwage/default.aspx>
- (2) Ensure that all tiers of subcontractors, including all trucking firms, either submit their weekly certified payroll reports (contracts with federal funds) or labor data (contracts with state funds only) electronically through CRCS. These payrolls or labor data are due within seven calendar days following the close of the payroll period. Every firm providing physical labor towards completing the project is a subcontractor under this special provision.
- (3) Upon receipt of contract execution, promptly make all affected firms aware of the requirements under this special provision and arrange for them to receive CRCS training as they are about to begin their submittals. The department will provide training either in a classroom setting at one of our regional offices or by telephone. Contact Paul Ndon at (414) 438-4584 to schedule the training.
- (4) The department will reject all paper submittals for information required under this special provision. All costs for conforming to this special provision are incidental to the contract.
- (5) Firms wishing to export payroll/labor data from their computer system into CRCS should have their payroll coordinator contact Paul Ndon at paul.ndon@dot.wi.gov. Not every contractor's payroll system is capable of producing export files. For details, see Section 4.8 CPR Auto Submit (Data Mapping) on pages 49-50; 66-71 of the CRCS Payroll Manual at:
<https://wisconsindot.gov/Documents/doing-bus/civil-rights/labornwage/crcs-payroll-manual.pdf>

REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS

- I. General
- II. Nondiscrimination
- III. Non-segregated Facilities
- IV. Davis-Bacon and Related Act Provisions
- V. Contract Work Hours and Safety Standards Act Provisions
- VI. Subletting or Assigning the Contract
- VII. Safety: Accident Prevention
- VIII. False Statements Concerning Highway Projects
- IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
- X. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion
- XI. Certification Regarding Use of Contract Funds for Lobbying
- XII. Use of United States-Flag Vessels:

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under title 23, United States Code, as required in 23 CFR 633.102(b) (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services). 23 CFR 633.102(e).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider. 23 CFR 633.102(e).

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services) in accordance with 23 CFR 633.102. The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in solicitation-for-bids or request-for-proposals documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract). 23 CFR 633.102(b).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work

performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract. 23 CFR 633.102(d).

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. 23 U.S.C. 114(b). The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors. 23 U.S.C. 101(a).

II. NONDISCRIMINATION (23 CFR 230.107(a); 23 CFR Part 230, Subpart A, Appendix A; EO 11246)

The provisions of this section related to 23 CFR Part 230, Subpart A, Appendix A are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR Part 60, 29 CFR Parts 1625-1627, 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR Part 60, and 29 CFR Parts 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR Part 230, Subpart A, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal Employment Opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (see 28 CFR Part 35, 29 CFR Part 1630, 29 CFR Parts 1625-1627, 41 CFR Part 60 and 49 CFR Part 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140, shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR Part 35 and 29 CFR Part 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract. 23 CFR 230.409 (g)(4) & (5).

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, sexual orientation, gender identity, color, national origin, age or disability. Such action shall include: 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, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action or are substantially involved in such action, will be made fully cognizant of and will implement the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer or other knowledgeable company official.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action

within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs (i.e., apprenticeship and on-the-job training programs for the geographical area of contract performance). In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. 23 CFR 230.409. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide

sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants /

Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established thereunder. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:

The contractor shall not discriminate on the grounds of race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors, suppliers, and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurances Required:

a. The requirements of 49 CFR Part 26 and the State DOT's FHWA-approved Disadvantaged Business Enterprise (DBE) program are incorporated by reference.

b. The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

- (1) Withholding monthly progress payments;
- (2) Assessing sanctions;
- (3) Liquidated damages; and/or
- (4) Disqualifying the contractor from future bidding as non-responsible.

c. The Title VI and nondiscrimination provisions of U.S. DOT Order 1050.2A at Appendixes A and E are incorporated by reference. 49 CFR Part 21.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women.

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on [Form FHWA-1391](#). The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of more than \$10,000. 41 CFR 60-1.5.

As prescribed by 41 CFR 60-1.8, the contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location under the contractor's control where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size), in accordance with 29 CFR 5.5. The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. 23 U.S.C. 113. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. 23 U.S.C. 101. Where applicable law requires that projects be treated as a project on a Federal-aid highway, the provisions of this subpart will apply regardless of the location of the project. Examples include: Surface Transportation Block Grant Program projects funded under 23 U.S.C. 133 [excluding recreational trails projects], the Nationally Significant Freight and Highway

Projects funded under 23 U.S.C. 117, and National Highway Freight Program projects funded under 23 U.S.C. 167.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages (29 CFR 5.5)

a. *Wage rates and fringe benefits.* All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act ([29 CFR part 3](#))), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of 29 CFR 5.5, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act ([40 U.S.C. 3141\(2\)\(B\)](#)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.e. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph 4. of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph 1.c. of this section) and the Davis-Bacon poster (WH-1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. *Frequently recurring classifications.* (1) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in [29 CFR part 1](#), a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph 1.c. of this section, provided that:

(i) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(ii) The classification is used in the area by the construction industry; and

(iii) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(2) The Administrator will establish wage rates for such classifications in accordance with paragraph 1.c.(1)(iii) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

c. *Conformance.* (1) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is used in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(3) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to DBAconformance@dol.gov. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(4) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to DBAconformance@dol.gov, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(5) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division

under paragraphs 1.c.(3) and (4) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 1.c.(3) or (4) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

d. *Fringe benefits not expressed as an hourly rate.* Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

e. *Unfunded plans.* If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

f. *Interest.* In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

2. Withholding (29 CFR 5.5)

a. *Withholding requirements.* The contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph 3.d. of this section, the contracting agency may on its own initiative and after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with paragraph

2.a. of this section or Section V, paragraph 3.a., or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its procurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, [31 U.S.C. 3901–3907](#).

3. Records and certified payrolls (29 CFR 5.5)

a. Basic record requirements (1) Length of record retention. All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(2) Information required. Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in [40 U.S.C. 3141\(2\)\(B\)](#) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(3) Additional records relating to fringe benefits. Whenever the Secretary of Labor has found under paragraph 1.e. of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in [40 U.S.C. 3141\(2\)\(B\)](#) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(4) Additional records relating to apprenticeship. Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

b. Certified payroll requirements (1) Frequency and method of submission. The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the contracting

agency. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(2) Information required. The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph 3.a.(2) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (e.g., the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH-347 or in any other format desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division website at <https://www.dol.gov/sites/dolgov/files/WHDL/legacy/files/wh347.pdf> or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the contracting agency.

(3) Statement of Compliance. Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(i) That the certified payroll for the payroll period contains the information required to be provided under paragraph 3.b. of this section, the appropriate information and basic records are being maintained under paragraph 3.a. of this section, and such information and records are correct and complete;

(ii) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in [29 CFR part 3](#); and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(4) Use of Optional Form WH-347. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 will satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(3) of this section.

(5) *Signature.* The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(6) *Falsification.* The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under [18 U.S.C. 1001](#) and [31 U.S.C. 3729](#).

(7) *Length of certified payroll retention.* The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

c. *Contracts, subcontracts, and related documents.* The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

d. *Required disclosures and access* (1) *Required record disclosures and access to workers.* The contractor or subcontractor must make the records required under paragraphs 3.a. through 3.c. of this section, and any other documents that the contracting agency, the State DOT, the FHWA, or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(2) *Sanctions for non-compliance with records and worker access requirements.* If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under [29 CFR part 6](#) any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(3) *Required information disclosures.* Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address

of each covered worker, and must provide them upon request to the contracting agency, the State DOT, the FHWA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

4. Apprentices and equal employment opportunity (29 CFR 5.5)

a. *Apprentices (1) Rate of pay.* Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) *Fringe benefits.* Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(3) *Apprenticeship ratio.* The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph 4.a.(4) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph 4.a.(1) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(4) *Reciprocity of ratios and wage rates.* Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

b. *Equal employment opportunity.* The use of apprentices and journeyworkers under this part must be in conformity with

the equal employment opportunity requirements of Executive Order 11246, as amended, and [29 CFR part 30](#).

c. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. 23 CFR 230.111(e)(2). The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeyworkers shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract as provided in 29 CFR 5.5.

6. Subcontracts. The contractor or subcontractor must insert FHWA-1273 in any subcontracts, along with the applicable wage determination(s) and such other clauses or contract modifications as the contracting agency may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate. 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract as provided in 29 CFR 5.5.

9. Disputes concerning labor standards. As provided in 29 CFR 5.5, disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility. a. By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of [40 U.S.C. 3144\(b\)](#) or § 5.12(a).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of [40 U.S.C. 3144\(b\)](#) or § 5.12(a).

c. The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, [18 U.S.C. 1001](#).

11. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or [29 CFR part 1](#) or [3](#);

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or [29 CFR part 1](#) or [3](#);

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or [29 CFR part 1](#) or [3](#); or

d. Informing any other person about their rights under the DBA, Related Acts, this part, or [29 CFR part 1](#) or [3](#).

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Pursuant to 29 CFR 5.5(b), the following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchpersons and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek. 29 CFR 5.5.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph 1. of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or

mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph 1. of this section, in the sum currently provided in 29 CFR 5.5(b)(2)* for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1. of this section.

* \$31 as of January 15, 2023 (See 88 FR 88 FR 2210) as may be adjusted annually by the Department of Labor, pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990.

3. Withholding for unpaid wages and liquidated damages

a. *Withholding process.* The FHWA or the contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this section on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with Section IV paragraph 2.a. or paragraph 3.a. of this section, or both, over claims to those funds by:

- (1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;
- (2) A contracting agency for its procurement costs;
- (3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;
- (4) A contractor's assignee(s);
- (5) A contractor's successor(s); or
- (6) A claim asserted under the Prompt Payment Act, [31 U.S.C. 3901](#)–3907.

4. **Subcontracts.** The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs 1. through 5. of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1. through 5. In the

event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

5. **Anti-retaliation.** It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

d. Informing any other person about their rights under CWHSSA or this part.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System pursuant to 23 CFR 635.116.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" in paragraph 1 of Section VI refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions: (based on longstanding interpretation)

- (1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
- (2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract. 23 CFR 635.102.

2. Pursuant to 23 CFR 635.116(a), the contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. Pursuant to 23 CFR 635.116(c), the contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract. (based on long-standing interpretation of 23 CFR 635.116).

5. The 30-percent self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements. 23 CFR 635.116(d).

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR Part 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract. 23 CFR 635.108.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and

health standards (29 CFR Part 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704). 29 CFR 1926.10.

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR Part 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 11, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (42 U.S.C. 7606; 2 CFR 200.88; EO 11738)

This provision is applicable to all Federal-aid construction contracts in excess of \$150,000 and to all related subcontracts. 48 CFR 2.101; 2 CFR 200.327.

By submission of this bid/proposal or the execution of this contract or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, subcontractor, supplier, or vendor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal Highway Administration and the Regional Office of the Environmental Protection Agency. 2 CFR Part 200, Appendix II.

The contractor agrees to include or cause to be included the requirements of this Section in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements. 2 CFR 200.327.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200. 2 CFR 180.220 and 1200.220.

1. Instructions for Certification – First Tier Participants:

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction. 2 CFR 180.320.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default. 2 CFR 180.325.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances. 2 CFR 180.345 and 180.350.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900-180.1020, and 1200. "First Tier Covered Transactions" refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contract). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction. 2 CFR 180.330.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold. 2 CFR 180.220 and 180.300.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. 2 CFR 180.300; 180.320, and 180.325. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. 2 CFR 180.335. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (<https://www.sam.gov/>). 2 CFR 180.300, 180.320, and 180.325.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default. 2 CFR 180.325.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.335;.

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property, 2 CFR 180.800;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification, 2 CFR 180.700 and 180.800; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. 2 CFR 180.335(d).

(5) Are not a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(6) Are not a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability (USDOT Order 4200.6 implementing appropriations act requirements).

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal. 2 CFR 180.335 and 180.340.

3. Instructions for Certification - Lower Tier Participants:

(Applicable to all subcontracts, purchase orders, and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200). 2 CFR 180.220 and 1200.220.

a. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which

this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances. 2 CFR 180.365.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900 – 180.1020, and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contractor). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated. 2 CFR 1200.220 and 1200.332.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold. 2 CFR 180.220 and 1200.220.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (<https://www.sam.gov/>), which is compiled by the General Services Administration. 2 CFR 180.300, 180.320, 180.330, and 180.335.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily

excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment. 2 CFR 180.325.

* * * * *

4. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

a. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals:

(1) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.355;

(2) is a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(3) is a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. (USDOT Order 4200.6 implementing appropriations act requirements)

b. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000. 49 CFR Part 20, App. A.

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or

cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

XII. USE OF UNITED STATES-FLAG VESSELS:

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, or any other covered transaction. 46 CFR Part 381.

This requirement applies to material or equipment that is acquired for a specific Federal-aid highway project. 46 CFR 381.7. It is not applicable to goods or materials that come into inventories independent of an FHWA funded-contract.

When oceanic shipments (or shipments across the Great Lakes) are necessary for materials or equipment acquired for a specific Federal-aid construction project, the bidder, proposer, contractor, subcontractor, or vendor agrees:

1. To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels. 46 CFR 381.7.

2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, 'on-board' commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b)(1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Office of Cargo and Commercial Sealift (MAR-620), Maritime Administration, Washington, DC 20590. (MARAD requires copies of the ocean carrier's (master) bills of lading, certified onboard, dated, with rates and charges. These bills of lading may contain business sensitive information and therefore may be submitted directly to MARAD by the Ocean Transportation Intermediary on behalf of the contractor). 46 CFR 381.7.

**ATTACHMENT A - EMPLOYMENT AND MATERIALS
PREFERENCE FOR APPALACHIAN DEVELOPMENT
HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS
ROAD CONTRACTS (23 CFR 633, Subpart B, Appendix B)**

This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

NON-DISCRIMINATION PROVISIONS

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. Compliance with Regulations: The contractor (hereinafter includes consultants) will comply with the Acts and the Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. Non-discrimination: The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21.

3. Solicitations for Subcontracts, Including Procurements of Materials and Equipment: In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Non-discrimination on the grounds of race, color, or national origin.

4. Information and Reports: The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the Federal Highway Administration to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the Recipient or the Federal Highway Administration, as appropriate, and will set forth what efforts it has made to obtain the information.

5. Sanctions for Noncompliance: In the event of a contractor's noncompliance with the Non-discrimination provisions of this contract, the Recipient will impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to:

- a. Withholding payments to the contractor under the contract until the contractor complies; and/or
- b. Cancelling, terminating, or suspending a contract, in whole or in part.

6. Incorporation of Provisions: The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the Recipient or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the Recipient to enter into any litigation to protect the interests of the Recipient. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

Pertinent Non-Discrimination Authorities:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin); and 49 CFR Part 21.
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 et seq.), (prohibits discrimination on the basis of sex);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability); and 49 CFR Part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131-12189) as implemented by Department of Transportation regulations at 49 C.F.R. parts 37 and 38;
- The Federal Aviation Administration's Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures Non-discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of Limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

1. The Offeror's or Bidder's attention is called to the "Employment Practices" and "Equal Opportunity Clause" set forth in the Required Contract Provisions, FHWA 1273.
2. The goals and timetables for minority and female participation expressed in percentage terms for the contractor's aggregate work force in each trade, on all construction work in the covered area, are as follows:

Goals for Minority Participation for Each Trade:

<u>County</u>	<u>%</u>	<u>County</u>	<u>%</u>	<u>County</u>	<u>%</u>
Adams	1.7	Iowa	1.7	Polk	2.2
Ashland	1.2	Iron	1.2	Portage	0.6
Barron	0.6	Jackson	0.6	Price	0.6
Bayfield	1.2	Jefferson	7.0	Racine	8.4
Brown	1.3	Juneau	0.6	Richland	1.7
Buffalo	0.6	Kenosha	3.0	Rock	3.1
Burnett	2.2	Kewaunee	1.0	Rusk	0.6
Calumet	0.9	La Crosse	0.9	St. Croix	2.9
Chippewa	0.5	Lafayette	0.5	Sauk	1.7
Clark	0.6	Langlade	0.6	Sawyer	0.6
Columbia	1.7	Lincoln	0.6	Shawano	1.0
Crawford	0.5	Manitowoc	1.0	Sheboygan	7.0
Dane	2.2	Marathon	0.6	Taylor	0.6
Dodge	7.0	Marinette	1.0	Trempealeau	0.6
Door	1.0	Marquette	1.7	Vernon	0.6
Douglas	1.0	Menominee	1.0	Vilas	0.6
Dunn	0.6	Milwaukee	8.0	Walworth	7.0
Eau Claire	0.5	Monroe	0.6	Washburn	0.6
Florence	1.0	Oconto	1.0	Washington	8.0
Fond du Lac	1.0	Oneida	0.6	Waukesha	8.0
Forest	1.0	Outagamie	0.9	Waupaca	1.0
Grant	0.5	Ozaukee	8.0	Waushara	1.0
Green	1.7	Pepin	0.6	Winnebago	0.9
Green Lake	1.0	Pierce	2.2	Wood	0.6

Goals for female participation for each trade: 6.9%

These goals are applicable to all the contractor's construction work, (whether or not it is federal or federally assisted), performed in the covered area. If the contractor performs construction work in the geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The contractor's compliance with the Executive Order and the Regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor or from project to project for the sole purpose of meeting the contractor's goals shall be a violation of the contract, the Executive Order and the Regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within ten (10) working days of award of any construction subcontract in excess of \$10,000.00 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor, employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

As referred to in this section, the Director means:

Director
Office of Federal Contract Compliance Programs
Ruess Federal Plaza
310 W. Wisconsin Ave., Suite 1115
Milwaukee, WI 53202

The "Employer Identification Number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

4. As used in this notice, and in the contract resulting from solicitation, the "covered area" is the county(ies) in Wisconsin to which this proposal applies.

ADDITIONAL FEDERAL-AID PROVISIONS

NOTICE TO ALL BIDDERS

To report bid rigging activities call:

1-800-424-9071

The U.S. Department of Transportation (DOT) operates the above toll-free "hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m., Eastern Time. Anyone with knowledge of possible bid rigging, bidding collusion, or other fraudulent activities should use the "hotline" to report such activities.

The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

BUY AMERICA PROVISION

Buy America (as documented in [88 FR 57750 \(2 CFR part 184 and 200\)](#) from the Office of Management and Budget: [Federal Register: Guidance for Grants and Agreements](#)) shall be domestic products and permanently incorporated in this project as classified in the following three categories, and as noted in the Construction and Materials Manual (CMM):

1. Iron and Steel

All iron and steel manufacturing and coating processes (from the initial melting stage through the application of coatings) must have occurred within the United States. Coating includes epoxy coating, galvanizing, painting and any other coating that protects or enhances the value of a material subject to the requirements of Buy America.

The exemption of the iron and steel manufacturing and coating processes Buy America requirement is the minimal use of foreign materials if the total cost of such material permanently incorporated in the product does not exceed one-tenth of one percent (1/10 of 1%) of the total contract cost or \$2,500.00, whichever is greater. For purposes of this paragraph, the cost is that shown to be the value of the subject products as they are delivered to the project.

2. Manufactured Product

All manufactured products (as defined in CMM 228.5) are covered under a previous waiver from 1983 and are currently exempt from Buy America.

3. Construction Material

All construction materials (as defined in [88 FR 57750 \(2 CFR part 184 and 200\)](#) and as referenced in CMM 228.5) must comply with Buy America. All manufacturing process of construction materials must occur in the United States.

[88 FR 55817 \(DOT-OST-2022-0124\)](#) allows a limited waiver of Buy America requirements for de minimis costs and small grants.

- The Total value of the non-compliant products is no more than the lesser of \$1,000,000 or 5% of total applicable costs for the project¹; or
- The total amount of Federal financial assistance applied to the project, through awards or subaward, is below \$500,000²

The contractor shall take actions and provide documentation conforming to CMM 228.5 to ensure compliance with this Buy America provision.

<https://wisconsin.gov/rdwy/cmm/cm-02-28.pdf>

Upon completion of the project, certify to the engineer, in writing using department form DT4567 that all iron and steel, manufactured products, and construction materials conform to this Buy America provision.

Form DT4567 is available at: <https://wisconsin.gov/Documents/formdocs/dt4567.docx>

Attach a list of iron or steel and construction material exemptions and their associated costs to the certification form using the Buy America Exemption Tracking Tool, available at:

<https://wisconsin.gov/hccidocs/contracting-info/buy-america-exemption-tracking-tool.xlsx>

¹ The de minimis public interest waiver does not apply to iron and steel subject to the requirements of 23 U.S.C. 313 on financial assistance administered by FHWA. The de minimis threshold in 23 CFR 635.410(b)(4) continues to apply for iron and steel.

² The small grant portion of the waiver does not apply to iron, steel, and manufactured goods subject to the requirements of 49 U.S.C. 22905(a).

CARGO PREFERENCE ACT REQUIREMENT

All Federal-aid projects shall comply with 46 CFR 381.7 (a) – (b) as follows:

(a) *Agreement Clauses.* “Use of United States-flag vessels:”

(1) Pursuant to Pub. L. 664 (43 U.S.C. 1241(b)) at least 50 percent of any equipment, materials or commodities procured, contracted for or otherwise obtained with funds granted, guaranteed, loaned, or advanced by the U.S. Government under this agreement, and which may be transported by ocean vessel, shall be transported on privately owned United States-flag commercial vessels, if available.

(2) Within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (a)(1) of this section shall be furnished to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590.”

(b) *Contractor and Subcontractor Clauses.* “Use of United States-flag vessels: The contractor agrees—”

(1) To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels.

(2) To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b) (1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590.

(3) To insert the substance of the provisions of this clause in all subcontracts issued pursuant to this contract.

**WISCONSIN DEPARTMENT OF TRANSPORTATION
DIVISION OF TRANSPORTATION AND SYSTEM DEVELOPMENT**

**SUPPLEMENTAL REQUIRED CONTRACT PROVISIONS
FOR PROJECTS WITH FEDERAL AID**

I. PREVAILING WAGE RATES

The attached U.S. Department of Labor (Davis-Bacon Minimum Wage Rates) furnishes the minimum prevailing wage rates pursuant to the Davis-Bacon and Related Acts. The wage rates shown are the minimum rates required by the contract to be paid during its life, however this is not a representation that labor can be obtained at these rates. It is the responsibility of bidders to inform themselves as to the local labor conditions and prospective changes or adjustments of wage rates. No increase in the contract price will be allowed or authorized on account of the payment of wage rates in excess of those listed herein.

II. COVERAGE OF TRUCK DRIVERS

Truck drivers are covered by Davis-Bacon Minimum Wage Rates in the following circumstances:

- Drivers of a contractor or subcontractor for time spent working on the site of the work.
- Drivers of a contractor or subcontractor for time spent loading and/or unloading materials and supplies on the site of the work, if such time is not de minimis.
https://www.dol.gov/whd/FOH/FOH_Ch15.pdf
- Truck drivers transporting materials or supplies between a facility that is deemed part of the site of the work and the actual construction site.
- Truck drivers transporting portions of the building or work between a site established specifically for the performance of the contract where a significant portion of such building or work is constructed and the physical place where the building or work called for in the contract will remain.

Truck drivers are not covered by Davis-Bacon Minimum Wage Rates in the following circumstances:

- Material delivery truck drivers while off the site of the work.
- Drivers of a contractor or subcontractor traveling between a Davis-Bacon job and a commercial supply facility while they are off the site of the work.”
- Truck drivers whose time spent on the site of the work is de minimis, such as only a few minutes at a time merely to pick up or drop off materials or supplies.

Details are available online at:

<https://www.dol.gov/whd/recovery/pwrb/Tab9.pdf>

<https://wisconsindot.gov/Pages/doing-bus/civil-rights/labornwage/trckng.aspx>

III. POSTINGS AT THE SITE OF THE WORK

In addition to the required postings furnished by the department, the contractor shall post the following in at least one conspicuous and accessible place at the site of work:

- a. A copy of the contractor's Equal Employment Opportunity Policy.

All required documents shall be posted by the first day of work and be accurate and complete. Postings must be readable, in an area where they will be noticed, and maintained until the last day of work.

IV. RESOURCES

Required information regarding compliance with federal provisions is found in the following resources:

- FHWA-1273 included in this contract
- U.S. Department of Labor Prevailing Wage Resource Book
- U.S. Department of Labor Field Operations Handbook
- U.S. Code of Federal Regulations
- Any applicable law, Act, or Executive Order enacted by the federal government at the time of the letting of this contract

"General Decision Number: WI20240010 09/06/2024

Superseded General Decision Number: WI20230010

State: Wisconsin

Construction Type: Highway

Counties: Wisconsin Statewide.

HIGHWAY, AIRPORT RUNWAY & TAXIWAY CONSTRUCTION PROJECTS (does not include bridges over navigable waters; tunnels; buildings in highway rest areas; and railroad construction)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

|_____||_____||

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/05/2024
1	01/26/2024
2	02/02/2024
3	02/16/2024
4	03/15/2024
5	05/24/2024
6	06/21/2024
7	06/28/2024
8	07/05/2024
9	08/02/2024
10	08/23/2024
11	09/06/2024

BRWI0001-002 06/01/2023

CRAWFORD, JACKSON, JUNEAU, LA CROSSE, MONROE, TREMPPEALEAU, AND VERNON COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 40.18	25.88

BRWI0002-002 06/01/2023		

ASHLAND, BAYFIELD, DOUGLAS, AND IRON COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 47.10	25.16

BRWI0002-005 06/01/2023		

ADAMS, ASHLAND, BARRON, BROWN, BURNETT, CALUMET, CHIPPEWA,

CLARK, COLUMBIA, DODGE, DOOR, DUNN, FLORENCE, FOND DU LAC,
FOREST, GREEN LAKE, IRON, JEFFERSON, KEWAUNEE, LANGLADE,
LINCOLN, MANITOWOC, MARATHON, MARINETTE, MARQUETTE, MENOMINEE,
OCONTO, ONEIDA, OUTAGAMIE, POLK, PORTAGE, RUSK, ST CROIX, SAUK,
SHAWANO, SHEBOYGAN, TAYLOR, VILAS, WALWORTH, WAUPACA, WAUSHARA,
WINNEBAGO, AND WOOD COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 39.97	25.02

BRWI0003-002 06/01/2023		

BROWN, DOOR, FLORENCE, KEWAUNEE, MARINETTE, AND OCONTO COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 40.00	26.06

BRWI0004-002 06/01/2023		

KENOSHA, RACINE, AND WALWORTH COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 44.50	26.96

BRWI0006-002 06/01/2023		

ADAMS, CLARK, FOREST, LANGLADE, LINCOLN, MARATHON, MENOMINEE,
ONEIDA, PORTAGE, PRICE, TAYLOR, VILAS AND WOOD COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 40.08	25.98

BRWI0007-002 06/01/2023		

GREEN, LAFAYETTE, AND ROCK COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 40.95	26.80

BRWI0008-002 06/05/2023		

MILWAUKEE, OZAUKEE, WASHINGTON, AND WAUKESHA COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 44.96	25.67

BRWI0011-002 06/01/2023		

CALUMET, FOND DU LAC, MANITOWOC, AND SHEBOYGAN COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 40.00	26.06

BRWI0019-002 06/01/2023		

BARRON, BUFFALO, BURNETT, CHIPPEWA, DUNN, EAU CLAIRE, PEPIN,
PIERCE, POLK, RUSK, ST. CROIX, SAWYER AND WASHBURN COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 39.32	26.74

BRWI0034-002 06/01/2023		

COLUMBIA AND SAUK COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 41.56	26.19

CARP0068-011 05/02/2022		

BURNETT (W. of Hwy 48), PIERCE (W. of Hwy 29), POLK (W. of Hwys
35, 48 & 65), AND ST. CROIX (W. of Hwy 65) COUNTIES

	Rates	Fringes
Carpenter & Piledrivermen.....	\$ 41.19	27.05

CARP0231-002 06/05/2023		

KENOSHA, MILWAUKEE, OZAUKEE, RACINE, WASHINGTON, AND WAUKESHA
COUNTIES

Rates	Fringes

CARPENTER.....\$ 41.91 29.72

CARP0310-002 06/03/2024

ADAMS, ASHLAND, BAYFIELD (Eastern 2/3), FOREST, IRON, JUNEAU,
LANGLADE, LINCOLN, MARATHON, ONEIDA, PORTAGE, PRICE, SHAWANO
(Western Portion of the County), TAYLOR, VILAS, AND WOOD
COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 42.44	28.44
Piledriver.....	\$ 42.44	28.44

CARP0314-001 06/05/2023

COLUMBIA, DANE, DODGE, GRANT, GREEN, IOWA, JEFFERSON,
LAFAYETTE, RICHLAND, ROCK, SAUK, AND WALWORTH COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 38.86	27.06
Piledriver.....	\$ 39.43	27.02

CARP0361-004 05/01/2018

BAYFIELD (West of Hwy 63) AND DOUGLAS COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 36.15	20.43

CARP0731-002 06/03/2024

CALUMET (Eastern Portion of the County), FOND DU LAC (Eastern
Portion of the County), MANITOWOC, AND SHEBOYGAN COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 42.44	28.44
Piledriver.....	\$ 42.44	28.44

CARP0955-002 06/03/2024

CALUMET (Western Portion of the County), FOND DU LAC (Western
Portion of the County), GREEN LAKE, MARQUETTE, OUTAGAMIE,

WAUPACA, WAUSHARA, AND WINNEBAGO

	Rates	Fringes
CARPENTER.....	\$ 42.44	28.44
PILEDRIVER.....	\$ 42.44	28.44

CARP1056-002 06/01/2024		

ADAMS, ASHLAND, BARRON, BAYFIELD , BROWN, BUFFALO, BURNETT
,CALUMET, CHIPPEWA, CLARK, COLUMBIA, CRAWFORD, DANE, DODGE,
DOOR, DUNN, EAU CLAIRE, FLORENCE, FOND DU LAC, FOREST, GRANT,
GREEN, GREEN LAKE, IOWA, IRON, JACKSON, JEFFERSON, JUNEAU,
KEWAUNEE, LA CROSSE, LAFAYETTE, LANGLADE, LINCOLN, MANITOWOC,
MARATHON, MARINETTE, MARQUETTE, MENOMINEE, MONROE, OCONTO,
ONEIDA, OUTAGAMIE, PEPIN, PIERCE (E. of Hwy. 29 & 65), POLK (E.
of Hwy. 35, 48 & 65), PORTAGE, PRICE, RICHLAND, ROCK, RUSK,
SAUK, SAWYER, SHAWANO, SHEBOYGAN, ST. CROIX (E. of Hwy. 65),
TAYLOR, TREMPLEAU, VERNON, VILAS, WALWORTH, WASHBURN,
WAUPACA, WAUSHARA, WINNEBAGO, AND WOOD COUNTIES

	Rates	Fringes
MILLWRIGHT.....	\$ 42.00	28.85

CARP1074-002 06/03/2024		

BARRON, BURNETT, CHIPPEWA, CLARK, DUNN, EAU CLAIRE, PEPIN,
PIERCE (E. of Hwy. 29 & 65), POLK (E. of Hwy. 35, 48 & 65),
RUSK, SAWYER, ST. CROIX (E. of Hwy. 65), AND WASHBURN

	Rates	Fringes
CARPENTER.....	\$ 42.44	28.44
PILEDRIVER.....	\$ 42.44	28.44

CARP1143-002 06/03/2024		

BUFFALO, CRAWFORD, JACKSON, LA CROSSE, MONROE, TREMPLEAU AND
VERNON COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 42.44	28.44
PILEDRIVER.....	\$ 42.44	28.44

CARP1146-002 06/03/2024

BROWN, DOOR, FLORENCE, KEWAUNEE, MARINETTE, MENOMINEE, OCONTO,
AND SHAWANO (Western Portion of the County) COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 42.44	28.44
PILEDRIVER.....	\$ 42.44	28.44

CARP2337-009 06/03/2024

KENOSHA, MILWAUKEE, OZAUKEE, RACINE, WASHINGTON, AND WAUKESHA

	Rates	Fringes
PILEDRIVERMAN.....	\$ 42.21	34.07

ELEC0014-002 05/26/2024

ASHLAND, BARRON, BAYFIELD, BUFFALO, BURNETT, CHIPPEWA, CLARK
(except Maryville, Colby, Unity, Sherman, Fremont, Lynn &
Sherwood), CRAWFORD, DUNN, EAU CLAIRE, GRANT, IRON, JACKSON, LA
CROSSE, MONROE, PEPIN, PIERCE, POLK, PRICE, RICHLAND, RUSK, ST
CROIX, SAWYER, TAYLOR, TREMPLEAU, VERNON, AND WASHBURN
COUNTIES

	Rates	Fringes
Electricians:.....	\$ 42.73	23.99

ELEC0014-007 05/26/2024

REMAINING COUNTIES

	Rates	Fringes
Teledata System Installer		
Installer/Technician.....	\$ 30.27	19.11

Low voltage construction, installation, maintenance and
removal of teledata facilities (voice, data, and video)
including outside plant, telephone and data inside wire,
interconnect, terminal equipment, central offices, PABX,
fiber optic cable and equipment, micro waves, V-SAT,
bypass, CATV, WAN (wide area networks), LAN (local area

networks), and ISDN (integrated systems digital network).

ELEC0127-002 06/01/2023

KENOSHA COUNTY

	Rates	Fringes
Electricians:.....	\$ 46.05	30%+13.15

ELEC0158-002 05/30/2021

BROWN, DOOR, KEWAUNEE, MANITOWOC (except Schleswig),
MARINETTE(Wausuakee and area South thereof), OCONTO, MENOMINEE
(East of a ine 6 miles West of the West boundary of Oconto
County), SHAWANO (Except Area North of Townships of Aniwa and
Hutchins) COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 36.14	29.75%+10.26

ELEC0159-003 05/26/2024

COLUMBIA, DANE, DODGE (Area West of Hwy 26, except Chester and
Emmet Townships), GREEN, LAKE (except Townships of Berlin,
Seneca, and St. Marie), IOWA, MARQUETTE (except Townships of
Neshkoka, Crystal Lake, Newton, and Springfield), and SAUK
COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 48.55	25.91

ELEC0219-004 06/01/2019

FLORENCE COUNTY (Townships of Aurora, Commonwealth, Fern,
Florence and Homestead) AND MARINETTE COUNTY (Township of
Niagara)

	Rates	Fringes
Electricians:		
Electrical contracts over		
\$180,000.....	\$ 33.94	21.80

Electrical contracts under		
\$180,000.....	\$ 31.75	21.73

ELEC0242-005 06/02/2024

DOUGLAS COUNTY

	Rates	Fringes
Electricians:.....	\$ 46.23	69.19%

ELEC0388-002 06/01/2023

ADAMS, CLARK (Colby, Freemont, Lynn, Mayville, Sherman, Sherwood, Unity), FOREST, JUNEAU, LANGLADE, LINCOLN, MARATHON, MARINETTE (Beecher, Dunbar, Goodman & Pembine), MENOMINEE (Area West of a line 6 miles West of the West boundary of Oconto County), ONEIDA, PORTAGE, SHAWANO (Aniwa and Hutchins), VILAS AND WOOD COUNTIES

	Rates	Fringes
Electricians:.....	\$ 38.74	26%+11.76

ELEC0430-002 06/01/2023

RACINE COUNTY (Except Burlington Township)

	Rates	Fringes
Electricians:.....	\$ 46.70	25.02

ELEC0494-005 05/26/2024

MILWAUKEE, OZAUKEE, WASHINGTON, AND WAUKESHA COUNTIES

	Rates	Fringes
Electricians:.....	\$ 49.48	27.34

ELEC0494-006 05/26/2024

CALUMET (Township of New Holstein), DODGE (East of Hwy 26 including Chester Township), FOND DU LAC, MANITOWOC (Schleswig), and SHEBOYGAN COUNTIES

	Rates	Fringes

.....

Installer	\$ 36 03	18 87

Technician	\$ 36 03	18 87

ELEC0890-003 06/01/2024

DODGE (Emmet Township only), GREEN, JEFFERSON, LAFAYETTE,
RACINE (Burlington Township), ROCK AND WALWORTH COUNTIES

	Rates	Fringes
Electricians:.....	\$ 43.65	25.95%+12.26

ELEC0953-001 06/02/2019

	Rates	Fringes
Line Construction:		
(1) Lineman.....	\$ 47.53	21.43
(2) Heavy Equipment Operator.....	\$ 42.78	19.80
(3) Equipment Operator.....	\$ 38.02	18.40
(4) Heavy Groundman Driver..	\$ 33.27	16.88
(5) Light Groundman Driver..	\$ 30.89	16.11
(6) Groundsman.....	\$ 26.14	14.60

ENGI0139-005 06/01/2024

	Rates	Fringes
Power Equipment Operator		
Group 1.....	\$ 46.37	28.80
Group 2.....	\$ 45.87	28.80
Group 3.....	\$ 44.77	28.80
Group 4.....	\$ 44.51	28.80
Group 5.....	\$ 44.22	28.80
Group 6.....	\$ 38.32	28.80

HAZARDOUS WASTE PREMIUMS:
EPA Level ""A"" protection - \$3.00 per hour
EPA Level ""B"" protection - \$2.00 per hour
EPA Level ""C"" protection - \$1.00 per hour

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Cranes, tower cranes, and derricks with or without
attachments with a lifting capacity of over 100 tons; or
cranes, tower cranes, and derricks with boom, leads and/or
jib lengths measuring 176 feet or longer.

GROUP 2: Cranes, tower cranes and derricks with or without
attachments with a lifting capacity of 100 tons or less; or

cranes, tower cranes, and derricks with boom, leads, and/or jibs lengths measuring 175 feet or under and Backhoes (excavators) weighing 130,000 lbs and over; caisson rigs; pile driver; dredge operator; dredge engineer; Boat Pilot.

GROUP 3: Mechanic or welder - Heavy duty equipment; cranes with a lifting capacity of 25 tons or under; concrete breaker (manual or remote); vibratory/sonic concrete breaker; concrete laser screed; concrete slipform paver; concrete batch plant operator; concrete pvt. spreader - heavy duty (rubber tired); concrete spreader & distributor; automatic subgrader (concrete); concrete grinder & planing machine; concrete slipform curb & gutter machine; slipform concrete placer; tube finisher; hydro blaster (10,000 psi & over); bridge paver; concrete conveyor system; concrete pump; Rotec type Conveyor; stabilizing mixer (self-propelled); shoulder widener; asphalt plant engineer; bituminous paver; bump cutter & grooving machine; milling machine; screed (bituminous paver); asphalt heater, planer & scarifier; Backhoes (excavators) weighing under 130,000 lbs; grader or motor patrol; tractor (scraper, dozer, pusher, loader); scraper - rubber tired (single or twin engine); endloader; hydraulic backhoe (tractor type); trenching machine; skid rigs; tractor, side boom (heavy); drilling or boring machine (mechanical heavy); roller over 5 tons; percussion or rotary drilling machine; air track; blaster; loading machine (conveyor); tugger; boatmen; winches & A-frames; post driver; material hoist.

GROUP 4: Greaser, roller steel (5 tons or less); roller (pneumatic tired) - self propelled; tractor (mounted or towed compactors & light equipment); shouldering machine; self-propelled chip spreader; concrete spreader; finishing machine; mechanical float; curing machine; power subgrader; joint sawer (multiple blade) belting machine; burlap machine; texturing machine; tractor endloader (rubber tired) - light; jeep digger; forklift; mulcher; launch operator; fireman, environmental burner

GROUP 5: Air compressor; power pack; vibrator hammer and extractor; heavy equipment, leadman; tank car heaters; stump chipper; curb machine operator; Concrete proportioning plants; generators; mudjack operator; rock breaker; crusher or screening plant; screed (milling machine); automatic belt conveyor and surge bin; pug mill operator; Oiler, pump (over 3 inches); Drilling Machine Tender, day light machine

GROUP 6: Off-road material hauler with or without ejector.

IRON0008-002 06/02/2024

BROWN, CALUMET, DOOR, FOND DU LAC, KEWAUNEE, MANITOWOC,
MARINETTE, OCONTO, OUTAGAMI, SHAWANO, SHEBOYGAN, AND WINNEBAGO
COUNTIES:

	Rates	Fringes
IRONWORKER.....	\$ 43.02	32.32

Paid Holidays: New Year's Day, Memorial Day, July 4th, Labor
Day, Thanksgiving Day & Christmas Day.

IRON0008-003 06/02/2024

KENOSHA, MILWAUKEE, OZAUCKEE, RACINE, WALWORTH (N.E. 2/3),
WASHINGTON, AND WAUKESHA COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 44.79	32.32

Paid Holidays: New Year's Day, Memorial Day, July 4th, Labor
Day, Thanksgiving Day & Christmas Day.

IRON0383-001 06/02/2024

ADAMS, COLUMBIA, CRAWFORD, DANE, DODGE, FLORENCE, FOREST,
GRANT, GREENE, (Excluding S.E. tip), GREEN LAKE, IOWA,
JEFFERSON, JUNEAU, LA CROSSE, LAFAYETTE, LANGLADE, MARATHON,
MARQUETTE, MENOMINEE, MONROE, PORTAGE, RICHLAND, ROCK (Northern
area, vicinity of Edgerton and Milton), SAUK, VERNON, WAUPACA,
WAUSHARA, AND WOOD COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 42.00	31.93

IRON0498-005 06/01/2023

GREEN (S.E. 1/3), ROCK (South of Edgerton and Milton), and
WALWORTH (S.W. 1/3) COUNTIES:

	Rates	Fringes
IRONWORKER.....	\$ 45.18	47.08

IRON0512-008 04/30/2023

BARRON, BUFFALO, CHIPPEWA, CLARK, DUNN, EAU CLAIRE, JACKSON,
PEPIN, PIERCE, POLK, RUSK, ST CROIX, TAYLOR, AND TREMPLEAU
COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 43.00	34.11

IRON0512-021 04/30/2023

ASHLAND, BAYFIELD, BURNETT, DOUGLAS, IRON, LINCOLN, ONEIDA,
PRICE, SAWYER, VILAS AND WASHBURN COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 39.14	34.00

LAB00113-002 06/03/2024

MILWAUKEE AND WAUKESHA COUNTIES

	Rates	Fringes
LABORER		
Group 1.....	\$ 35.61	25.01
Group 2.....	\$ 35.76	25.01
Group 3.....	\$ 35.96	25.01
Group 4.....	\$ 36.11	25.01
Group 5.....	\$ 36.26	25.01
Group 6.....	\$ 32.10	25.01

LABORERS CLASSIFICATIONS

GROUP 1: General Laborer; Tree Trimmer; Conduit Layer;
Demolition and Wrecking Laborer; Guard Rail, Fence, and
Bridge Builder; Landscaper; Multiplate Culvert Assembler;
Stone Handler; Bituminous Worker (Shoveler, Loader, and
Utility Man); Batch Truck Dumper or Cement Handler;
Bituminous Worker (Dumper, Ironer, Smoother, and Tamper);

Concrete Handler

GROUP 2: Air Tool Operator; Joint Sawyer and Filler
(Pavement); Vibrator or Tamper Operator (Mechanical Hand
Operated); Chain Saw Operator; Demolition Burning Torch
Laborer

GROUP 3: Bituminous Worker (Raker and Luteman); Formsetter
(Curb, Sidewalk, and Pavement); Strike Off Man

GROUP 4: Line and Grade Specialist

GROUP 5: Blaster and Powderman

GROUP 6: Flagperson; traffic control person

LAB00113-003 06/03/2024

OZAUKEE AND WASHINGTON COUNTIES

	Rates	Fringes
LABORER		
Group 1.....	\$ 34.86	25.01
Group 2.....	\$ 34.96	25.01
Group 3.....	\$ 35.01	25.01
Group 4.....	\$ 35.21	25.01
Group 5.....	\$ 35.06	25.01
Group 6.....	\$ 31.95	25.01

LABORERS CLASSIFICATIONS

GROUP 1: General Laborer; Tree Trimmer; Conduit Layer;
Demolition and Wrecking Laborer; Guard Rail, Fence, and
Bridge Builder; Landscaper; Multiplate Culvert Assembler;
Stone Handler; Bituminous Worker (Shoveler, Loader, and
Utility Man); Batch Truck Dumper or Cement Handler;
Bituminous Worker (Dumper, Ironer, Smoother, and Tamper);
Concrete Handler

GROUP 2: Air Tool Operator; Joint Sawyer and Filler
(Pavement); Vibrator or Tamper Operator (Mechanical Hand
Operated);

GROUP 3: Bituminous Worker (Raker and Luteman); Formsetter
(Curb, Sidewalk, and Pavement); Strike Off Man

GROUP 4: Line and Grade Specialist

GROUP 5: Blaster; powderman

GROUP 6: Flagperson and Traffic Control Person

* LAB00113-011 06/03/2024

KENOSHA AND RACINE COUNTIES

	Rates	Fringes
LABORER		
Group 1.....	\$ 34.67	25.01
Group 2.....	\$ 34.82	25.01
Group 3.....	\$ 35.02	25.01
Group 4.....	\$ 34.99	25.01
Group 5.....	\$ 35.32	25.01
Group 6.....	\$ 31.81	25.01

LABORERS CLASSIFICATIONS:

GROUP 1: General laborer; Tree Trimmer; Conduit Layer;
Demolition and Wrecking Laborer; Guard Rail, Fence, and
Bridge Builder; Landscaper; Multiplate Culvert Assembler;
Stone Handler; Bituminous Worker (Shoveler, Loader, and
Utility Man); Batch Truck Dumper or Cement Handler;
Bituminous worker (Dumper, Ironer, Smoother, and Tamper);
Concrete Handler

GROUP 2: Air Tool Operator; Joint Sawyer and Filler
(Pavement); Vibrator or Tamper Operator (Mechanical Hand
Operated); Chain Saw Operator; Demolition Burning Torch
Laborer

GROUP 3: Bituminous Worker (Raker and Luteman); Formsetter
(Curb, Sidewalk, and Pavement); Strike Off Man

GROUP 4: Line and Grade Specialist

GROUP 5: Blaster and Powderman

GROUP 6: Flagman; traffic control person

LAB00140-002 06/03/2024

ADAMS, ASHLAND, BARRON, BAYFIELD, BROWN, BUFFALO, BURNETT,
CALUMET, CHIPPEWA, CLARK, COLUMBIA, CRAWFORD, DODGE, DOOR,

DOUGLAS, DUNN, EAU CLAIRE, FLORENCE, FOND DU LAC, FOREST,
GRANT, GREEN, GREEN LAKE, IRON, JACKSON, JUNEAU, IOWA,
JEFFERSON, KEWAUNEE, LA CROSSE, LAFAYETTE, LANGLADE, LINCOLN,
MANITOWOC, MARATHON, MARINETTE, MARQUETTE, MENOMINEE, MONROE,
OCONTO, ONEIDA, OUTAGAMIE, PEPIN, PIERCE, POLK, PORTAGE, PRICE,
RICHLAND, ROCK, RUSK, SAUK, SAWYER, SHAWANO, SHEBOYGAN, ST.
CROIX, TAYLOR, TREMPLEAU, VERNON, VILLAS, WALWORTH, WASHBURN,
WAUPACA, WAUSHARA, WINNEBAGO, AND WOOD COUNTIES

	Rates	Fringes
LABORER		
Group 1.....	\$ 40.57	19.45
Group 2.....	\$ 40.67	19.45
Group 3.....	\$ 40.72	19.45
Group 4.....	\$ 40.92	19.45
Group 5.....	\$ 40.77	19.45
Group 6.....	\$ 37.20	19.45

LABORER CLASSIFICATIONS

GROUP 1: General Laborer; Tree Trimmer; Conduit Layer;
Demolition and Wrecking Laborer; Guard Rail, Fence, and
Bridge Builder; Landscaper; Multiplate Culvert Assembler;
Stone Handler; Bituminous Worker (Shoveler, Loader, and
Utility Man); Batch Truck Dumper or Cement Handler;
Bituminous Worker (Dumper, Ironer, Smoother and Tamper);
Concrete Handler

GROUP 2: Air Tool Operator; Joint Sawyer and Filler
(Pavement); Vibrator or Tamper Operator (Mechanical Hand
Operated); Chain Saw Operator, Demolition Burning Torch
Laborer

GROUP 3: Bituminous Worker (Raker and Luteman); Formsetter
(Curb, Sidewalk and Pavement); Strike Off Man

GROUP 4: Line and Grade Specialist

GROUP 5: Blaster; powderman

GROUP 6: Flagperson; Traffic Control

LAB00464-003 06/03/2024

DANE COUNTY

	Rates	Fringes
LABORER		
Group 1.....	\$ 40.85	19.45
Group 2.....	\$ 40.95	19.45
Group 3.....	\$ 41.00	19.45
Group 4.....	\$ 41.20	19.45
Group 5.....	\$ 41.05	19.45
Group 6.....	\$ 37.20	19.45

LABORERS CLASSIFICATIONS:

GROUP 1: General Laborer; Tree Trimmer; Conduit Layer; Demolition and Wrecking Laborer; Guard Rail, Fence, and Bridge Builder; Landscaper; Multiplate Culvert Assembler; Stone Handler; Bituminous Worker (Shoveler, Loader, and Utility Man); Batch Truck Dumper or Cement Handler; Bituminous Worker (Dumper, Ironer, Smoother, and Tamper); Concrete Handler

GROUP 2: Air Tool Operator; Joint Sawyer and Filler (Pavement); Vibrator or Tamper Operator (Mechanical Hand Operated); Chain Saw Operator; Demolition Burning Torch Laborer

GROUP 3: Bituminous Worker (Raker and Luteman); Formsetter (Curb, Sidewalk, and Pavement); Strike Off Man

GROUP 4: Line and Grade Specialist

GROUP 5: Blaster; Powderman

GROUP 6: Flagperson and Traffic Control Person

PAIN0106-008 05/06/2024

ASHLAND, BAYFIELD, BURNETT, AND DOUGLAS COUNTIES

	Rates	Fringes
Painters:		
New:		
Brush, Roller.....	\$ 36.16	26.27
Spray, Sandblast, Steel....	\$ 36.76	26.27
Repaint:		
Brush, Roller.....	\$ 34.66	26.27
Spray, Sandblast, Steel....	\$ 35.26	26.27

PAIN0108-002 06/01/2024

RACINE COUNTY

	Rates	Fringes
Painters:		
Brush, Roller.....	\$ 42.04	22.95
Spray & Sandblast.....	\$ 43.04	22.95

PAIN0259-002 05/01/2008

BARRON, CHIPPEWA, DUNN, EAU CLAIRE, PEPIN, PIERCE, POLK, RUSK,
SAWYER, ST. CROIX, AND WASHBURN COUNTIES

	Rates	Fringes
PAINTER.....	\$ 24.11	12.15

PAIN0259-004 05/01/2015

BUFFALO, CRAWFORD, JACKSON, LA CROSSE, MONROE, TREMPLEAU, AND
VERNON COUNTIES

	Rates	Fringes
PAINTER.....	\$ 22.03	12.45

PAIN0781-002 06/01/2024

JEFFERSON, MILWAUKEE, OZAUKEE, WASHINGTON, AND WAUKESHA COUNTIES

	Rates	Fringes
Painters:		
Bridge.....	\$ 41.39	24.92
Brush.....	\$ 40.64	24.92
Spray & Sandblast.....	\$ 41.39	24.92

PAIN0802-002 06/01/2024

COLUMBIA, DANE, DODGE, GRANT, GREEN, IOWA, LAFAYETTE, RICHLAND,
ROCK, AND SAUK COUNTIES

Rates	Fringes

PAINTER
Brush.....\$ 36.35 20.87

PREMIUM PAY:
Structural Steel, Spray, Bridges = \$1.00 additional per
hour.

PAIN0802-003 06/01/2024

ADAMS, BROWN, CALUMET, CLARK, DOOR, FOND DU LAC, FOREST, GREEN
LAKE, IRON, JUNEAU, KEWAUNEE, LANGLADE, LINCOLN, MANITOWOC,
MARATHON, MARINETTE, MARQUETTE, MENOMINEE, OCONTO, ONEIDA,
OUTAGAMIE, PORTAGE, PRICE, SHAWANO, SHEBOYGAN, TAYLOR, VILAS,
WAUSHARA, WAUPACA, WINNEBAGO, AND WOOD COUNTIES

	Rates	Fringes
PAINTER.....	\$ 36.35	20.87

PAIN0934-001 06/01/2024

KENOSHA AND WALWORTH COUNTIES

	Rates	Fringes
Painters:		
Brush.....	\$ 38.67	26.32
Spray.....	\$ 39.67	26.32
Structural Steel.....	\$ 38.82	26.32

PAIN1011-002 06/02/2024

FLORENCE COUNTY

	Rates	Fringes
Painters:.....	\$ 29.95	15.89

PLAS0599-002 06/01/2023

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER		
Area A.....	\$ 45.17	27.27
Area B.....	\$ 39.97	25.02
Area C.....	\$ 40.40	25.25
Area D.....	\$ 41.16	24.49

Area E.....	\$ 40.50	25.14
Area F.....	\$ 36.98	28.67

AREA DESCRIPTIONS

AREA A: ASHLAND, BURNETT, BAYFIELD, DOUGLAS, IRON, PRICE, SAWYER, AND WASHBURN COUNTIES

AREA B: ADAMS, BARRON, BROWN, CALUMET, CHIPPEWA, CLARK, COLUMBIA, DODGE, DOOR, DUNN, FLORENCE, FOND DU LAC, FOREST, GREEN LAKE, JEFFERSON, KEWAUNEE, LANGLADE, LINCOLN, MANITOWOC, MARATHON, MARINETTE, MARQUETTE, MENOMINEE, OCONTO, ONEIDA, OUTAGAMIE, POLK, PORTAGE, RUSK, ST. CROIX, SAUK, SHAWANO, SHEBOYGAN, TAYLOR, VILAS, WALWORTH, WAUPACA, WAUSHARA, WINNEBAGO, AND WOOD COUNTIES

AREA C: BUFFALO, CRAWFORD, EAU CLAIRE, JACKSON, JUNEAU, LA CROSSE, MONROE, PEPIN, PIERCE, RICHLAND, TREMPLEALEAU, AND VERNON COUNTIES

AREA D: MILWAUKEE, OZAUKEE, WASHINGTON, AND WAUKESHA COUNTIES

AREA E: DANE, GRANT, GREEN, IOWA, LAFAYETTE, AND ROCK COUNTIES

AREA F: KENOSHA AND RACINE COUNTIES

TEAM0039-001 06/01/2024

	Rates	Fringes
TRUCK DRIVER		
1 & 2 Axles.....	\$ 37.57	27.41
3 or more Axles; Euclids, Dumpton & Articulated, Truck Mechanic.....	\$ 37.72	27.41

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

=====

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide

employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

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

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

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate

changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

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

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

Union Average Rate Identifiers

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

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

State Adopted Rate Identifiers

Classifications listed under the ""SA"" identifier indicate that the prevailing wage rate set by a state (or local) government was adopted under 29 C.F.R. 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an

internal number used in producing the wage determination.
01/03/2024 reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

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

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

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

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

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

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

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

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

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

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

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

=====

END OF GENERAL DECISION"

"General Decision Number: WI20240011 09/27/2024

Superseded General Decision Number: WI20230011

State: Wisconsin

Construction Type: Building

Counties: Adams, Ashland, Barron, Bayfield, Buffalo, Burnett, Clark, Columbia, Crawford, Dodge, Door, Dunn, Florence, Fond Du Lac, Forest, Grant, Green, Green Lake, Iowa, Iron, Jackson, Jefferson, Juneau, Kewaunee, Lafayette, Langlade, Lincoln, Manitowoc, Marinette, Marquette, Menominee, Monroe, Oconto, Oneida, Pepin, Polk, Portage, Price, Richland, Rusk, Sauk, Sawyer, Shawano, Taylor, Trempealeau, Vernon, Vilas, Walworth, Washburn, Waupaca, Waushara and Wood Counties in Wisconsin.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the	. Executive Order 13658 generally applies to the contract.

contract is not renewed or extended on or after January 30, 2022:	. The contractor must pay all covered workers at least \$12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/05/2024
1	01/26/2024
2	02/02/2024
3	02/16/2024
4	03/15/2024
5	05/10/2024
6	05/17/2024
7	05/24/2024
8	06/21/2024
9	06/28/2024
10	07/05/2024
11	08/23/2024
12	09/06/2024
13	09/20/2024
14	09/27/2024

ASBE0019-002 06/01/2024

COLUMBIA, CRAWFORD, DODGE, GRANT, GREEN, IOWA, JEFFERSON, JUNEAU, LAFAYETTE, MARQUETTE, MONROE, RICHLAND, SAUK, VERNON, AND WALWORTH COUNTIES

Rates	Fringes

Asbestos Workers/Insulator

(Includes the application of all insulating materials, protective coverings, coatings, and finishes to all types of mechanical systems. Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems whether they contain asbestos or not)....\$ 43.48 37.50

ASBE0034-005 06/01/2024

BARRON, BUFFALO, DUNN, PEPIN, AND POLK COUNTIES

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials; protective coatings, coverings, and finishes to all types of mechanical systems. Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems whether they contain asbestos or not)....\$ 45.65		36.18

ASBE0049-003 06/01/2023

ASHLAND, BAYFIELD, BURNETT, IRON, SAWYER, AND WASHBURN COUNTIES

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials; protective coverings, coatings, and finishes to all types of mechanical systems. Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging		

and disposing of all
insulation materials from
mechanical systems whether
they contain asbestos or not)....\$ 37.62 29.00

ASBE0127-002 06/01/2024

ADAMS, CLARK, DOOR, FLORENCE, FOND DU LAC, FOREST, GREEN LAKE,
JACKSON, KEWAUNEE, LANGLADE, LINCOLN, MANITOWOC, MARINETTE,
MENOMINEE, OCONTO, ONEIDA, PORTAGE, PRICE, RUSK, SHAWANO,
TAYLOR, TREMPLEAU, VILAS, WAUPACA, WAUSHARA, AND WOOD COUNTIES

	Rates	Fringes
Heat and Frost Insulator (Includes the application of all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems; and the application of firestopping material in walls, floors, ceilings. Includes preparation, wetting, stripping, removal, scrapping vacuuming, bagging and disposing of all insulation materials from mechanical systems whether they contain asbestos or not)....\$ 43.24		28.56

BOIL0107-001 01/01/2021

	Rates	Fringes
BOILERMAKER		
Boilermaker.....\$ 39.52		31.50
Small Boiler Repair (under 25,000 lbs/hr).....\$ 26.91		16.00

BRWI0001-003 06/01/2023

CRAWFORD, JUNEAU, MONROE, TREMPLEAU, AND VERNON COUNTIES

	Rates	Fringes
Bricklayer & Tile Setter.....\$ 40.18		25.88

BRWI0002-003 06/01/2023

ASHLAND, BURNETT, IRON, WASHBURN

	Rates	Fringes
BRICKLAYER		
Bricklayer, Tile Setter.....	\$ 47.10	25.16
Cement Mason/Concrete Finisher.....	\$ 44.75	25.16

BRWI0002-004 06/01/2023

BAYFIELD COUNTY

	Rates	Fringes
BRICKLAYER		
Bricklayer & Tile Setter....	\$ 47.10	25.16

BRWI0003-001 06/01/2023

DOOR, KEWAUNEE, FLORENCE, FOND DU LAC, GREEN LAKE, MANITOWOC, MARINETTE, MARQUETTE, OCONTO, SHAWANO, WAUPACA, AND WAUSHARA COUNTIES

	Rates	Fringes
BRICKLAYER		
Bricklayer, Cement Mason, Tile Setter.....	\$ 40.00	26.06

BRWI0004-003 06/01/2023

WALWORTH COUNTY

	Rates	Fringes
BRICKLAYER.....	\$ 44.50	26.96
CEMENT MASON/CONCRETE FINISHER...	\$ 40.16	26.96
TILE SETTER.....	\$ 37.29	26.96

BRWI0006-001 06/01/2023

ADAMS, CLARK, FOREST, LANGLADE, LINCOLN, MENOMINEE, ONEIDA, PORTAGE, TAYLOR, VILAS AND WOOD COUNTIES

	Rates	Fringes
BRICKLAYER		
Bricklayer,Cement Mason,Tile Setter.....	\$ 40.08	25.98

BRWI0006-004 06/01/2023		

PRICE COUNTY

	Rates	Fringes
Bricklayer & Tile Setter.....	\$ 40.08	25.98

BRWI0007-003 06/01/2023		

GREEN AND LAFAYETTE COUNTIES

	Rates	Fringes
Bricklayer & Tile Setter.....	\$ 40.95	26.80

BRWI0013-003 06/01/2023		

GRANT, IOWA, AND RICHLAND COUNTIES

	Rates	Fringes
Bricklayer.....	\$ 41.56	26.19
Tile Layer.....	\$ 38.40	25.66

BRWI0019-004 06/01/2023		

BARRON, BURNETT (Southern half), DUNN, PEPIN, POLK, RUSK, AND
WASHBURN (Southern half) COUNTIES

	Rates	Fringes
BRICKLAYER		
Bricklayer, Cement Mason, Tile Layer.....	\$ 39.32	26.74

BRWI0019-005 06/01/2023		

SAWYER COUNTY

Rates	Fringes

Bricklayer & Tile Setter.....	\$ 39.32	26.74

BRWI0021-001 06/01/2023

DODGE AND JEFFERSON COUNTIES

	Rates	Fringes
BRICKLAYER		
Bricklayer, Cement Mason,		
Tile Layer.....	\$ 40.49	27.24

BRWI0034-001 06/01/2023

COLUMBIA AND SAUK COUNTIES

	Rates	Fringes
BRICKLAYER		
Bricklayer, Cement Mason,		
Tile Layer.....	\$ 41.56	26.19

CARP0068-013 05/02/2022

BURNETT (West of highway 48) AND POLK(West of Highways 35, 48 & 65) COUNTIES

	Rates	Fringes
CARPENTER (Including Drywall		
Hanging, Acoustical work).....	\$ 41.51	27.32

CARP0310-007 06/01/2024

ADAMS, BAYFIELD (Eastern 2/3), FOREST, IRON, ONEIDA, PORTAGE, PRICE, SHAWANO (Western Portion of the County), TAYLOR, VILAS, AND WOOD COUNTIES

	Rates	Fringes
CARPENTER (Including Drywall		
Hanging, Acoustical Work).....	\$ 40.44	28.43
Piledriverman.....	\$ 40.44	28.43

CARP0310-008 06/01/2024

ASHLAND COUNTY

	Rates	Fringes
CABINET INSTALLER (Including Drywall Hanging & Acoustical Work).....	\$ 40.44	28.43

CARP0314-006 06/05/2023		

COLUMBIA, DODGE, GRANT, GREEN, IOWA, JEFFERSON, LAFAYETTE, RICHLAND, SAUK, AND WALWORTH COUNTIES

	Rates	Fringes
CARPENTER (Including Drywall Hanging, Acoustical Work).....	\$ 38.86	27.06
Piledriverman.....	\$ 39.43	27.02

CARP0361-006 05/03/2021		

BAYFIELD COUNTY (West of Hwy 63)

	Rates	Fringes
Carpenters: (Including Drywall Hanging, Acoustical work).....	\$ 39.71	26.01

CARP0731-006 06/01/2024		

FOND DU LAC (Eastern Portion of the County) AND MANITOWOC COUNTIES

	Rates	Fringes
CARPENTER (Including Drywall Hanging, Acoustical Work).....	\$ 40.44	28.43
Piledriverman.....	\$ 40.44	28.43

CARP0955-004 06/01/2024		

FOND DU LAC (Western Portion of the County), GREEN LAKE, MARQUETTE, WAUPACA, AND WAUSHARA COUNTIES

Rates	Fringes

CARPENTER (Including Drywall		
Hanging, Acoustical Work).....	\$ 40.44	28.43
Piledriverman.....	\$ 40.44	28.43

CARP1056-004 06/01/2024

ADAMS, ASHLAND, BARRON, BAYFIELD (Eastern 2/3), BUFFALO,
 BURNETT, CLARK, COLUMBIA, CRAWFORD, DODGE, DOOR, DUNN,
 FLORENCE, FOND DU LAC, FOREST, GRANT, GREEN, GREEN LAKE, IOWA,
 IRON, JACKSON, JEFFERSON, JUNEAU, KEWAUNEE, LAFAYETTE,
 LANGLADE, LINCOLN, MANITOWOC, MARINETTE, MARQUETTE, MENOMINEE,
 MONROE, OCONTO, ONEIDA, PEPIN, POLK (E. of Hwy. 35, 48 & 65),
 PORTAGE, PRICE, RICHLAND, RUSK, SAUK, SAWYER, SHAWANO, TAYLOR,
 TREMPLEALEAU, VERNON, VILAS, WALWORTH, WASHBURN, WAUPACA,
 WAUSHARA, AND WOOD COUNTIES

	Rates	Fringes
MILLWRIGHT.....	\$ 42.00	28.85

CARP1074-009 06/01/2024

BARRON, BURNETT (East of Hwy 48), CLARK, DUNN, POLK (East of
 Hwy 35, 48, 65), RUSK, SAWYER, AND WASHBURN COUNTIES

	Rates	Fringes
CARPENTER (Including Drywall		
Hanging, Acoustical Work).....	\$ 40.44	28.43
Piledriverman.....	\$ 40.44	28.43

CARP1143-006 06/01/2024

BUFALO, CRAWFORD, JACKSON, MONROE, TREMPLEALEAU, AND VERNON
 COUNTIES

	Rates	Fringes
CARPENTER (Including Drywall		
Hanging, Acoustical Work).....	\$ 40.44	28.43
Piledriverman.....	\$ 40.44	28.43

CARP1146-006 06/01/2024

DOOR, FLORENCE (Except area bordering Michigan), KEWAUNEE,
 MARINETTE (Except N.E. corner), MENOMINEE, OCONTO, AND SHAWANO

(Western Portion of the County) COUNTIES

	Rates	Fringes
CARPENTER (Including Drywall Hanging, Acoustical Work).....	\$ 40.44	28.43
Piledriverman.....	\$ 40.44	28.43

CARP1348-006 05/01/2020		

BAYFIELD COUNTY (Western 1/3)

	Rates	Fringes
MILLWRIGHT.....	\$ 35.75	21.30

ELEC0014-001 05/26/2024		

ASHLAND, BARRON, BAYFIELD, BUFFALO, BURNETT, CHIPPEWA, CLARK
(Except Colby, Fremont, Lynn, Maryville, Sherman, Sherwood,
Unity), CRAWFORD, DUNN, GRANT, IRON, JACKSON, MONROE, PEPIN,
POLK, PRICE, RICHLAND, RUSK, SAWYER, TAYLOR, TREMPPEALEAU,
VERNON, AND WASHBURN COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 42.73	23.99

ELEC0014-005 05/26/2024		

	Rates	Fringes
Teledata System Installer Installer/Technician.....	\$ 30.27	19.11

Low voltage construction, installation, maintenance and
removal of teledata facilities (voice, data, and video)
including outside plant, telephone and data inside wire,
interconnect, terminal equipment, central offices, PABX,
fiber optic cable and equipment, micro waves, V-SAT,
bypass, CATV, WAN (wide area networks), LAN (local area
networks), and ISDN (integrated systems digital network).

ELEC0158-007 05/30/2021

DOOR, KEWAUNEE, MANITOWOC (except Schleswig),

MARINETTE(Wausuakee and area South thereof), OCONTO, MENOMINEE
(East of a ine 6 miles West of the West boundary of Oconto
County), SHAWANO (Except Area North of Townships of Aniwa and
Hutchins) COUNTIES

	Rates	Fringes
Electricians:.....	\$ 36.14	29.75%+10.26

ELEC0159-001 05/26/2024		

COLUMBIA, DODGE (West of Hwy 26 except Chester and Emmet Twps),
GREEN LAKE COUNTY (Except Townships of Berlin, Seneca & St.
Marie), IOWA, MARQUETTE COUNTY (Except Townships of Neshkoka,
Crystal Lake, Newton, and Springfield), AND SAUK COUNTIES

	Rates	Fringes
Electricians:.....	\$ 48.55	25.91

ELEC0219-006 06/01/2019		

FLORENCE COUNTY (Townships of Aurora, Commonwealth, Fern,
Florence and Homestead) AND MARINETTE COUNTY (Township of
Niagara)

	Rates	Fringes
ELECTRICIAN		
Electrical contracts over		
\$180,000.....	\$ 33.94	21.80
Electrical contracts under		
\$180,000.....	\$ 31.75	21.73

ELEC0388-004 06/01/2023		

ADAMS, CLARK (Colby, Freemont, Lynn, Mayville, Sherman,
Sherwood, Unity), FOREST, JUNEAU, LANGLADE, LINCOLN, MARINETTE
(Beecher, Dunbar, Goodman & Pembine), MENOMINEE (Area West of a
line 6 miles West of the West boundary of Oconto County),
ONEIDA, PORTAGE, SHAWANO (Aniwa and Hutchins), VILAS AND WOOD
COUNTIES

Rates	Fringes

ELECTRICIAN.....\$ 38.74 26%+11.76

ELEC0494-010 05/26/2024

DODGE COUNTY (Area East of Hwy 26 including all of Chester Township, but excluding Emmet Township), FOND DU LAC (except Waupun), AND MANITOWOC (Schleswig) COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 42.77	24.66

ELEC0494-014 05/26/2024

DODGE (Area East of Hwy 26 including Chester Twp but excluding Emmet Twp), FOND DU LAC (Except Waupun), AND MANITOWOC (Schleswig) COUNTIES

	Rates	Fringes
Sound & Communications		
Installer.....	\$ 36.03	18.87
Technician.....	\$ 36.03	18.87

Installation, testing, maintenance, operation and servicing of all sound, intercom, telephone interconnect, closed circuit TV systems, radio systems, background music systems, language laboratories, electronic carillon, antenna distribution systems, clock and program systems and low-voltage systems such as visual nurse call, audio/visual nurse call systems, doctors entrance register systems. Includes all wire and cable carrying audio, visual, data, light and radio frequency signals. Includes the installation of conduit, wiremold, or raceways in existing structures that have been occupied for six months or more where required for the protection of the wire or cable, but does not mean a complete conduit or raceway system. work covered does not include the installation of conduit, wiremold or any raceways in any new construction, or the installation of power supply outlets by means of which external electric power is supplied to any of the foregoing equipment or products

ELEC0577-001 05/26/2024

GREEN LAKE (N. Part including Twps of Berlin, St Marie, and

Seneca), MARQUETTE (N. part including Twps of Crystal Lake, Neshkoro, Newton, and Springfield), WAUPACA, AND WAUSHARA COUNTIES,

	Rates	Fringes
ELECTRICIAN.....	\$ 40.00	22.69

ELEC0890-005 06/01/2024		

DODGE (Emmet Township only), GREEN, JEFFERSON, LAFAYETTE, AND WALWORTH COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 43.65	25.95%+12.26

ENGI0139-004 06/03/2024		

	Rates	Fringes
OPERATOR: Power Equipment		
(1) Cranes, Tower Cranes		
with or w/o attachments		
over 100 tons; Cranes,		
tower Cranes with boom,		
leads and or jib length		
176 ft or longer.....	\$ 48.78	27.14
(2) Cranes, Tower Cranes		
with or w/o attachments		
100 tons or less; Cranes,		
Tower Cranes with boom,		
leads, and or jib lengths		
175 ft or less.....	\$ 47.53	27.14
(3) Travelling Crane		
(bridge type).....	\$ 44.23	27.14
(4) Hydraulic Crane, 10		
tons or less.....	\$ 43.70	27.14
(6) Forklift.....	\$ 40.10	27.14

HAZARDOUS WASTE PREMIUMS:
EPA Level ""A"" Protection: \$3.00 per hour
EPA Level ""B"" Protection: \$2.00 per hour
EPA Level ""C"" Protection: \$1.00 per hour

IRON0008-012 06/02/2024		

CALUMET, DOOR, FOND DU LAC, KEWAUNEE, MANITOWOC, MARINETTE,
OCONTO, OUTAGAMIE, SHAWANO AND WALWORTH (Northeastern part)
COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 43.02	32.32
Paid Holidays: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day & Christmas Day.		

IRON0383-004 06/02/2024

ADAMS, COLUMBIA, CRAWFORD, DODGE, FLORENCE, FOREST, GRANT,
GREENE (Except S.E. tip), GREEN LAKE, IOWA, JEFFERSON, JUNEAU,
LAFAYETTE, LANGLADE, MARATHON, MARQUETTE, MENOMINEE, MONROE,
PORTAGE, RICHLAND, SAUK, VERNON, WAUPACA, WAUSHARA, AND WOOD
COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 42.00	31.93
----- IRON0498-007 06/01/2023		

GREEN (S.E. 1/3) AND WALWORTH (Except N.E. part) COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 45.18	47.08
----- IRON0512-009 04/30/2023		

BARRON, BUFFALO, CLARK, DUNN, JACKSON, PEPIN, POLK, RUSK,
TAYLOR AND TREMPLEAU COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 43.00	34.11
----- IRON0512-023 04/30/2023		

ASHLAND, BAYFIELD, BURNETT, IRON, LINCOLN, ONEIDA, PRICE,
SAWYER, VILAS AND WASHBURN COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 39.14	34.11

LAB00140-003 06/03/2024

BUFFALO, CRAWFORD, GRANT, JACKSON, JUNEAU, MONROE, RICHLAND,
TREMPEALEAU (Southern part), AND VERNON COUNTIES

	Rates	Fringes
Laborer, General.....	\$ 36.35	19.45
Laborer: Asbestos/hazardous material remover (Preparation, Removal and Encapsulation of Hazardous Materials from Non-Mechanical Systems).....	\$ 35.30	19.45

NOTE: Mason Tender \$1.00 over general laborer scale;
Pipelayer \$1.00 over general laborer scale

LAB00268-001 06/03/2024

AREA 1: BARRON, CLARK (West 1/3), DUNN, PEPIN, POLK, RUSK
TAYLOR (West 1/3)

AREA 2: CLARK (East 2/3), LANGLADE, LINCOLN, ONEIDA, PRICE,
TAYLOR (East 2/3), VILAS, WOOD

AREA 3: BURNETT, IRON, SAWYER, WASHBURN

	Rates	Fringes
Laborer, General		
Area 1.....	\$ 36.35	19.45
Area 2.....	\$ 35.70	19.45
Area 3.....	\$ 35.00	19.45
Laborer: Asbestos/hazardous material remover (Preparation, Removal, Encapsulation of Hazardous materials from Non-mechanical Systems)		

Area 1.....	\$ 35.30	19.45
Area 2.....	\$ 35.30	19.45
Area 3.....	\$ 35.30	19.45

NOTE: Mason Tender \$1.00 over general laborer. Burnett, Iron, Sawyer & Washburn \$.70 over general laborer.

LAB00330-001 06/03/2024

DODGE, DOOR, FLORENCE, FOND DU LAC, FOREST, GREEN LAKE, KEWAUNEE, MANITOWOC, MARINETTE, MARQUETTE, MENOMINEE, OCONTO, PORTAGE, SHAWANO, WAUPACA,WAUSHARA

	Rates	Fringes
Laborer: Asbestos/hazardous material remover (Preparation, Removal, Encapsulation of Hazardous materials from Non-mechanical Systems).....	\$ 35.70	19.45
Laborers, General.....	\$ 35.30	19.45

NOTE: Mason Tender \$1.00 over general laborer.

LAB00464-005 06/03/2024

ADAMS, COLUMBIA, GREEN, JEFFERSON, LAFAYETTE, SAUK, AND WALWORTH COUNTIES

	Rates	Fringes
Laborer, General		
Adams County.....	\$ 35.70	19.45
Remaining Area.....	\$ 36.35	19.45
Laborer: Asbestos/hazardous material remover (Preparation, Removal, Encapsulation of Hazardous Materials from Non-mechanical Systems)		
Adams County.....	\$ 35.30	19.45
Remaining Area.....	\$ 35.30	19.45

LAB00464-008 06/01/2024

	Rates	Fringes
Landscape Laborer.....	\$ 20.59	18.44

LAB01091-001 05/01/2024		

BAYFIELD (West of County Trunk A including the Iron River
National Fish Hatchery and Great Lakes Transmission Co.,
Station 6) COUNTY

	Rates	Fringes
Laborer, General.....	\$ 33.99	23.00
Laborer: Asbestos/hazardous material remover (Preparation, Removal, Encapsulation of Hazardous materials from Non-mechanical Systems).....	\$ 34.99	23.00

LAB01091-002 05/01/2024		

ASHLAND & BAYFIELD (East of County Trunk A exclusive of the
Iron River National Fish Hatchery and Great Lakes Transmission
Co., Station 6) COUNTIES

	Rates	Fringes
Laborer, General.....	\$ 32.54	23.00
Laborer: Asbestos/hazardous material remover (Preparation, Removal, Encapsulation of Hazardous materials from Non-mechanical Systems).....	\$ 33.54	23.00

PLAS0599-003 06/04/2023		

PEPIN COUNTY

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 36.04	25.80
PLASTERER.....	\$ 39.26	23.92

PLAS0599-007 06/04/2023		

BUFFALO, CRAWFORD, JACKSON, JUNEAU, MONROE, POLK, RICHLAND,
TREMPEALEAU, AND VERNON COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 36.04	25.80
PLASTERER.....	\$ 39.26	23.92

PLAS0599-011 06/05/2023		

GRANT, GREEN, IOWA, AND LAFAYETTE COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 42.07	24.59
PLASTERER.....	\$ 39.98	25.81

PLAS0633-046 06/01/2023		

BAYFIELD, PRICE, AND SAWYER COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 45.17	22.13
PLASTERER.....	\$ 38.24	23.23

PLUM0011-009 05/06/2024		

ASHLAND BAYFIELD, BURNETT, IRON, SAWYER, AND WASHBURN COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER (Including HVAC work).....	\$ 49.32	27.18

PLUM0075-006 06/01/2024		

DODGE (Watertown), GREEN, JEFFERSON, AND LAFAYETTE COUNTIES

	Rates	Fringes
PLUMBER (Including HVAC work)....	\$ 57.60	26.90

PLUM0075-008 06/01/2024		

COLUMBIA, IOWA, MARQUETTE, RICHLAND, AND SAUK COUNTIES

Rates	Fringes

PLUMBER (Including HVAC work)....\$ 58.12 26.34

PLUM0118-003 06/24/2024

WALWORTH COUNTY

	Rates	Fringes
PLUMBER/PIPEFITTER (Including HVAC work).....	\$ 54.60	26.12

PLUM0400-002 06/01/2024

ADAMS, CALUMET, DODGE (Except Watertown), DOOR, FOND DU LAC, GREEN LAKE, KEWAUNEE, MANITOWOC, MARINETTE (Except Niagara), MENOMINEE, OCONTO, OUTAGAMIE, SHAWANO, WAUPACA, WAUSHARA, AND WINNEBAGO COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER (Including HVAC work)		
(1) Small buildings (except industrial and power plants) where plumbing or heating is \$50,000 or less.....	\$ 45.86	21.73
(2) All other work.....	\$ 49.00	21.84

PLUM0434-004 06/16/2024

BARRON, BUFFALO, CLARK, CRAWFORD, DUNN, FLORENCE, FOREST, GRANT, JACKSON, JUNEAU, LANGLADE, LINCOLN, MONROE, ONEIDA, PEPIN, PIERCE, POLK, PORTAGE, PRICE, RUSK, TAYLOR, TREMPLEAU, VERNON, VILAS, AND WOOD COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER (Including HVAC work).....	\$ 49.24	24.38

PLUM0601-006 06/03/2024

DODGE (Watertown), GREEN, JEFFERSON, AND LAFAYETTE COUNTIES

Rates	Fringes

PIPEFITTER (Including HVAC work).....	\$ 55.67	31.19

PLUM0601-008 06/03/2024

COLUMBIA, IOWA, MARQUETTE, RICHLAND, AND SAUK COUNTIES

	Rates	Fringes
PIPEFITTER (Including HVAC work).....	\$ 56.88	30.01

SHEE0010-031 05/01/2008

ASHLAND, BAYFIELD AND IRON COUNTIES

	Rates	Fringes
SHEET METAL WORKER.....	\$ 27.53	14.61

SHEE0018-003 06/01/2024

FOND DU LAC AND MANITOWOC COUNTIES

	Rates	Fringes
Sheet Metal Worker (Including HVAC work).....	\$ 40.76	31.62

SHEE0018-004 06/01/2024

ADAMS, DOOR, FLORENCE, FOREST, GREEN LAKE, KEWAUNEE, MARINETTE,
MARQUETTE, MENOMINEE, OCONTO, SHAWANO, WAUPACA, AND WAUSHARA
COUNTIES

	Rates	Fringes
Sheet Metal Worker (Including HVAC work).....	\$ 44.47	29.35

SHEE0018-014 06/01/2024

DODGE AND JEFFERSON COUNTIES

	Rates	Fringes

Sheet Metal Worker (Including

HVAC work).....	\$ 55.58	29.28

* SHEE0018-015 09/01/2024

WALWORTH COUNTY

	Rates	Fringes
SHEET METAL WORKER (Including HVAC work).....	\$ 46.34	37.54

SHEE0018-017 06/01/2024

GREEN COUNTY

	Rates	Fringes
Sheet Metal Worker (Including HVAC work).....	\$ 46.59	36.97

SHEE0018-018 06/01/2024

LANGLADE, LINCOLN, ONEIDA, PORTAGE, AND WOOD COUNTIES

	Rates	Fringes
Sheet Metal Worker (Including HVAC work)		
Contracts \$120,000 or less..	\$ 40.90	33.79
Contracts over \$120,000.....	\$ 40.90	33.79

SHEE0018-022 06/01/2024

BARRON, BUFFALO, BURNETT, CLARK, DUNN, JACKSON, PEPIN, POLK, PRICE, RUSK, SAWYER, TAYLOR, TREMPLEAU, AND WASHBURN COUNTIES

	Rates	Fringes
Sheet Metal Worker (Including HVAC work).....	\$ 40.75	32.22

SHEE0018-023 06/01/2024

COLUMBIA AND SAUK COUNTIES

	Rates	Fringes

Sheet Metal Worker (Including

HVAC work).....	\$ 48.42	33.55

SHEE0018-024 06/01/2024

CRAWFORD, GRANT, JUNEAU, MONROE, RICHLAND, AND VERNON COUNTIES

Rates	Fringes

SHEET METAL WORKER (Including HVAC work).....	\$ 42.84	30.59

TEAM0346-003 05/01/2024

ASHLAND, BAYFIELD, BURNETT, SAWYER & WASHINGTON COUNTIES

Rates	Fringes

TRUCK DRIVER 2 Axle Trucks.....	\$ 34.86	23.03

TEAM0662-002 06/01/2024

ADAMS, BARRON, BUFFALO, CLARK , DOOR, DUNN, JACKSON, JUNEAU,
KEWAUNEE, LANGLADE, LINCOLN, MANITOWOC, MENOMINEE, OCONTO,
ONEIDA, PEPIN, POLK, PORTAGE, PRICE, RUSK, SHAWANO, TAYLOR,
TEMPEALEAU, WAUPACA & WOOD COUNTIES

Rates	Fringes

TRUCK DRIVER 2 Axle Trucks.....	\$ 37.57	27.41
3 or more Axles.....	\$ 37.72	27.41

* SUWI2002-001 01/23/2002

Rates	Fringes

Fence Installers.....	\$ 15.00 **	2.37

GLAZIER.....	\$ 20.21	1.86

Painters:

Brush & Roller (Excluding Drywall Finishing).....	\$ 14.64 **	2.55
Spray.....	\$ 13.72 **	2.25

Power Equipment Operator Backhoe.....	\$ 17.454	7.61

Excavator.....	\$ 17.37	7.45
Front End Loader.....	\$ 23.36	4.61
ROOFER.....	\$ 15.52 **	3.21
TRUCK DRIVER (3-Axle).....	\$ 15.28 **	4.78

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

=====

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.20) or 13658 (\$12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

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

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

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

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

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

Survey Rate Identifiers

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

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

Union Average Rate Identifiers

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

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

State Adopted Rate Identifiers

Classifications listed under the "SA" identifier indicate that the prevailing wage rate set by a state (or local) government was adopted under 29 C.F.R. 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 01/03/2024 reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

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

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

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this

initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

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

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

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

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

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

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

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

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

=====
END OF GENERAL DECISION"

NOTICE TO BIDDERS WAGE RATE DECISION

The wage rate decision of the Department of Labor which has been incorporated in these advertised specifications is incomplete in that the classifications may be omitted from the Department of Labor's decision.

Since the bidder is responsible, independently, for ascertaining area practice with respect to the necessity, or lack of necessity, for the use of these classifications in the prosecution of the work contemplated by this project, no inference may be drawn from the omission of these classifications concerning prevailing area practices relative to their use. Further, this omission will not, per se, be construed as establishing any governmental liability for increased labor cost if it is subsequently determined that such classifications are required.

There may be omissions and/or errors in the federal wage rates. The bidder is responsible for evaluating and determining the correct applicable rate.

If a project includes multiple types of construction (highway, bridge over navigable water, sanitary sewer and water main, building) and there is not a separate wage determination for this type of work included in the proposal, use the wage determination that is in the proposal.

If a project includes multiple types of construction, different wage rate determinations may be inserted into the contract (WI10/Highway = in all WisDOT highway contracts, WI15/Heavy = bridge over navigable water per USDOL and US Coast Guard designation, WI8/Heavy (Sewer & Water Line & Tunnel) = sanitary sewer and water main if the cost is more than 20% of the contract and/or at least \$1,000,000, and Building). If multiple wage rate determinations are inserted into the contract, use the classification in the wage determination for the work being done. Use WI15 wage rates when working on the bridge and/or structure from bank to bank. Use WI8 wage rates when working on any sanitary sewer or water main work. Use Building wage rates for all work done within the footprint of the building. Use WI10 wage rates for all other highway work in the contract and approaches to structures. For example, if a laborer is working within the footprint of a building, use the Laborer rate in the Building wage determination inserted in the contract. If a laborer is working on a bridge/structure within the banks, use the Laborer rate in the WI15/Heavy wage determination if inserted in the contract. If the laborer is working on the highway, use the Laborer rate in the WI10/Highway wage determination.



Proposal Schedule of Items

Page 1 of 3

Proposal ID: 20241112028 Project(s): 1225-10-73

Federal ID(s): WISC 2025022

SECTION: 0001

Contract Items

Alt Set ID:

Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price	Bid Amount
0002	213.0100 Finishing Roadway (project) 01. 1225-10-73	1.000 EACH	_____.	_____.
0004	608.6008 Storm Sewer Pipe Composite 8-Inch	985.000 LF	_____.	_____.
0006	618.0100 Maintenance and Repair of Haul Roads (project) 01. 1225-10-73	1.000 EACH	_____.	_____.
0008	619.1000 Mobilization	1.000 EACH	_____.	_____.
0010	639.0112 Drill Hole in Earth 12-Inch	442.000 LF	_____.	_____.
0012	639.0508 Drill Hole in Rock 8-Inch	548.000 LF	_____.	_____.
0014	639.0512 Drill Hole in Rock 12-Inch	138.000 LF	_____.	_____.
0016	639.1008 Well Casing Pipe 8-Inch	590.000 LF	_____.	_____.
0018	639.1700 Well Screen	40.000 LF	_____.	_____.
0020	639.2100 Grout for Sealing Well Casing	108.000 CF	_____.	_____.
0022	639.4000 Test Pumping	4.000 EACH	_____.	_____.
0024	SPV.0060 Special 01. Rest Area 51 Building, General Construction	1.000 EACH	_____.	_____.
0026	SPV.0060 Special 02. Rest Area 52 Building, General Construction	1.000 EACH	_____.	_____.
0028	SPV.0060 Special 03. Rest Area 51 Building, Plumbing	1.000 EACH	_____.	_____.



Proposal Schedule of Items

Page 2 of 3

Proposal ID: 20241112028 Project(s): 1225-10-73

Federal ID(s): WISC 2025022

SECTION: 0001

Contract Items

Alt Set ID:

Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price	Bid Amount
0030	SPV.0060 Special 04. Rest Area 52 Building, Plumbing	1.000 EACH	_____.	_____.
0032	SPV.0060 Special 05. Rest Area 51 Building, Heating and Ventilation	1.000 EACH	_____.	_____.
0034	SPV.0060 Special 06. Rest Area 52 Building, Heating and Ventilation	1.000 EACH	_____.	_____.
0036	SPV.0060 Special 07. Rest Area 51 Building, Electrical	1.000 EACH	_____.	_____.
0038	SPV.0060 Special 08. Rest Area 52 Building, Electrical	1.000 EACH	_____.	_____.
0040	SPV.0060 Special 09. Rest Area 51 Maintenance Building	1.000 EACH	_____.	_____.
0042	SPV.0060 Special 10. Rest Area 52 Maintenance Building	1.000 EACH	_____.	_____.
0044	SPV.0060 Special 11. Picnic Shelter Large	2.000 EACH	_____.	_____.
0046	SPV.0060 Special 12. Picnic Shelter Small	4.000 EACH	_____.	_____.
0048	SPV.0060 Special 13. Pitless Adaptor	4.000 EACH	_____.	_____.
0050	SPV.0060 Special 14. Well System Controls	2.000 EACH	_____.	_____.
0052	SPV.0060 Special 15. Well Pump	4.000 EACH	_____.	_____.
0054	SPV.0060 Special 16. Construction Staking, Water System	2.000 EACH	_____.	_____.
0056	SPV.0060 Special 24. Construction Staking, Building	4.000 EACH	_____.	_____.



Proposal Schedule of Items

Page 3 of 3

Proposal ID: 20241112028 Project(s): 1225-10-73

Federal ID(s): WISC 2025022

SECTION: 0001

Contract Items

Alt Set ID:

Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price	Bid Amount
0058	SPV.0060 Special 25. Coring Manhole	5.000 EACH	_____.	_____.
0060	SPV.0090 Special 01. Underground Copper Water Line, 3-Inch	711.000 LF	_____.	_____.
0062	SPV.0090 Special 02. Underground Copper Water Line, 1-Inch	436.000 LF	_____.	_____.
0064	SPV.0090 Special 03. Sanitary Sewer PVC, 6-Inch	95.000 LF	_____.	_____.
0066	SPV.0090 Special 04. Sanitary Sewer PVC, 8-Inch	102.000 LF	_____.	_____.
0068	SPV.0090 Special 05. Construction Staking, Sanitary Sewer System	197.000 LF	_____.	_____.
Section: 0001			Total:	_____.
			Total Bid:	_____.

PLEASE ATTACH ADDENDA HERE



Wisconsin Department of Transportation

October 28, 2024

**Division of Transportation Systems
Development**

Bureau of Project Development
4822 Madison Yards Way, 4th Floor South
Madison, WI 53705

Telephone: (608) 266-1631

Facsimile (FAX): (608) 266-8459

NOTICE TO ALL CONTRACTORS:

ASP-6 Addendum #01

Letting of November 12, 2024

Attached is a copy of the revised ASP-6. This ASP-6 replaces ASP-6 in all proposals in the November 12, 2024 Letting.

The responsibility for notifying potential subcontractors and suppliers of these changes remains with the prime contractors.

Sincerely,

Mike Coleman

Proposal Development Specialist
Proposal Management Section

END OF ADDENDUM

Additional Special Provision 6 (ASP-6)

Modifications to the standard specifications

Make the following revisions to the standard specifications.

107 Legal Relations and Responsibility to the Public

Add subsection 107.27 effective with the November 2024 letting.

107.27 Drones or Unmanned Aircraft Systems (UAS)

107.27.1 Licensing and Compliance

- (1) Obtain and possess the necessary Federal Aviation Administration (FAA) licenses and certifications to operate drones commercially (<https://www.faa.gov/uas>).
- (2) Comply with all FAA regulations, airspace restrictions, and local laws. Operators of small drones that are less than 55 pounds for work or business must follow all requirements as listed in Title 14, Chapter 1, Subchapter F, Part 107 of the Code of Federal Regulations (14 CFR) and obtain a remote pilot certificate (https://www.faa.gov/uas/commercial_operators).
- (3) Comply with Wisconsin State Statute 942.10. Limit operations to the specific approved purpose and employ reasonable precautions to avoid capturing images of the public except those that are incidental to the project.
- (4) Provide copies of waivers required for specific project conditions to the engineer prior to any flight.

107.27.2 Flight Approval, Safety, and Incident Reporting

- (1) Submit information in 107.27.2(2) to obtain written drone flight approval from the engineer at least 3 business days prior to operating a drone within the right-of-way. Do not operate a drone within the right-of-way unless approved by the engineer.
- (2) Drone flight application for review and approval must include:
 - UAS pilot information and qualifications, images of certification
 - UAS drone information and FAA tail numbers
 - Max/ Min allowable flight parameters (weather)
 - Specifics of flight mission: capture scope
 - Estimated flight duration
 - Pre-flight checklist
 - Site-specific parameters
 - Notification protocols - Federal/Local/Agency/Owner/Responsible in Charge
 - Confirmation and verification of approved operators and hardware
 - Flight plan map diagram (including launch and landing location)
 - FAA-Airspace flight map classification and confirmation with graphics
 - UAS incident management protocol
- (3) If contractor is requesting multiple types of the same flight, a simplified request can be submitted listing weekly flight plan.
- (4) Safety measures must include but are not limited to:
 - Regular training and updates on drone regulations are required and must be provided upon request.
 - Drones must be operated in accordance with safety guidelines, including maintaining a safe distance from people, structures, vehicles, etc.
 - Conduct a pre-flight safety assessment, considering weather conditions, airspace restrictions, and potential hazards.
 - Emergency procedures (e.g., drone malfunction, loss of control) must be documented and followed.
 - All incidents must be reported to the engineer.
- (5) If the drone has an incident during flight, report the following to the engineer:
 - Incident background and details.
 - FAA (14 CFR 107.9) and NTSB (49 CFR 870) notification protocol.
 - Contractor internal notification protocol.

107.27.3 Insurance Requirements

- (1) Maintain drone liability insurance with the following limits.
 1. For drones weighing 10 pounds or less, a liability policy with a minimum limit of \$1,000,000.00 is required.

2. For drones weighing more than 10 pounds and less than or equal to 20 pounds, a liability policy with a minimum limit of \$2,000,000.00 is required.
3. For drones weighing more than 20 pounds, notify engineer and department will determine appropriate liability policy coverage levels based on size, use, location, and other risk factors.

646 Pavement Markings

646.3.2.4 Black Epoxy

Replace paragraph (1) with the following effective with the November 2024 letting.

- (1) Apply black epoxy in a grooved slot directly after the white marking. Apply epoxy at a wet mil thickness of 20. Apply black aggregate at or exceeding 25 pounds per gallon of epoxy. Do not apply glass beads to black epoxy.

ERRATA

204.3.1.3 Salvaging or Disposal of Materials

Replace paragraph (2) to correct link from 203.3.4 to 203.3.5 effective with the November 2024 letting.

- (2) Dispose of concrete, stone, brick, and other material not designated for salvage as specified for disposing of materials under 203.3.5.

204.3.2.3 Removing Buildings

Replace paragraph (2) to correct link from 203.3.4 to 203.3.5 effective with the November 2024 letting.

- (2) Buildings removed and materials resulting from building removal become the contractor's property unless the contract specifies otherwise. Dispose of unclaimed and removed material as specified for disposing of materials in 203.3.5.

335.3.2 Rubblizing

Replace paragraph (6) to correct link from 203.3.4 to 203.3.5 effective with the November 2024 letting.

- (6) Remove reinforcing steel exposed at the surface by cutting below the surface and disposing of the steel as specified in 203.3.5. Do not remove unexposed reinforcing steel.

335.3.3 Compacting

Replace paragraph (2) to correct link from 203.3.4 to 203.3.5 effective with the November 2024 letting.

- (2) Remove loose asphaltic patching material, joint fillers, expansion material, or other similar materials from the compacted surface. Also remove pavement or patches that have a maximum dimension greater than or equal to 6 inches that are either not well seated or projecting more than one inch. Dispose of removed material as specified in 203.3.5.

526.3.4 Construction, Backfilling, Inspection and Maintenance

Replace paragraph (3) to correct link from 203.3.4 to 203.3.5 effective with the November 2024 letting.

- (3) Maintain temporary structures and approaches in place until no longer needed. Unless the engineer directs otherwise, completely remove and dispose of as specified in 203.3.5. Contractor-furnished materials remain the contractor's property upon removal.

602.3.6 Concrete Rumble Strips

Replace paragraph (5) to correct link from 203.3.4 to 203.3.5 effective with the November 2024 letting.

- (5) At the end of each workday, move equipment and material out of the clear zone and sweep or vacuum the traveled way pavement and shoulder areas. Sweep away or vacuum up milling debris before opening adjacent lanes to traffic. Dispose of waste material as specified in 203.3.5; do not place on the finished shoulder surface.

604.2 Materials

Replace paragraph (1) with the following information to remove line and link for crushed aggregate effective with the November 2024 letting. The crushed aggregate gradation information for slope paving is now found in 604.2(3).

- (1) Furnish materials conforming to the following:

Water.....	501.2
Select crushed material.....	312.2
Concrete.....	501
Reinforcement.....	505
Expansion joint filler.....	415.2.3
Asphaltic materials	455.2



Wisconsin Department of Transportation

October 31, 2024

Division of Transportation Systems Development

Bureau of Project Development
4822 Madison Yards Way, 4th Floor South
Madison, WI 53705

Telephone: (608) 266-1631
Facsimile (FAX): (608) 266-8459

NOTICE TO ALL CONTRACTORS:

Proposal #28: 1225-10-73, WISC 2025022
Manitowoc - Green Bay
SRA 51 Maribel/SRA 52 Denmark
IH 43
Manitowoc County

Letting of November 12, 2024

This is Addendum No. 01, which provides for the following:

Special Provisions:

Revised Special Provisions	
Article No.	Description
19	Rest Area 51 Building, General Construction, Item SPV.0060.01; Rest Area 52 Building, General Construction, Item SPV.0060.02; Rest Area 51 Building, Plumbing, Item SPV.0060.03; Rest Area 52 Building, Plumbing, Item SPV.0060.04; Rest Area 51 Building, Heating and Ventilation, Item SPV.0060.05; Rest Area 52 Building, Heating and Ventilation, Item SPV.0060.06; Rest Area 51 Building, Electrical, Item SPV.0060.07; Rest Area 52 Building, Electrical, Item SPV.0060.08; Rest Area 51 Maintenance Building, Item SPV.0060.09; Rest Area 52 Maintenance Building, Item SPV.0060.10

Plan Sheets:

Revised Plan Sheets	
Plan Sheet	Plan Sheet Title (brief description of changes to sheet)
161	GROUND LEVEL LIGHTING PLAN - AREA A
162	GROUND LEVEL LIGHTING PLAN - AREA B

The responsibility for notifying potential subcontractors and suppliers of these changes remains with the prime contractor.

Sincerely,

Mike Coleman

Proposal Development Specialist
Proposal Management Section

ADDENDUM NO. 01

1225-10-73

October 31, 2024

Special Provisions

19. Rest Area 51 Building, General Construction, Item SPV.0060.01; Rest Area 52 Building, General Construction, Item SPV.0060.02; Rest Area 51 Building, Plumbing, Item SPV.0060.03; Rest Area 52 Building, Plumbing, Item SPV.0060.04; Rest Area 51 Building, Heating and Ventilation, Item SPV.0060.05; Rest Area 52 Building, Heating and Ventilation, Item SPV.0060.06; Rest Area 51 Building, Electrical, Item SPV.0060.07; Rest Area 52 Building, Electrical, Item SPV.0060.08; Rest Area 51 Maintenance Building, Item SPV.0060.09; Rest Area 52 Maintenance Building, Item SPV.0060.10.

Replace paragraph B.2 under Part 1.3 WORK COVERED BY CONTRACT DOCUMENTS under section titled Section 01 10 00 with the following:

2. All site demolition, roadwork, site utility work, earthwork, grading, landscaping, stormwater management, and other civil work shall be performed under a separate contract (WisDOT project number 1225-10-72.) Owner shall coordinate schedules of the Contracts. Contractors shall fully cooperate with each other to maintain project schedule and budget, including coordination of site access and maintenance during construction.

Add the following under subsection titled 2.3 TOILET ACCESSORIES under section titled Section 10 28 13 TOILET ACCESSORIES:

K. Adult Changing Tables

1. TA11:

- a. Model KB3000-AHL as manufactured by Koala Kare Products, a Division of Bobrick; or equal.
- b. Powered-Height Adjustability: Changing surface shall electronically adjust from 12" (300mm) to 41" (1,041mm) from floor.
- c. Unit shall have two sets of built-in electronic controls for height adjustment. One located on face of wall cover and one on the front of changing surface.
- d. Weight Capacity: Tested to support up to 500 lbs. (227 kg.) static load.
- e. Changing Surface shall be polyethylene and meet IK10 standard for resistance to high impact and sharp objects.
- f. Back-Up Battery: Unit shall have a built-in backup battery system that allows for continuous operation in the event of a power interruption.
- g. Emergency Stop: Unit shall include a wall-mounted emergency stop to break power to actuator.
- h. Changing Surface shall be a minimum 75 ¼" (1,911mm) long, and 31 ½" (800mm) wide, and can be opened and closed with one-hand.
- i. Unit shall have a safety rail with a curved dip in the center for easier patient changing by caregiver. Safety rail rotates and locks under changing bed when in closed position.

j. Unit shall withstand significant exposure to water without damage to electrical components. It shall include a grounded power cord and have a splash-proof control system. Electrical components and wiring shall not come in contact with station users or caregivers.

Plan Sheets

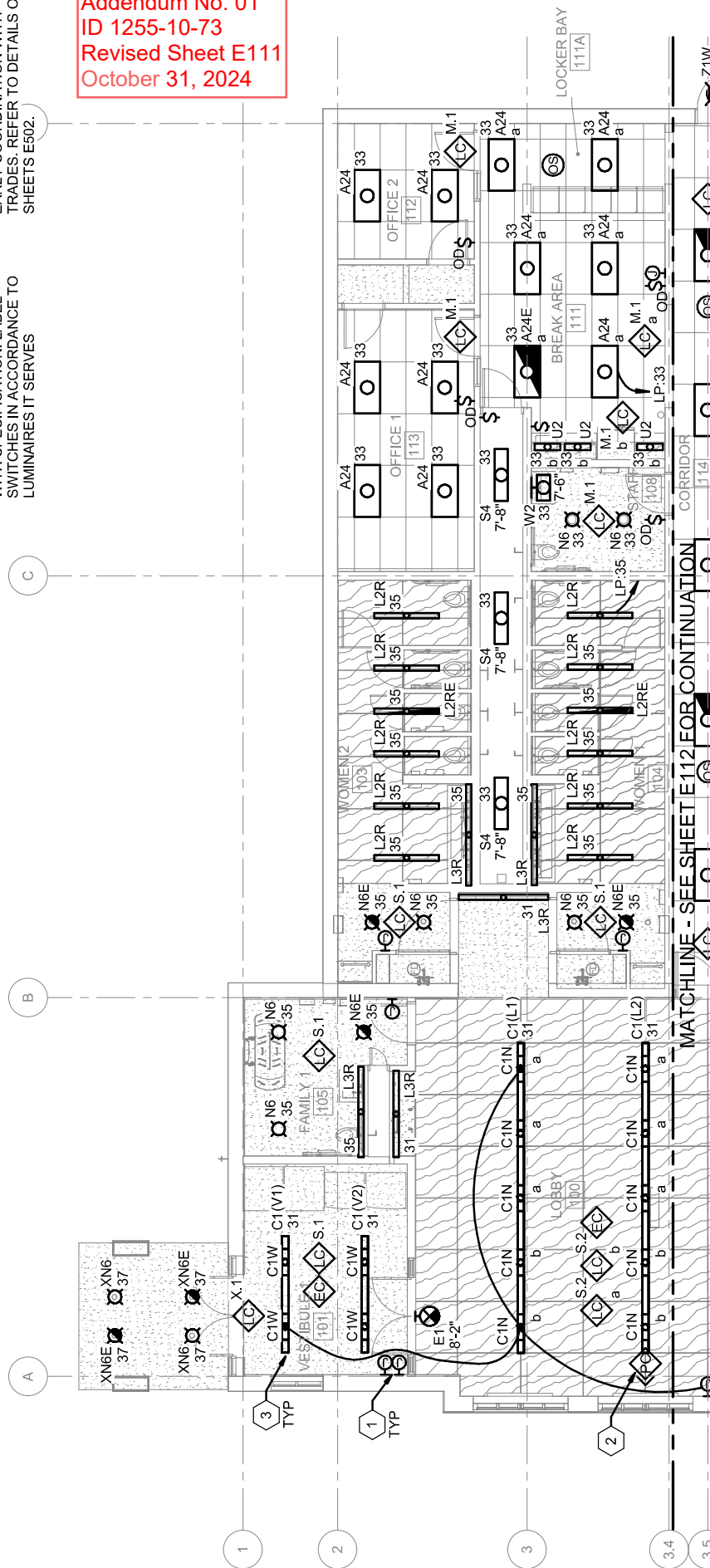
The following 8½ x 11-inch sheets are attached and made part of the plans for this proposal:
Revised: 161, 162

END OF ADDENDUM

KEYNOTES

1. J-BOX ON LIGHTING PLANS
DENOTE WALL MOUNTED
REMOTE EMERGENCY TEST
SWITCH LOCATIONS.
COORDINATE IN CONCEALED
LOCATION WITH ALL OTHER
TRADES. COORDINATE FINISHES
WITH SPECIFICATION. LABEL
SWITCHES IN ACCORDANCE TO
LUMINAIRE IT SERVES
2. COORDINATE PHOTOCELL
SENSOR LOCATION IN CHANNEL
'C1' WITH MANUFACTURER.
3. LUMINAIRE TYPES 'C1' HAVE
BUILDING SYSTEM
INTEGRATION AND REQUIRE
EARLY COORDINATION WITH
TRADES. REFER TO DETAILS ON
SHEETS E502.)

Addendum No. 01
ID 1255-10-73
Revised Sheet E111
October 31, 2024





Wisconsin Department of Transportation

November 7, 2024

Division of Transportation Systems Development

Bureau of Project Development
4822 Madison Yards Way, 4th Floor South
Madison, WI 53705

Telephone: (608) 266-1631
Facsimile (FAX): (608) 266-8459

NOTICE TO ALL CONTRACTORS:

Proposal #28: 1225-10-73, WISC 2025022
Manitowoc - Green Bay
SRA 51 Maribel/SRA 52 Denmark
IH 43
Manitowoc County

Letting of November 12, 2024

This is Addendum No.02, which provides for the following:

Special Provisions:

Revised Special Provisions	
Article No.	Description
19	Rest Area 51 Building, General Construction, Item SPV.0060.01; Rest Area 52 Building, General Construction, Item SPV.0060.02; Rest Area 51 Building, Plumbing, Item SPV.0060.03; Rest Area 52 Building, Plumbing, Item SPV.0060.04; Rest Area 51 Building, Heating and Ventilation, Item SPV.0060.05; Rest Area 52 Building, Heating and Ventilation, Item SPV.0060.06; Rest Area 51 Building, Electrical, Item SPV.0060.07; Rest Area 52 Building, Electrical, Item SPV.0060.08; Rest Area 51 Maintenance Building, Item SPV.0060.09; Rest Area 52 Maintenance Building, Item SPV.0060.10
27	Underground Copper Water Line, 3-Inch, Item SPV.0090.01; Underground Copper Water Line, 1-Inch, Item SPV.0090.02.
28	Sanitary Sewer PVC, 6-Inch, Item SPV.0090.03; Sanitary Sewer PVC, 8-Inch, Item SPV.0090.04.

Plan Sheets:

Revised Plan Sheets	
Plan Sheet	Plan Sheet Title (brief description of changes to sheet)
58	INTERIOR ELEVATIONS
61	INTERIOR ELEVATIONS
100	INTERIOR FINISH LEGEND AND NOTES
109	MAINTENANCE BUILDING
134	HVAC SCHEDULES

The responsibility for notifying potential subcontractors and suppliers of these changes remains with the prime contractor.

Sincerely,

Mike Coleman

Proposal Development Specialist
Proposal Management Section

ADDENDUM NO. 02

1225-10-73

November 7, 2024

Special Provisions

- 19. Rest Area 51 Building, General Construction, Item SPV.0060.01; Rest Area 52 Building, General Construction, Item SPV.0060.02; Rest Area 51 Building, Plumbing, Item SPV.0060.03; Rest Area 52 Building, Plumbing, Item SPV.0060.04; Rest Area 51 Building, Heating and Ventilation, Item SPV.0060.05; Rest Area 52 Building, Heating and Ventilation, Item SPV.0060.06; Rest Area 51 Building, Electrical, Item SPV.0060.07; Rest Area 52 Building, Electrical, Item SPV.0060.08; Rest Area 51 Maintenance Building, Item SPV.0060.09; Rest Area 52 Maintenance Building, Item SPV.0060.10**

Add the following section:

SECTION 09 68 13

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Carpet Tile in accordance with provisions of the Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 - 1. ASTM D1335 Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.
 - 2. ASTM D3936 Standard Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering.
 - 3. ASTM D5116 Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
 - 4. ASTM D5417 Standard Practice for Operation of the Vettermann Drum Tester.
 - 5. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 - 6. ASTM E662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
 - 2. NFPA 258 Recommended Practice for Determining Smoke Generation of Solid Materials.
- C. American National Standards Institute (ANSI):
 - 1. ISO 14040 Environmental Management - Life Cycle Assessment - Principles And Framework.
 - 2. ISO 14044 Environmental Management - Life Cycle Assessment - Requirements And Guidelines.
- D. Carpet and Rug Institute (CRI):
 - 1. CRI TM101 Assessment of Carpet Surface Appearance Change.
 - 2. CRI TM102 Fluorochemical Finishes.
 - 3. CRI-104 Standard for Installation of Commercial Carpet.
 - 4. CRI Green Label program.
 - 5. CRI Green Label Plus program.
- E. Consumer Product Safety Commission (CPSC):
 - 1. 16 CFR Part 1630 - Standard for the Surface Flammability of Carpets and Rugs (FF-1-70).

- F. American Association of Textile Chemists and Colorists (AATCC):
 - 1. AATCC TM16.3 Colorfastness to Light: Xenon-Arc.
 - 2. AATCC TM20 Fiber Analysis – Qualitative.
 - 3. AATCC TM129 Colorfastness to Light: Xenon-Arc.
 - 4. AATCC TM134 Electrostatic Propensity of Carpets.
 - 5. AATCC TM164 Colorfastness to Oxides of Nitrogen in the Atmosphere Under High Humidities.
 - 6. AATCC TM171 Carpets: Cleaning of, Hot Water Extraction.
 - 7. AATCC TM189 Fluorine Content of Carpet Fibers.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Samples:
 - 1. Three samples 12 inches 300 mm square of each material and color specified in Drawing Finish Schedule.
- C. Contract Closeout Information:
 - 1. Maintenance data:
 - a. See Section 01 78 23.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Carpet manufacturer shall have no less than ten years of production experience with carpet similar to type specified in this document; and whose published product literature clearly indicates compliance of products with requirements of this section.
- B. Contractor Qualifications:
 - 1. Firm with not less than five years of successful carpeting experience similar to work of this section and recommended and approved by the carpet manufacturer. Upon request, submit letter from carpet manufacturer stating certification qualifications and acceptance.
- C. Installer Qualifications:
 - 1. Mill-trained skilled mechanics supervised by experienced superintendent with 50,000 yards experience.
- D. Single Source Responsibility:
 - 1. Provide product material by a single manufacturer for each carpet type specified.
- E. Fire and Smoke Compliance:
 - 1. Comply with 16 CFR Part 1630 - Standard for the Surface Flammability of Carpets and Rugs (FF-1-70)
 - 2. Critical Radiant Flux, per ASTM E648 and NFPA 253:
 - a. Class I, not less than 0.45 W/cm².
 - 3. Smoke Developed:
 - a. 450 or less per ASTM E662 / NFPA 258.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Carpet Tile:
 - 1. Base:
 - a. As specified in Drawing Finish Schedule.
- B. Carpet Edging Strips:
 - 1. Base:
 - a. BurkeMercer.
- C. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Carpet Tile:
 - 1. First quality, no seconds or imperfections.
 - 2. Deliver with mill register numbers attached.
 - 3. Comply with applicable state and local codes.
- B. Carpet Edging Strips:
 - 1. Base Product: Carpet to Resilient Transition 170 by BurkeMercer.

2. Thickness to match carpet.
3. Color as selected by Architect.
- C. Leveling Compound:
 1. Non-crumbling, non-staining, cementitious type.
 2. Install in thickness from 1/8 inch to 1-1/2 inches.
 3. Compressive strength 5,000 pounds at 28 days.
 4. Prepare surface with manufacturer recommended primer.
 5. K 15 by Ardex or Ultraplan 1 Plus by Mapei.
- D. Patching Compound:
 1. Fill cracks, joints, holes, or uneven areas with polymer modified cement-based compound.
 2. Install from featheredge to 1 inch thick.
 3. Feather Finish by Ardex or Planiprep SC by Mapei.
- E. Adhesive:
 1. Non-staining, non-bleeding, strippable type.
 2. As recommended by carpet manufacturer with VOC content no greater than 50 g/L.
 3. Allow removal of carpet without damage or adherence to carpet.
- F. Carpet Types:
 1. See material and color specified in Interior Finish Schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify concrete floor surfaces are suitable for Carpet Tile installation.

3.2 PREPARATION

- A. Clean areas to receive carpet tile.
 1. Strip waxes and finishes.
 2. Vacuum and wet mop.
- B. Layout:
 1. Arrange joints symmetrically at centerline of rooms.
 2. Lay and match adjacent tiles for pile and pattern directions.

3.3 INSTALLATION

- A. Install carpet patterns in accordance with layouts indicated in Drawings.
 1. Develop templates as required.
- B. Comply with manufacturer's instructions and recommendations for seam locations and lay of carpet pile.
 1. Do not mix dye lots in same area.
 2. Install carpet under open bottom items, removable flanges, furnishings, alcoves, and closets.
 3. Install tight against walls, columns, cabinets, and over recessed door closers.
 4. Butt edges tight without distortion.
 5. Where carpet tiles abut deeper finish flooring materials, feather leveling compound for approximately 12 inches 25 mm for each 1/8 inches 3 mm of rise so finished surfaces align.
 6. Fill or level floors at uneven areas with leveling compound and feather minimum 4 feet 1.2 m.
 7. Expansion joints:
 - a. Do not bridge building expansion joints with continuous carpeting.
 - b. Provide for movement.
- C. Install carpet edging strips, transition strips and reducer strips at non-carpeted floor surface.
 1. Conceal cut edges with protective edge guards or overlapping flanges.
 2. Score and trim narrow end of reducer strip to conform to adjacent floor finish.

3.4 CLEAN

- A. Remove spots and adhesive from face or seams in accordance with manufacturer recommendations.
- B. Vacuum using pile lifter.
- C. Advise Owner regarding care and maintenance.

END OF SECTION

27. Underground Copper Water Line, 3-Inch, Item SPV.0090.01; Underground Copper Water Line, 1-Inch, Item SPV.0090.02.

*Replace paragraph two under section titled **C Construction** with the following:*

Backfill the copper waterline according to standard spec 608.3.5 except as hereinafter modified. Lay the waterline in a 12-inch envelope of sand backfill, backfill the remainder of the trench with the native excavated material.

28. Sanitary Sewer PVC, 6-Inch, Item SPV.0090.03; Sanitary Sewer PVC, 8-Inch, Item SPV.0090.04.

*Add the following to section titled **B Materials**:*

B.4 Trench Backfill

Furnish trench backfill material conforming to 209.2 or 520.2.5.2.

In C Construction delete "Prior to backfilling, test each section of sewer according to standard spec 607.3.5 and compact to the density of the surrounding undisturbed soils." Replace with: "Backfill trenches according to standard spec 608.3.5."

Plan Sheets

The following 8½ x 11-inch sheets are attached and made part of the plans for this proposal:
Revised: 58, 61, 100, 109, 134

END OF ADDENDUM

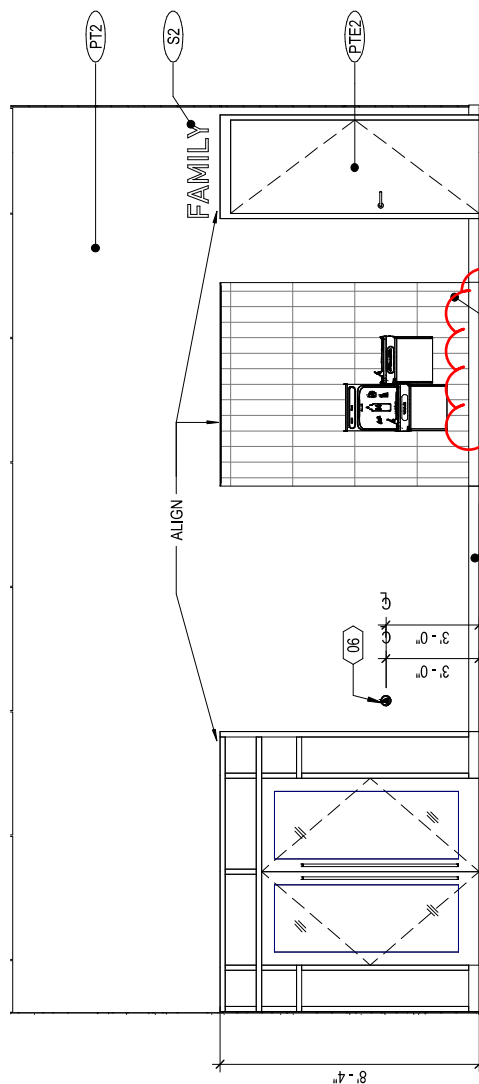
SHEET KEYNOTES

06	AUTOMATIC DOOR OPERATOR BUTTON
PT2	PANT 2
PT2Z	EPOXY PAINT 2
S1	DIMENSIONAL LETTERING, OPAQUE WHITE
S2	DIMENSIONAL LETTERING, OPAQUE BLACK
T1	FILED TILE - WHITE
T3	ACCENT TILE
TER1B	
WDP1	WOOD WALL PANEL

GENERAL NOTES

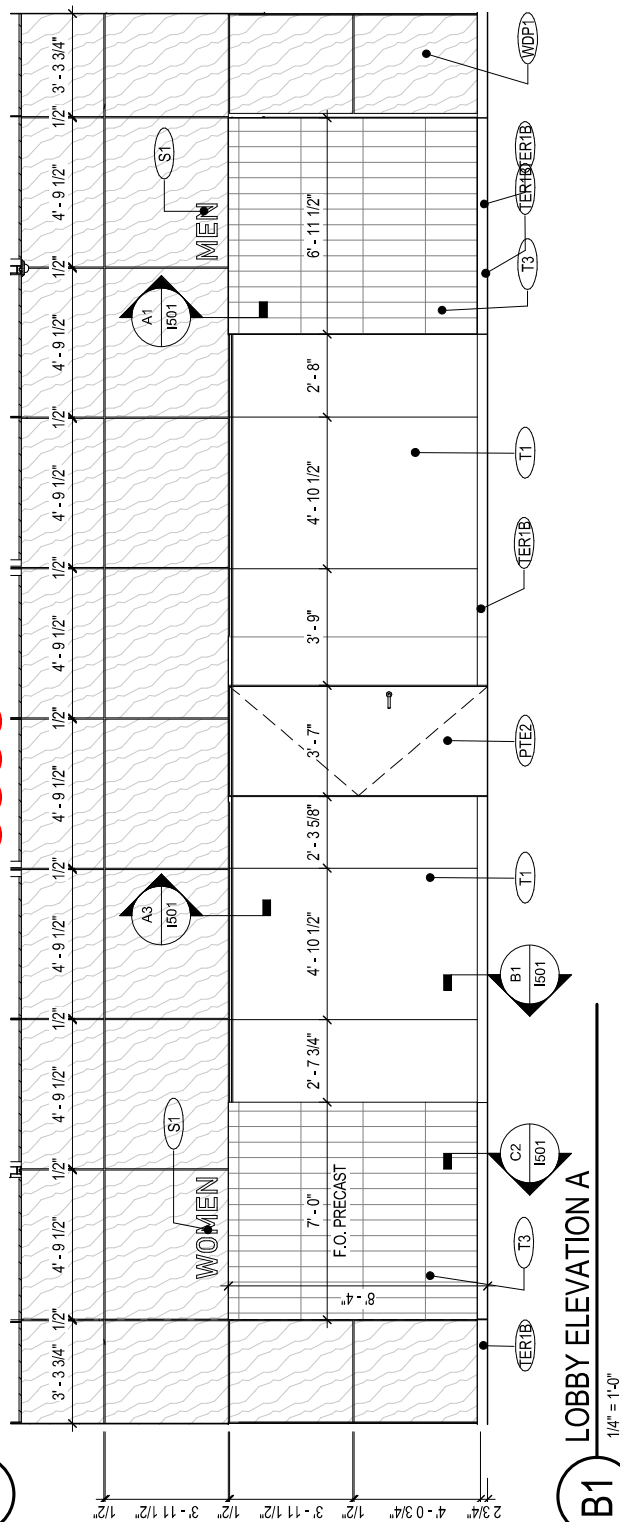
1. SEE SHEET A001 FOR SYMBOLS AND TAGS.
2. SEE SHEETS I001 AND I002 FOR DESCRIPTIONS OF INTERIOR FINISHES.
3. SEE I501 FOR DETAILS OF TRANSITIONS BETWEEN INTERIOR MATERIALS.

Addendum No. 02
ID 1225-10-73
Revised Sheet 58
November 7, 2024



LOBBY ELEVATION B

1/4" = 1'-0"



LOBBY ELEVATION A

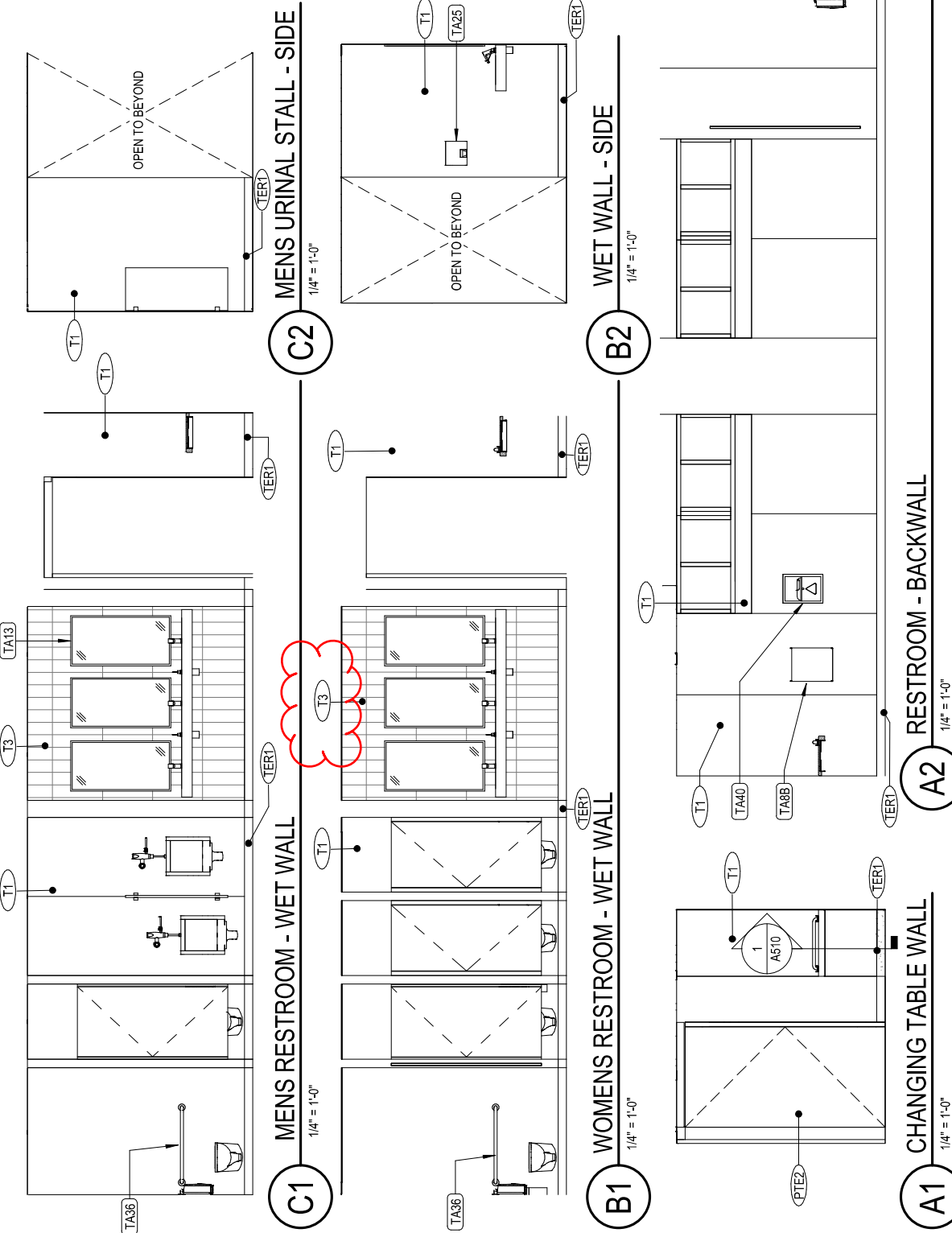
$$1/4'' = 1'-0''$$

PTE2	EPOXY PAINT 2
T1	FILED TILE - WHITE
T3	ACCENT TILE
TER1	TERRAZZO 1, POURED IN PLACE

GENERAL NOTES

1. SEE SHEET A001 FOR SYMBOLS AND TAGS.
2. SEE SHEETS I001 AND I002 FOR DESCRIPTIONS OF INTERIOR FINISHES.
3. SEE I501 FOR DETAILS OF TRANSITIONS BETWEEN INTERIOR MATERIALS.

Addendum No. 02
ID 1225-10-73
Revised Sheet 61
November 7, 2024



INTERIOR FINISH SCHEDULE					2
Code	Manufacturer	Series/ Style	Color	Size	Comments
T1	LAMINAM	LARGE FORMAT PORCELAIN TILE, CALCE COLLECTION	BIANCO	63.7" x 127.5" (3MM THICK)	PROVIDE SHOP DRAWINGS OF PANEL LAYOUTS; EPOXY GROUT: MAPEI, 14 BISCUIT
T2	LAMINAM	LARGE FORMAT PORCELAIN TILE, CALCE COLLECTION	TERRACOTTA	63.7" x 127.5" (3MM THICK)	PROVIDE SHOP DRAWINGS OF PANEL LAYOUTS; EPOXY GROUT: MAPEI, 107 IRON
T3	CROSSVILLE	COLOR BLOX 2.0	BLUE SUEDE SHOES	6" X 24"	ACCENT WALL TILE. EPOXY GROUT: MAPEI, 19 PEARL GRAY
TT1	SCHLUTER	COVE-SHAPED PROFILE, DILEX	STAINLESS STEEL	AS NEEDED PER DRAWINGS	-
TT2	SCHLUTER	FINEC TILE TRIM	STAINLESS STEEL	-	ALL EXPOSED TILE EDGES AND OUTSIDE CORNERS
ACT1	ARMSTRONG	#3257 OPTIMA, TEGULAR EDGE, 9/16" GRID	WHITE	24" X 48" X 3/4" THICK	-
RB1	MANINGTON	BURKE COLLECTION, RUBBER WALL BASE	MOONBEAM 050	4"H ROLL GOODS	STRAIGHT AT CARPET, COVED AT SEALED CONCRETE
TER1 B1	TERRAZZO & MARBLE SUPPLY COMPANIES	APPLIED TERRAZZO WALL BASE	MATCH TER1	4"H	-
TER1 B2	TERRAZZO & MARBLE SUPPLY COMPANIES	INTEGRAL TERRAZZO WALL BASE	MATCH TER1	4"H	-
TER1	TERRAZZO & MARBLE SUPPLY COMPANIES	THIN-SET POURED EPOXY TERRAZZO, TERROXY	TM#23-2537	-	-
TER2	TERRAZZO & MARBLE SUPPLY COMPANIES	THIN-SET POURED EPOXY TERRAZZO, TERROXY	TM- #23-2225	-	ACCENT TERRAZZO
CES1	SEE SPECIFICATION				
CPT1	J+J FLOORING	KINETEX STRATA 1826	1848 FELDSPAR	18" X 36"	PATTERN: ASHLAR
WDP1	PARKLEX PRODEMA	INTERIOR PANELING, WALLS	AMERICAN WALNUT	48" X 96" (12MM THICK)	LOBBY, MEN'S, AND WOMEN'S CEILING PANELS
PT1	SHERWIN WILLIAMS	LATEX, FLAT	SW7007 CEILING BRIGHT WHITE	-	ALL GYP CEILINGS, U.N.O.
PT2	SHERWIN WILLIAMS	LATEX, EGGSHELL	SW9166 DRIFT OF MIST	-	GYP WALLS IN OFFICES AND BREAKROOM
PT1	SHERWIN WILLIAMS	EPOXY PAINT, SEMI-GLOSS	SW9166 DRIFT OF MIST	-	WALLS

Addendum No. 02
ID 1225-10-73
Revised Sheet 100
November 7, 2024

PLAN KEYNOTES

6. WALLS ARE WOOD-FRAMED CONVENTIONAL CONSTRUCTION; 2 X @ 16" W/ SILL (5/8" DIA X 6" LONG) J TYPE @ 4'-0" AND DOUBLE TOP PLATE, AND DOUBLE 2 X 10 UNTELS W/ (2) JACK-STUDS.
7. PLACE 3/8" THICK EXPANSION MATERIAL BETWEEN ALL WALLS AND SLABS. CAULK TOP OF JOINT.
8. PROVIDE FLOOR SLOPING AS SHOWN ON ARCHITECTURAL.
9. ROOF SYSTEM IS STRUCTURAL INSULATED PANEL (SIP), PROPRIETARY.

3. PROVIDE SIM TO DETAIL A1/S303.

4. WOOD COLUMN 6 X 6 TYPICAL 4 LOCATIONS. CONNECT W/ SHIPSON-BURZOR EQUIV.
5. PROVIDE 6" CONCRETE SLAB W/ #4 @ 12" EA WAY, CTDR.
6. 12" PLX WOOD JOISTS W/ 3" D. STEEL BEAMS.
7. LVL 3-1/2" X 9-1/4", SINGLE BEVEL.
8. LVL 3-1/2" X 9-1/4", DOUBLE BEVEL, TYP 4 LOCATIONS.
9. LVL 3-1/2" X 14" SINGLE BEVEL, TYP 2 LOCATIONS. DOUBLE JACK-STD BEARING.



Addendum No. 02
ID 1225-10-73
Revised Sheet 109
November 7, 2024

ENERGY RECOVERY UNITS

- ## GROUND SOURCE HEAT PUMPS

- ## GEO THERMAL WELLFIELD PUMPS

- **HEATING:** ON A CALL FOR HEATING THE HEAT PUMP SHALL OPERATE TO MAINTAIN A SUPPLY WATER TEMPERATURE OF 92°F. AT EACH ZONE, THE THREE-WAY VALVE SHALL MODULATE TO MAINTAIN A SPACE TEMPERATURE SETPOINT OF 70°F (ADJUSTABLE). ON A CALL FOR HEATING, THE PRIMARY AND SECONDARY RECIRCULATION PUMPS SHALL ENERGIZE AND OPERATE AT CONSTANT SPEED.
- **NEVER EXCEED 87°F.** IF THE SLAB TEMPERATURE EXCEEDS 87°, THE THREE-WAY VALVE SHALL MODULATE TO LOWER THE SUPPLY WATER TEMPERATURE IN THAT ZONE.

AIR SEPARATOR SCHEDULE

NOTES:

1. PROVIDE WITH AUTOMATIC AIR VENT.
2. PROVIDE A REMOVEABLE HEAD FOR CLEANING.

CHEMICAL AND GLYCOL FEEDER SCHEDULE

NOTES:

1. PRESSURE RANGE SETTINGS: 10-45 PSI CUT-IN, 20-50 PSI CUT-OUT, 10-30 PSI PRESSURE DIFFERENTIAL.
2. 8 FT 16 GA 115VAC POWER CORD ELECTRICAL CONNECTION, LOW LEVEL SWITCH, SUCTION STRAINER, DRAIN VALVE, CHECK VALVE, PRESSURE SWITCH, GAUGE, RELIEF VALVE AND ISOLATION VALVE.
3. PROVIDE FLOOR MOUNTING SUPPORT LEGS:

Addendum No. 02
ID 1225-10-73
Revised Sheet 134
November 7, 2024



Wisconsin Department of Transportation

November 11, 2024

Division of Transportation Systems Development

Bureau of Project Development
4822 Madison Yards Way, 4th Floor South
Madison, WI 53705

Telephone: (608) 266-1631
Facsimile (FAX): (608) 266-8459

NOTICE TO ALL CONTRACTORS:

Proposal #28: 1225-10-73, WISC 2025022
Manitowoc - Green Bay
SRA 51 Maribel/SRA 52 Denmark
IH 43
Manitowoc County

Letting of November 12, 2024

This is Addendum No.03, which provides for the following:

Special Provisions:

Revised Special Provisions	
Article No.	Description
19	Rest Area 51 Building, General Construction, Item SPV.0060.01; Rest Area 52 Building, General Construction, Item SPV.0060.02; Rest Area 51 Building, Plumbing, Item SPV.0060.03; Rest Area 52 Building, Plumbing, Item SPV.0060.04; Rest Area 51 Building, Heating and Ventilation, Item SPV.0060.05; Rest Area 52 Building, Heating and Ventilation, Item SPV.0060.06; Rest Area 51 Building, Electrical, Item SPV.0060.07; Rest Area 52 Building, Electrical, Item SPV.0060.08; Rest Area 51 Maintenance Building, Item SPV.0060.09; Rest Area 52 Maintenance Building, Item SPV.0060.10

Plan Sheets:

Revised Plan Sheets	
Plan Sheet	Plan Sheet Title (brief description of changes to sheet)
86	DETAILS - EXTERIOR
100	INTERIOR FINISH LEGEND AND NOTES
102	INTERIOR FINISH PLAN
107	ROOF FRAMING PLAN
150	PLUMBING SCHEDULES

Added Plan Sheets	
Plan Sheet	Plan Sheet Title (brief description of why sheet was added)
134A	HVAC SCHEDULES M604

The responsibility for notifying potential subcontractors and suppliers of these changes remains with the prime contractor.

Sincerely,

Mike Coleman

Proposal Development Specialist
Proposal Management Section

ADDENDUM NO. 03

1225-10-73

November 11, 2024

Special Provisions

- 19. Rest Area 51 Building, General Construction, Item SPV.0060.01; Rest Area 52 Building, General Construction, Item SPV.0060.02; Rest Area 51 Building, Plumbing, Item SPV.0060.03; Rest Area 52 Building, Plumbing, Item SPV.0060.04; Rest Area 51 Building, Heating and Ventilation, Item SPV.0060.05; Rest Area 52 Building, Heating and Ventilation, Item SPV.0060.06; Rest Area 51 Building, Electrical, Item SPV.0060.07; Rest Area 52 Building, Electrical, Item SPV.0060.08; Rest Area 51 Maintenance Building, Item SPV.0060.09; Rest Area 52 Maintenance Building, Item SPV.0060.10**

Section 06 16 43, Part 2.2, A: replace with:

A. Exterior Gypsum Soffit Board:

1. ASTM C1396/C1396M with manufacturer's standard edges.
2. Type X, 5/8" thick.
3. Taper long edges.
4. Joint sealant: use setting-type taping compound and setting-type, sandable compound.
5. Base Product:
 - a. ToughRock Fireguard C Soffit Board' by Georgia Pacific.

Section 23 25 13, Part 2.2, A.1, replace with:

1. 40% propylene, 60% water.

Section 23 25 13, Part 3.2, A, replace with:

- A. Fill systems with 40% propylene glycol solution.**

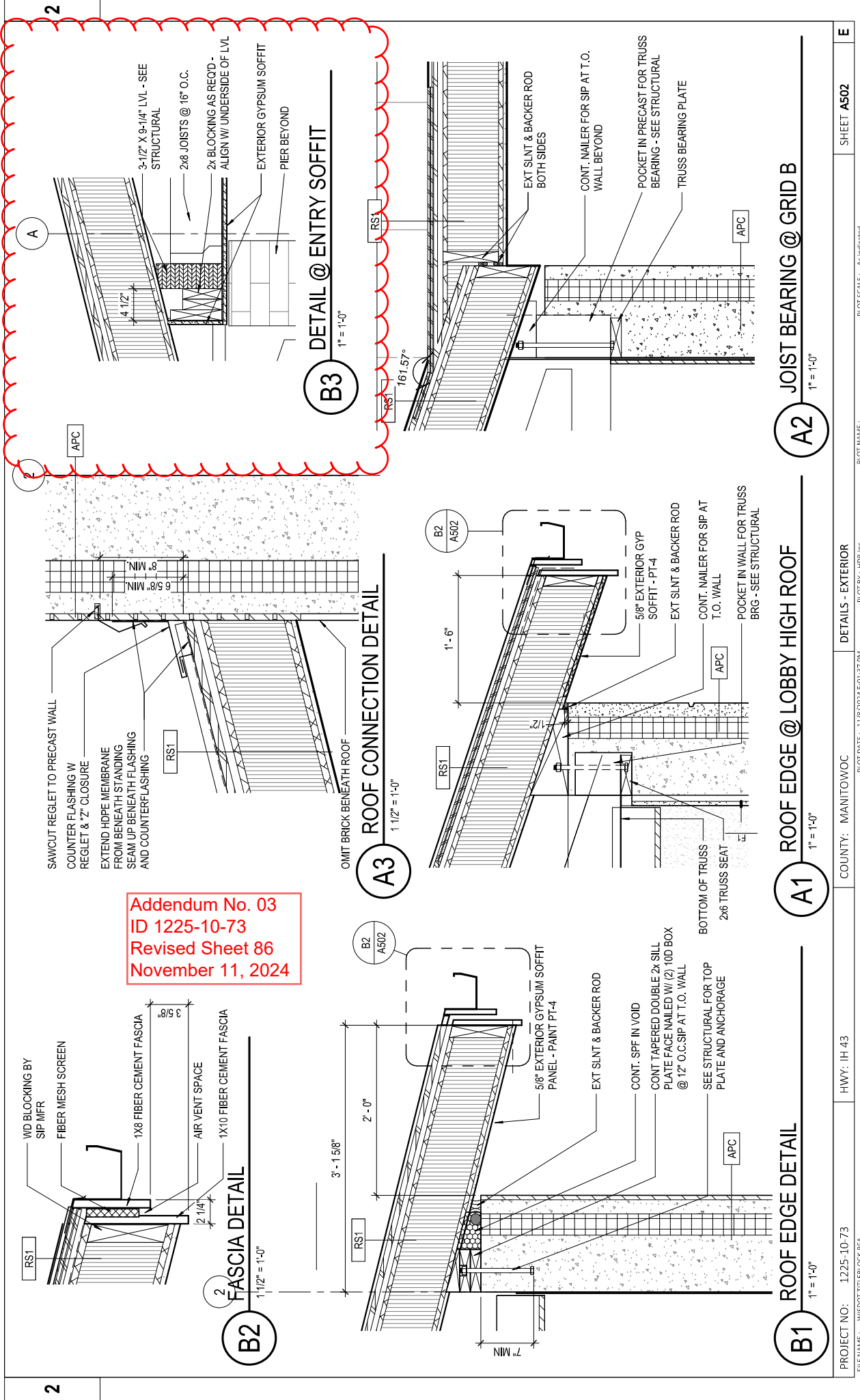
Plan Sheets

The following 8½ x 11-inch sheets are attached and made part of the plans for this proposal:

Revised: 86, 100, 102, 107, 150

Added: 134A

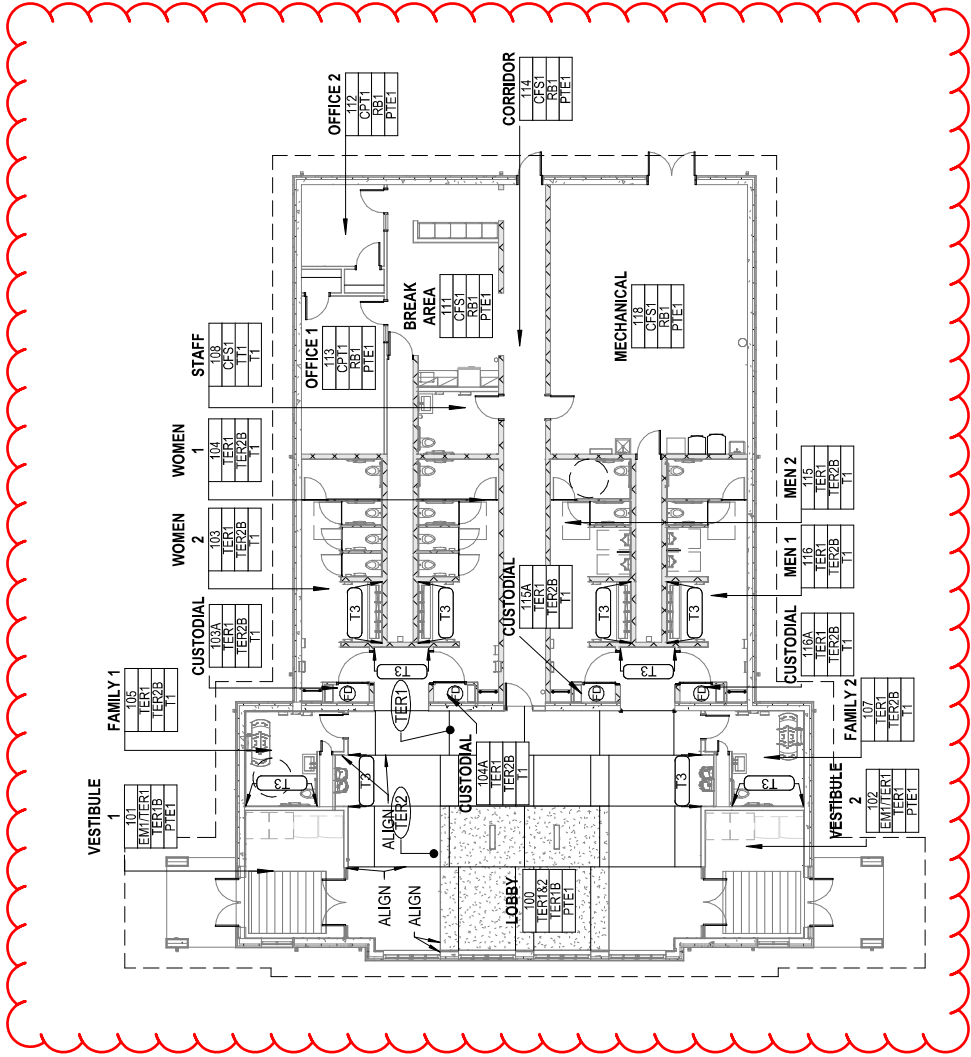
END OF ADDENDUM



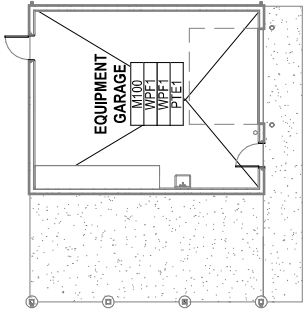
Addendum No. 03
ID 1225-10-73
Revised Sheet 86
November 11, 2024

INTERIOR FINISH SCHEDULE						2
Order	Manufacturer	Series/Style	Color	Size	Comments	
T1	LAMINAM	LARGE FORMAT PORCELAIN TILE, CALCE COLLECTION	BIANCO	1000 x 3000mm (3mm THICK)	PROVIDE SHOP DRAWINGS OF PANEL LAYOUTS; EPOXY GROUT; MAPEI, 14 BISCUIT	
T3	CROSSVILLE	COLOR BLOX 2.0	BLUE SUEDE SHOES	6" X 24"	ACCENT WALL TILE. EPOXY GROUT; MAPEI, 19 PEARL GRAY	
TT1	SCHLUTER	COVE-SHAPED PROFILE, DILEX	STAINLESS STEEL	AS NEEDED PER DRAWINGS	-	
TT2	SCHLUTER	FINEC TILE TRIM	STAINLESS STEEL	-	ALL EXPOSED TILE EDGES AND OUTSIDE CORNERS	
ACT1	ARMSTRONG	#3257 OPTIMA, TEGULAR EDGE, 9/16" GRID	WHITE	24" X 48" X 3/4" THICK	-	
RB1	MANNINGTON	BURKE COLLECTION, RUBBER WALL BASE	MOONBEAM 050	4"H ROLL GOODS	STRAIGHT AT CARPET, COVED AT SEALED CONCRETE	
TER1 B1	TERRAZZO & MARBLE SUPPLY COMPANIES	APPLIED TERRAZZO WALL BASE	MATCH TER1	4"H	-	
TER1 B2	TERRAZZO & MARBLE SUPPLY COMPANIES	INTEGRAL TERRAZZO WALL BASE	MATCH TER1	4"H	-	
TER1	TERRAZZO & MARBLE SUPPLY COMPANIES	THIN-SET POURED EPOXY TERRAZZO, TERROXY	TM#23-2537	-	-	
TER2	TERRAZZO & MARBLE SUPPLY COMPANIES	THIN-SET POURED EPOXY TERRAZZO, TERROXY	TM- #23-2225	-	ACCENT TERRAZZO	
CFS1	SEE SPECIFICATION	--	--	-	-	
CPT1	J-J FLOORING	KINETEX STRATA 1826	1848 FELDSPAR	18" X 36"	PATTERN: ASHLAR	
WDC1	PARKLEX PRODEMA	INTERIOR PANELING, CEILINGS WITH OPTION A	AMERICAN WALNUT	48" X 96" (12MM THICK)	LOBBY, MENS, AND WOMENS CEILING PANELS	
WDP1	PARKLEX PRODEMA	INTERIOR PANELING, WALLS	AMERICAN WALNUT	24" X 96" (12MM THICK)		
PT1	SHERWIN WILLIAMS	LATEX, FLAT	SW7007 CEILING BRIGHT WHITE	-	ALL GYP CEILINGS, U.N.O.	
PT2	SHERWIN WILLIAMS	LATEX, EGGSHELL	SW9166 DRIFT OF MIST	-	GYP WALLS IN OFFICES AND BREAKROOM	
PTE1	SHERWIN WILLIAMS	EPOXY PAINT, SEMI-GLOSS	SW9166 DRIFT OF MIST	-	WALLS	
PTE2	SHERWIN WILLIAMS	EPOXY PAINT TO METAL, SEMI-GLOSS	SW7568 NEUTRAL GROUND	-	HOLLOW METAL DOORS AND FRAMES AT FAMILY CUSTODIAL, OFFICES	
PROJECT NO: 1225-10-73						INTERIOR FINISH LEGEND AND NOTES
FILE NAME: WISDOT TITELBLOCK.RFA						SHEET 1001
PLOT DATE: 11/8/2024 5:00:39 PM						100
PLOT BY: HDR INC.						E
PLOT NAME:						
PLOT SCALE:						

Addendum No. 03
ID 1225-10-73
Revised Sheet 100
November 11, 2024



Addendum No. 03
ID 1225-10-73
Revised Sheet 102
November 11, 2024



A1 GROUND LEVEL FINISH PLAN
1/16" = 1'-0"

A2 EQUIPMENT GARAGE FINISH PLAN
1/16" = 1'-0"

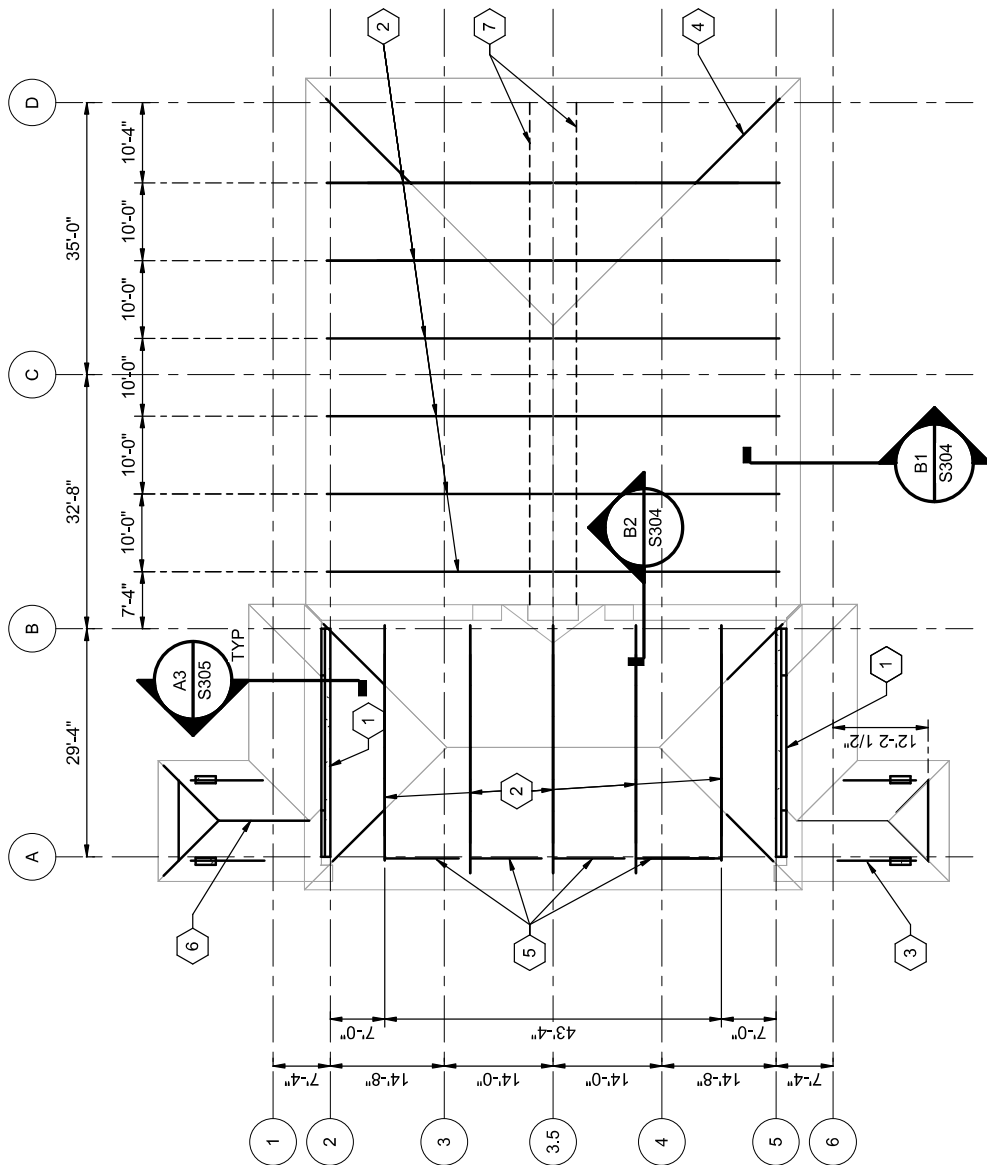
GENERAL NOTES:

1. ROOF SYSTEM IS "STRUCTURAL INSULATED PANEL" (SIP), PROPRIETARY.
2. FASTEN STRUCTURAL INSULATED PANEL (SIP) TO ALL TRUSSES AND TREATED WOOD-CANT AS INDICATED BY SIP DESIGNER. SEE DIAPHRAGM PLAN.

PLAN KEYNOTES

1. SEE SPANDREL ELEVATION A1/S306 FOR ROOF SUPPORT OF LOWER LEVEL.
2. (3) PLY WOOD TRUSS W/ 8.5" HEEL HEIGHT, PROVIDE TYPE1 A1/S304 EACH END, SEE ELEVATION B1/S306 TYP PRECAST BEARING WALLS.
3. PROVIDE LVL 3-1/2" x 9-1/4" MINIMUM, SINGLE BEVEL, TYPICAL 6 LOCATIONS, PROVIDE SIMPSON HHRC OR EQUAL, SEE DETAILS A1 & A3/S307 FOR CONNECTIONS AT PRECAST WALL AND COLUMNS.
4. LVL 3-1/2" x 9-1/4" MINIMUM, DOUBLE BEVEL, TYP 6 LOCATIONS, SEE DETAIL B1/S307 AND SIMILAR TO SIMPSON HHRC OR EQUAL FOR CONNECTIONS.
5. LVL 3-1/2" x FITTED SINGLE BEVEL MINIMUM, TYP 4 LOCATIONS, SEE DETAIL B1/S307 FOR CONNECTION AT PRECAST WALL, PROVIDE SIMPSON HANGERS OR EQUAL AT WOOD TRUSSES.
6. PROVIDE (1) LVL 5-1/4" x 1-2" RIDGE BEAM & (2) 3-1/2" x 9-1/4" DOUBLE BEVELED FRAMES, TYPICAL TWO LOCATIONS, SEE DETAIL A2/S307 FOR CONNECTION AT SPANDREL BEAM, PROVIDE SIMPSON HHRC OR EQUAL AT APEX.
7. PROVIDE TRUSS BEARING SECTION A3/S304 @ CMU, DETAIL A2/S302 @ 8'-0" OPENING, SEE ARCH.

Addendum No. 03
ID 1225-10-73
Revised Sheet 107
November 11, 2024



ROOF FRAMING PLAN

$$\underline{1/16'' = 1'-0''}$$

PROJECT NO: 1225-10-73	HWY: IH 43	COUNTY: MANITOWOC	ROOF FRAMING PLAN	E
FILE NAME: WISDOT TITLER BLOCK RFA		PLOT DATE: 11/8/2024 3:16:54 PM		
		PLOT BY:	PLOT NAME:	PLOT SCALE: As Indicated
			SHEET \$111	

DIFFUSER, REGISTER AND GRILLE SCHEDULE

MARK	DESCRIPTION	MOUNTING	USE	FACE SIZE (IN)	NECK SIZE (IN)	MATERIAL	FINISH	MAX. P.D. (IN. WG)	MAX. N.C. AT P.D. SHOWN	ACCESSORIES	BASIS OF DESIGN	NOTES
R1	LINEAR SLOT	LAY-IN	SUPPLY AIR	24X5	8" DIA	ALUMINUM	WHITE	0.08	20	-	TITUS FTI-20	2
R2	LINEAR SLOT	LAY-IN	SUPPLY AIR	60X4	8" DIA	ALUMINUM	WHITE	0.08	20	-	TITUS FTI-15	1
R2	LINEAR SLOT	SURFACE MOUNT	SUPPLY AIR	60X6	SEE PLAN	ALUMINUM	WHITE	0.08	20	-	TITUS FL-10	3
R3	SQUARE, THREE CONE	LAY-IN	SUPPLY AIR	24X24	SEE PLAN	ALUMINUM	WHITE	0.08	30	-	TITUS TMS-AA	
R4	SQUARE, THREE CONE	LAY-IN	SUPPLY AIR	24X24	SEE PLAN	ALUMINUM	WHITE	0.08	30	-	TITUS TMS-AA	
R5	SQUARE, THREE CONE	SURFACE MOUNT	SUPPLY AIR	12X12	SEE PLAN	ALUMINUM	WHITE	0.08	30	-	TITUS TMS-AA	
G1	LINEAR SLOT	LAY-IN	RET/EXH AIR	24X5	8" DIA	ALUMINUM	WHITE	0.08	20	-	TITUS FTI-20	2
G2	LINEAR SLOT	LAY-IN	RET/EXH AIR	60X4	8" DIA	ALUMINUM	WHITE	0.08	20	-	TITUS FTI-15	1
G2	LINEAR SLOT	SURFACE MOUNT	RET/EXH AIR	60X14	SEE PLAN	ALUMINUM	WHITE	0.08	20	-	TITUS FL-30	4
G-3	EGG-CRATE	LAY-IN	RET/EXH AIR	24X24	SEE PLAN	ALUMINUM	WHITE	0.08	30	-	TITUS 50F	

- NOTES:
- 1. 1-SLOT, UP TO 200 CFM.
 - 2. 2-SLOT, UP TO 200 CFM.
 - 3. 2-SLOT, UP TO 350 CFM.
 - 4. 2-SLOT, UP TO 1200 CFM.

Addendum No. 03
ID 1225-10-73
Added Sheet 134A
November 11, 2024

2		2																				
S-1 SINK		FIXTURE: SINGLE BOWL, SELF-RIMMING, COUNTER MOUNTED, 18 GAUGE TYPE 304 (18-8) STAINLESS STEEL WITH FAUCET LEDGE, SOUND DEADENING UNDERCOATING, PUNCHED TO MATCH FAUCET. DRAIN: CRUMB CUP STRAINER. OVERALL DIMENSIONS 22"x19-1/2"x7-5/8" DEEP. FAUCET: BELOW DECK MOUNTED SINK FAUCET WITH 8" FIXED CENTERS, CHROME PLATED FINISH. RESTRICTED SWING GOOSENECK SPOUT, 8" CENTER-TO-CENTER, 4" BLADE HANDLES WITH COLOR INDEX BUTTONS. CERAMIC 1/4 TURN CARTRIDGE, 1/2" SUPPLY INLETS AND COUPLING NUT. 1.5 GPM AERATOR.	FIXTURE: ELKAY LR2219 FAUCET: CHICAGO FAUCET 786- GR8E35V317X KAB	WASTE 1 1/2"	VENT 1 1/2"	CW 1/2"	HW 1/2"	REMARKS: 			DB-1 OUTLET BOX	FIXTURE: WASHING MACHINE OUTLET BOX WITH INTEGRAL WATER HAMMER ARRESTER SINGLE LEVER VALVE. BOX MATERIAL: HOT DIPPED GALVANIZED STEEL, 20 GAUGE BOX AND 20 GAUGE FACEPLATE. VALVE AND DRAIN: SINGLE LEVER ARRESTER VALVE KIT WITH 1/2" CONNECTIONS; 2" THREADED DRAIN.	FIXTURE: GUY GRAY WB200HA	WASTE 2"	VENT 2"	CW 1/2"	HW 1/2"	REMARKS: 	2		2	
WDF-1 WASH DOWN FAUCET		FAUCET: BOTTOM FORK BRACE. CAST BRASS SPOUT WITH VACUUM BREAKER, CERAMIC DISC VALVES, INTEGRAL SUPPLY STOPS, OFFSET SHANKS WITH INTEGRAL CHECK VALVES. VANDAL RESISTANT BLADE HANDLES, BUCKET HOOK, 3/4" THREADED HOSE END, 1/2" NPT FEMALE INLETS. ADJUSTABLE CENTER-TO-CENTER: 6" TO 19".	FAUCET: AMERICAN STANDARD 8355.110	WASTE -	VENT -	CW 3/4"	HW 3/4"	REMARKS: 			SS-1 SERVICE SINK	WALL MOUNT STAINLESS STEEL (14-GAUGE, TYPE 304) SERVICE SINK WITH 1-1/2" ROLLED RIMS, 12" HIGH BACKSPLASH, AND 3-1/2" DRAIN OPENING. FURNISHED WITH WALL HANGER AND STAINLESS STEEL SUPPORT BRACKETS. DIMENSIONS: 21" X 17-1/2" X 39-3/4". FAUCET: 8" CENTERSET WALL MOUNT FAUCET WITH 3" BUCKET HOOK SPOUT, 2" LEVER HANDLES (6" REACH), 1/2" OFFSET INLETS ROUGH CHROME, CHROME PLATED BRASS MATERIALS, QUARTER TURN CERAMIC DISC VALVE, 2 FAUCET HOLES. 4.0 GPM.	FIXTURE: SINK: ELKAY ESSB2118C FAUCET: ELKAY LK940BR03L2H P-TRAP ELKAY LK173	WASTE 3"	VENT 2"	CW 3/4"	HW 3/4"	REMARKS: 				

Addendum No. 03
ID 1225-10-73
Revised Sheet 150
November 11, 2024

PROJECT NO: 1225-10-73	HWY: IH 43	COUNTY: MANITOWOC	PLUMBING SCHEDULES	SHEET P604	E

Addendum No. 03
ID 1225-10-73
Revised Sheet 150
November 11, 2024

